

AMENDED SPECIFICATION

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PATENT SPECIFICATION

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(54) A SLIDING CLASP FASTENER WITH KNITTED STRINGER TAPES

(71) We, LIGHTNING FASTENERS LIMITED, a British Company, of Kynoch Works, Witton, Birmingham 6, England, 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:—

The invention relates to a process for the manufacture of sliding clasp fasteners.

In the usual course of manufacture of sliding clasp fasteners, the rows of interlocking elements are presented and attached to lengths of two stringer tape paid out from separate magazines and from which individual stringer tapes are cut. The lengths of stringer tape are separated into individual stringer tapes as required. Since each sliding clasp fastener incorporates two individual stringer tapes, the known fasteners may contain stringer tapes which have been made at different times and in different places (on different machines). Since the sliding clasp fastener manufacturers buy the lengths of stringer tape ready-made, it is generally impossible to be certain of the time and place of manufacture or to sort them into groups of like origin (i.e., made on the same machine). The sliding clasp fasteners are consequently subject to manufacturing tolerances that have an adverse effect on performance.

The disadvantages of the known processes are many. In the first place, the manufacture of lengths of stringer tape is relatively costly. Moreover, the mechanical properties (resilience, strength) of a length of stringer tape, both along its length and across its width, are variable. Since the pitch of the

rows of interlocking elements in a sliding clasp fastener, on which its resistance to breaking open is dependent, is wholly or partly determined by the stringer tapes to which the said rows are attached, the tolerances lead at once to a reduction in that resistance. Furthermore, because of the said tolerances sliding clasp fasteners incorporating stringer tapes that have been made at different times and in different places in many cases are no longer mechanically symmetrical about their central axis (even if the fastener geometrically is symmetrical), with a further adverse effect on resistance to breaking open. These disadvantages are significantly increased by the fact that to make a sliding clasp fastener the sewing machine used to attach the rows of interlocking elements to the stringer tapes must be fed, under individual guidance and handling, with two separate lengths of stