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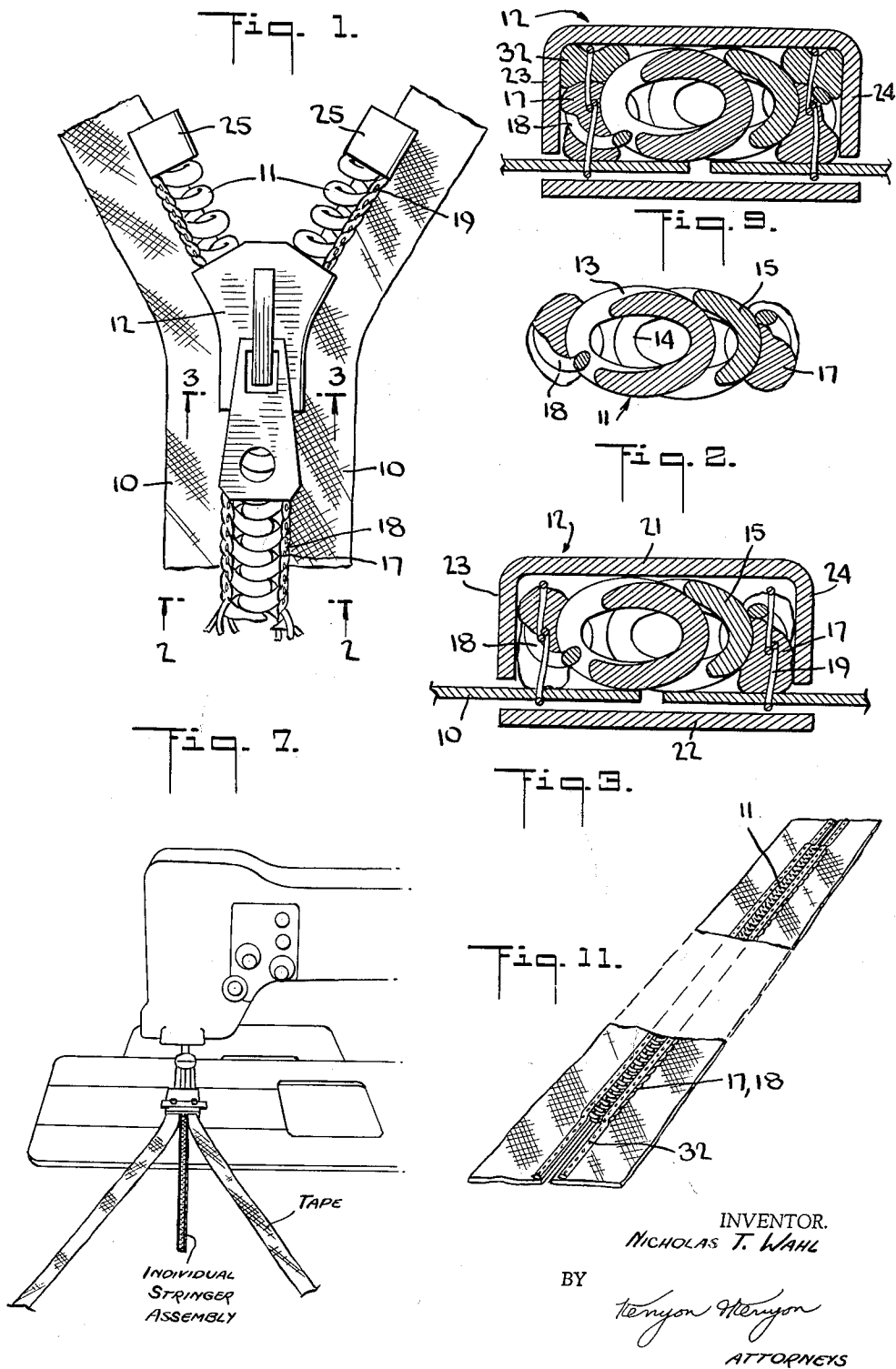
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TECHNIQUE FOR ASSEMBLING SLIDE FASTENERS

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2 Sheets-Sheet 1



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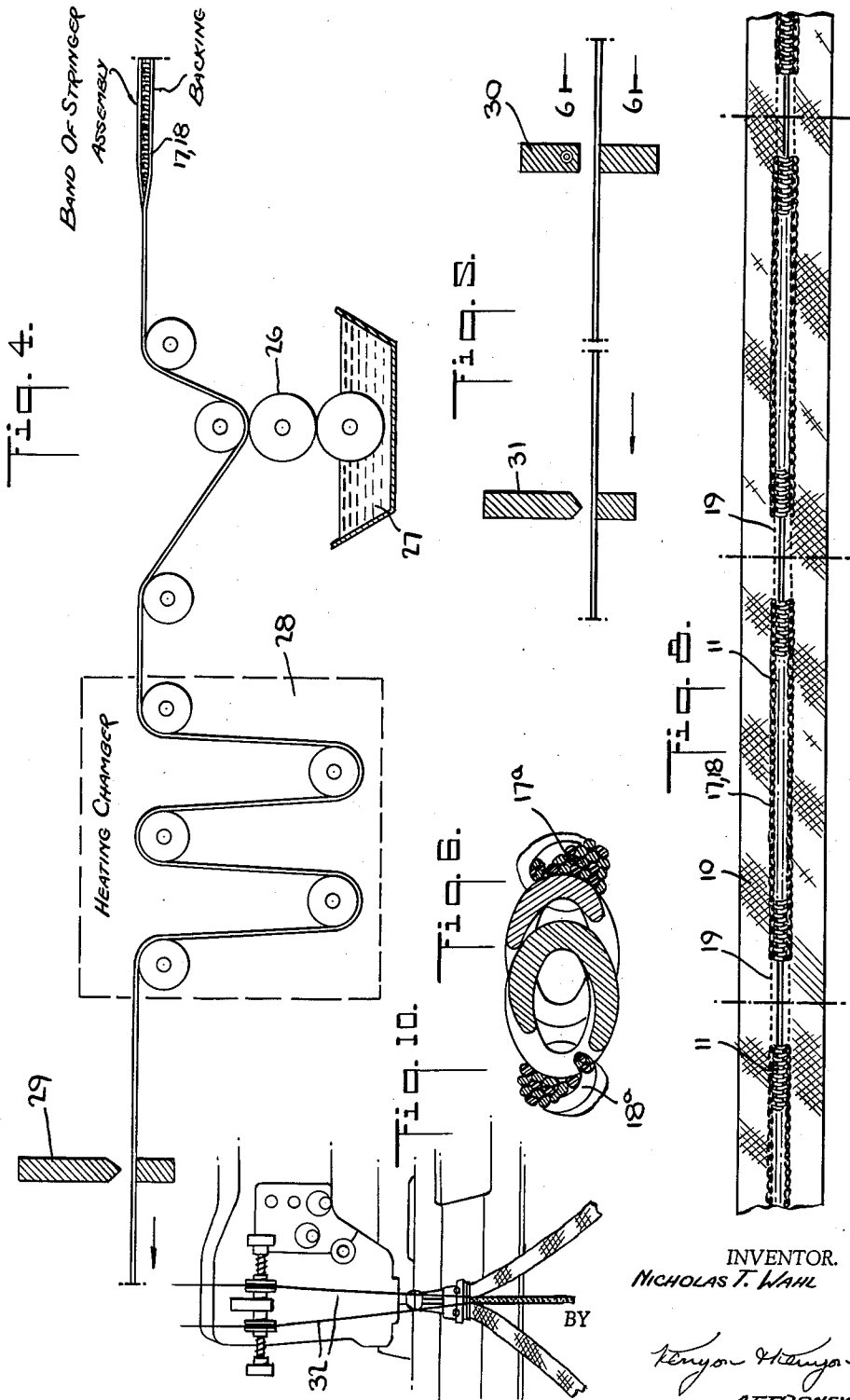
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TECHNIQUE FOR ASSEMBLING SLIDE
FASTENERS

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The present invention relates generally to slide fasteners, and more particularly to an improved method and apparatus for continuously fabricating coil-type slide fasteners in predetermined lengths without the need for gapping operations.

Slide fasteners are known in which the stringers are constituted by a pair of filamentary helices adapted to interlock with each other, the loops of the helices being secured to a tape or other piece of fabric or plastic sheet material. Thus, in the patent to Wahl No. 2,300,442, dated November 3, 1942, there is disclosed a slide fastener whose coils include oval loops formed of a filament of oblong cross-section, the loops being woven or sewn to the edge of the tape. In the copending application of Wahl, Serial No. 416,539, filed March 16, 1954, now abandoned, a coil-type fastener is fabricated by first binding the individual helices to a marginal backing, as by lashing, sewing or knitting, and thereafter interengaging two such backed helices by means of a slider. The backings to which the helices are attached are then sewn or otherwise secured to tapes or to the edges of the article to be fastened.

It has heretofore been the practice in manufacturing coil-type slide fasteners of the type disclosed in the above-identified Wahl patent and pending application to form the coils of the fastener in long lengths and to attach them to long strips of tape, either as a part of a continuous coil-forming and tape-weaving operation or by forming the coils separately and sewing them on the tapes with a sewing machine. After the long strips of tape and the fastener coils are joined together, they are sectioned into pieces whose length is suitable for the fasteners to be made. The coils are then cut to enable end segments of the coils to be removed, thereby forming coils of the desired lengths. The step of cutting and removing end segments of the coil for each stringer element is commonly referred to as "gapping."

In the patent to Neitlich No. 2,776,446, issued January 8, 1957, there is disclosed an apparatus for automatically gapping endless lengths of stringer. The apparatus is adapted to cut the helices at the end of a suitable length and then to cut a second time with a spacing of about one and a half inches from the first cut. The first cut marks the end of one slide fastener and the second cut marks the beginning of the next fastener. After the two cuts are made, the small segment of the helices lying between the cuts and isolated from the body of the continuous length of coil is removed by means of a mechanism which grasps the segment and bodily removes it from the stringer, the segment being withdrawn from the tapes.

Experience has shown that the process of gapping is not only wasteful and costly but it also impairs the quality of the resultant fastener. The plastic helix is formed of relatively expensive monofilament which has been fabricated to a high degree. Since the segment of the helix which is removed during the gapping operation must be scrapped, this represents a substantial waste of far greater significance than is ordinarily involved in discarding unprocessed raw material. Moreover, fabrication and labor costs entailed in securing the helices to the backing material are also lost, to say nothing of the value of the yarn forming the backing in the discarded

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segments. A more serious commercial disadvantage is that those portions of the tapes which bank the space where the helix segments have been removed are frayed by reason of the wrenching out of the segments. Thus the finished fastener presents a somewhat unsightly appearance.

In view of the foregoing, it is the primary object of this invention to obviate the drawbacks incident to prior art techniques by providing a novel method for fabricating fasteners of the coil-type without the need for gapping.

More specifically, it is an object of this invention to provide a method for securing pre-cut backing-mounted helices of the desired lengths to unbroken lengths of tape, the helices being separated from each other. In a method in accordance with the invention, separate slide fasteners of proper lengths are successively and continuously assembled by continuously feeding the tapes through a sewing machine or other attaching means, while discontinuously feeding therein the stringer helices which are assembled on backings.

Also, an object of my invention is to provide pre-cut helix assemblies of a desired length for slide fasteners, the helices having fabric backings which are processed to resist unravelling, whereby the assemblies may be readily sewn or attached to a tape or sheet material.

A further object of the invention is to provide an efficient, economical and reliable technique for automatically fabricating slide fasteners of high quality.

Briefly stated, these objects are accomplished by so processing a continuous band of stringer assembly material in which the stringer elements are marginally backed as to effect a bonding action at least at the spaced positions thereon at which the band is to be sectioned into individual assemblies, whereby the backing strands are prevented from unravelling at the cut ends thereof.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following detailed description to be read in conjunction with the accompanying drawings, wherein like components in the various views are identified by like reference numerals.

In the drawings:

FIG. 1 is a plan view of a separable fastener of the type to be manufactured by the method in accordance with the invention.

FIG. 2 is a sectional view taken along the plane of line 2-2 in FIG. 1.

FIG. 3 is a sectional view taken along the plane of line 3-3 in FIG. 1.

FIG. 4 is a schematic representation of one preferred technique for processing a stringer assembly to prevent unravelling at the ends of cut sections thereof.

FIG. 5 is a schematic view of another technique for processing a stringer assembly.

FIG. 6 is a sectional view showing the cut end of a stringer assembly incorporating a backing material in accordance with a feature of the invention.

FIG. 7 is a perspective view of the sewing mechanism for joining successive pre-cut stringer assemblies to a pair of tapes.

FIG. 8 is a plan view of the interlinked stringer assemblies resulting from the sewing operation illustrated in FIG. 7.

FIG. 9 is a sectional view of a modified form of fastener in accordance with the invention.

FIG. 10 is a perspective view of a sewing machine for joining pre-cut stringers to form the modified type of fastener.

FIG. 11 is a perspective view of a single fastener stringer of the modified form.

Referring now to the drawings and more particularly

to FIGS. 1 to 3 therein, a slide fastener produced in accordance with the invention comprises for example a pair of flexible strips or tapes 10, a pair of stringer elements 11 secured to the flexible tapes, and a slider 12 for separably interlocking the stringers, and hence the tapes. The tapes may be secured in the usual manner to the parts of a garment or other article to be separably fastened.

The stringers 11 are formed of flexible, helicoidal plastic filaments or coils whose convolutions, as best seen in FIG. 2, are somewhat flattened. Thus the individual loops 13 of the coils 11 are aligned in spaced parallel relation to form a row thereof and include inner engaging portions 14 and outer runner portions 15.

An elongated cord-like backing member 17 extends longitudinally along the outside margin of each of the stringers 11 and a flexible strand or filament 18 is wrapped around the backing member 17 and extended between each adjacent pair of engaging elements 13 to gird the runner portions 15. Thus strand 18 is wound at spaced points around backing member 17 and bound or looped about the runner portions 15 to attach stringer 11 to backing member 17 and combine with the latter to provide a base or backing for the stringer.

This attaching operation can be carried out by simply passing the stringer and backing member through a conventional winding machine so that the strand 18 is inserted between the convolutions of the coil and wound about the runner portions 15 and backing member 17. In this manner, the assembly formed by the coil stringer 11 and the stringer base composed of backing member 17 and binding strand 18 may be manufactured without a sewing operation. The combination of stringer elements, backing members and binding strands is hereinafter referred to as the "stringer assembly."

When it is desired to secure the stringer assembly of FIG. 2 to the tapes 10, the stringers 11 may be disposed in their interfitting or engaging relation and arranged with each of the members 17 overlying one of the tapes. The united or fastened stringer assemblies, together with the tapes 10 may be fed through a double needle sewing machine and the stitches 19 extended simultaneously through the stringer bases and tapes 10, as shown in FIG. 3.

As may be seen in FIG. 3, the slider 12 includes front and rear walls 21 and 22, respectively, and side flanges 23, 24 formed on the front wall. It will be noted that the built-up base is well adapted to provide a track or guide for the slider 12, substantially filling the latter, and engaging with the slider side walls 23 to prevent inadvertent movement of the slider between an adjacent pair of convolutions, such as has frequently occurred in prior fastener constructions. The details of the slider and of expedients such as metal stops 25 to limit the reciprocation thereof form no part of the present invention and any known elements may be used for this purpose.

As pointed out previously, the former practice in making slide fasteners of the coil-type was to form an endless chain of stringer assemblies marginally secured to continuous tapes, after which segments of the helices were gapped to establish the individual fasteners. In contradistinction to the conventional technique, in the present invention a continuously fabricated stringer is first marginally backed and then sectioned into individual assemblies of the desired length. The pre-cut stringer assemblies are thereafter joined to the tapes; this can be effected for example by feeding endless tapes continuously into a sewing machine and successively feeding the individual stringer assemblies therein to be sewn onto the tapes, the stringer assemblies being suitably spaced from each other, say, by an inch and a half. Thus the pre-cut stringer assemblies are interlinked by the tapes in spaced relation, and to separate the fasteners from each other one has

merely to cut the tapes transversely at the midway point in the region between adjacent stringer assemblies.

Since the marginally backed stringers are cut into sections before being joined to the tapes, the backing threads at the ends of the sections are disconnected and consequently have a tendency to separate from the plastic helices, with a resulting disassembly. Under these circumstances it becomes difficult to feed the loosened ends of the stringer assembly into the sewing machine in a consistent and convenient manner. Even if an assembly in this condition could be introduced into the machine, the helices of the stringers would not be attached to the supporting tapes throughout their lengths inasmuch as the backing has, for a few turns of the helices, come loose. For proper operation it is essential to prevent disassembly of the backing at the cut ends of the stringer.

One preferred method by which the stringer assembly is cut into desired lengths without causing unravelling of the backing at the cut ends will now be described in connection with FIG. 4.

A continuous band of stringer assembly, which may be manufactured in accordance with the procedures described in connection with FIGS. 1 to 3, or in the manner set forth in the above-identified copending application of Wahl, is fed between rollers 26 operating in an adhesive bath 27 whereby liquid adhesive is applied to the surfaces of the fibers 17, 18 forming the backing for the stringers. The profile of the rollers is such that the liquid engages and impregnates only the backing and preferably does not wet the coils of the stringer. From the rollers the assembly is fed through a suitable heating chamber 28 wherein the adhesive is dried, after which the continuous stringer assembly is cut by a mechanism 29 into sections of the desired length.

Thus the fibers of the backing are bonded together and even when the assembly is cut, unravelling will not occur. Upon completion of the fastener, the adhesive may be removed by any suitable solvent. In place of a liquid adhesive, a starch solution or a molten thermoplastic material may be used throughout the length of the assembly. When starch is used it may be washed out after the completion of the manufacture. In the case of the molten thermoplastic, this may be washed out by suitable solvents.

In lieu of coating the entire length of the assembly, the adhesive or stiffening material may be applied only to those areas on the assembly where a cutting action is to occur so that when the continuous stringer assembly band is severed into sections, the ends of the backing remain in their proper place and no difficulty is encountered in feeding an individual stringer assembly into the sewing machine for attachment to the tapes.

An alternative technique for ensuring that the backing will not unravel when the assembly is cut, is to employ for at least a part of the yarn, cord, thread or whatever materials are used for the backing, synthetic fibers which will melt and fuse when heated, the balance of such backing being of cotton or the like. Thus when the backing so constructed is successively heated, cooled and then cut, the fusion of the synthetic fibers of thermoplastic material with the other fibers will prevent separation of the backing yarns from the backing assembly.

As shown in FIG. 5, a stringer assembly band incorporating a backing of a composite construction including thermoplastic yarns is subjected to a heat and pressure operation by means of a reciprocating iron element 30 which bears down on the stringer assembly at spaced positions thereon where cuts are to be made, thereby fusing the backing fibers at those positions. The stringer assembly is then cut by a cutting tool 31 at the fused positions to the desired lengths. An advantage of this technique is that it is only necessary to heat the assembly where it is cut and the remainder of the slide fastener stringer is otherwise unheated and consequently unaf-

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fect. Preferably the thermoplastic yarn is formed of cellulose acetate. The advantage of this yarn is that it reacts quickly to a plasticizing treatment, it does not wash out and it is not chlorine retentive. This fusing and cutting operation can be synchronized with the operation of the sewing machine as shown in FIG. 7, to be later described. Other suitable thermoplastics are polyethylene, nylon, vinyl, etc.

FIG. 6 shows the end of the stringer assembly and it will be seen that the backing member 17a is a composite of several yarns and the binding line 18a is a similar composite, some of the fibers in the composite yarn being a thermoplastic material to permit the desired fusion when heat is applied.

Referring now to FIG. 7, there is shown a double needle sewing machine by which the marginal backings on the stringer assemblies are sewn to the tapes 10. Tapes 10 are fed into the machine continuously while the pre-cut stringer assemblies constituted by stringers 11 formed by interengaged coils and backings 17, 18 are fed in discontinuously one after the other, with a short spacing between successive assemblies. Issuing from the output side of the sewing machine is a continuous series of interlinked stringer assemblies attached to the tapes 10 by lines of stitches 19, as shown in FIG. 8. To obtain the separate fasteners, one has merely to cut the tapes at a point midway between successive stringer assemblies, as indicated by the dashed lines in the figure. The sliders and end stops may be applied before or after the tape cutting operation. The resultant fastener is of superior quality for the tapes at the ends are clean rather than frayed, since no gapping is involved in production. Moreover, production costs are lower than with prior techniques, no losses being incurred by reason of waste in stringer and backing material.

FIG. 9 shows a modified form of a slide fastener of the type illustrated in FIGS. 1 to 3 wherein an additional bead or cord 32 is secured in an overlapping relation along each backing member 17. The bead serves to protect the backing from wear and also acts to prevent looseness or wobbling of the slider.

The manner of introducing the additional bead on the sewing machine is shown in FIG. 10 wherein two cords 32 are fed into the machine simultaneously with the continuous tapes whereby the resultant series of interlinked stringer assemblies includes two parallel lines of beading along the inner margins of the tapes. Thus, as shown in the individual section in FIG. 11, the bead overlies the backing on the stringer assembly for the full length thereof and extends therebeyond onto the tapes. This beading facilitates the mounting of the slider for it now becomes possible to apply the slider before sectioning the tapes.

The invention is not limited to a composite yarn for the backing and the material may be entirely thermoplastic if desired. An important advantage flowing from the use of thermoplastic fibers in the backing is that it becomes possible by known heat-sealing techniques to secure the backing to thermoplastic sheet materials, thereby obviating the need for a sewing operation. Thus, in place of the sewing machine, the assemblies and sheet materials may be fed into a high frequency dielectric heating sealing mechanism to effect the desired connection between the backing and the material.

While there have been shown what are considered to be preferred embodiments of the invention, it will be manifest that many changes and modifications may be made therein without departing from the essential spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications as fall within the true scope of the invention.

I claim:

1. In the method of manufacturing separable fasteners wherein continuous filament type stringer elements are marginally backed with filamentary strands to form

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a stringer assembly having a backing, impregnating the backing of a continuous band of stringer assembly material with adhesive material, drying said backing to effect a bonding action between the strands of said backing to prevent unravelling thereof, cutting said band at spaced positions to form individual assemblies marginally securing said individual assemblies successively to continuous tapes to provide a series of interlinked stringer assemblies in which the individual assemblies are spaced from each other, and cutting said tapes in the spaces between successive assemblies to provide individual separable fasteners.

2. In the method of manufacturing separable fasteners wherein coil type stringer elements are marginally backed with filamentary strands to form a stringer assembly having a backing, impregnating the backing of a continuous band of stringer assembly material with molten thermoplastic material, which dries to effect a bonding action between the strands of said backing to prevent unravelling thereof, cutting said band at spaced positions to form individual assemblies marginally securing said individual assemblies successively to continuous tapes to provide a series of interlinked stringer assemblies in which the individual assemblies are spaced from each other, and cutting said tapes in the spaces between successive assemblies to provide individual separable fasteners.

3. In the method of manufacturing separable fasteners wherein coil type stringer elements are marginally backed with filamentary strands to form a stringer assembly, passing a continuous band of stringer assembly material through a starch bath, drying said band to effect a bonding action between the strands of said backing to prevent unravelling thereof, cutting said band at spaced positions to form individual assemblies marginally securing said individual assemblies successively to continuous tapes to provide a series of interlinked stringer assemblies in which the individual assemblies are spaced from each other, and cutting said tapes in the spaces between successive assemblies to provide individual separable fasteners.

4. In the method of manufacturing separable fasteners, the steps of marginally backing coil type stringer elements with filamentary strands at least some of which are formed of thermoplastic material to form a continuous band of stringer assemblies, heat treating said band at spaced positions thereon to fuse the strands to prevent unravelling when cut, and sectioning said band at said positions to form individual assemblies of the desired lengths.

5. In the method of manufacturing separable fasteners, the steps of marginally backing coil type stringer elements with filamentary strands at least some of which are formed of thermoplastic material to form a continuous band of stringer assemblies, heat treating said band to fuse the strands to prevent unravelling when cut, and sectioning said band to form individual assemblies of the desired lengths.

6. The method as set forth in claim 5, wherein said thermoplastic strands are formed of cellulose acetate.

7. The method as set forth in claim 5, wherein said thermoplastic strands are formed of nylon.

8. The method as set forth in claim 5, wherein said thermoplastic strands are formed of vinyl material.

9. The method of manufacturing separable fasteners comprising the steps of marginally backing coil type stringer elements with filamentary strands at least some of which are formed of thermoplastic material to form a continuous band of stringer assemblies having backings, heat treating said band to fuse the strands of said backings to prevent unravelling when cut, sectioning said band to form individual assemblies of the desired lengths, and heat sealing the backings of the individual assemblies to sheet material.

10. The method of manufacturing separable fasteners comprising the steps of marginally backing coil type stringer elements with filamentary strands at least some of which are formed of thermoplastic material to form a continuous band of stringer assemblies, heat treating said band to fuse the strands to prevent unravelling when cut, sectioning said band at said positions to form individual assemblies of the desired lengths, and sewing the backings of the individual assemblies to continuous tapes.

11. The method set forth in claim 10 wherein said sewing operation is synchronized with said sectioning operation.

12. A slide fastener comprising a precut stringer assembly including two rows of interlocking continuous filament type stringer elements each having a marginal backing formed of filamentary strands, said strands at the ends of said assembly being bonded together along their adjacent contacting surfaces to prevent unravelling thereof, and a tape marginally secured to each of said backings and extending beyond said stringer elements at both ends thereof.

13. A slide fastener comprising a precut stringer assembly including two rows of interlocking continuous filament type stringer elements each having a marginal backing formed of filamentary strands, said strands being a composite of thermoplastic synthetic yarns and non-thermoplastic yarns, said composite strands at least at the ends of said assembly being fused together to prevent unravelling thereof, and a tape marginally secured to each of said backing and extending beyond said stringer elements at both ends thereof.

14. A slide fastener as set forth in claim 13, wherein said thermoplastic synthetic yarns are constituted by nylon and wherein said tapes marginally secured to said backings are heat-sealed thereto.

15. In the method of manufacturing separable fasteners wherein continuous filament-type stringer elements are marginally backed with filamentary strands having contiguous surfaces to form a stringer assembly, the steps of bonding together the filamentary strands of a con-

tinuous band of stringer assembly material at their contiguous surfaces at least at the spaced positions along said band at which the band is to be cut into individual assemblies in order to prevent the strands from unravelling at said positions, cutting said band at said positions to form said individual assemblies, marginally securing said individual assemblies successively to continuous tapes to provide a series of interlinked stringer assemblies in which the individual assemblies are spaced from each other, and cutting said tapes in the spaces between successive assemblies to provide individual separable fasteners.

16. The method as set forth in claim 15, wherein the individual assemblies are marginally secured successively to a pair of tapes by continuously feeding the tapes into a double needle sewing machine, the individual assemblies being periodically fed into said machine.

17. The method set forth in claim 16 further including the step of introducing a pair of cords into said sewing machine continuously with said tapes to overlie said backing strands.

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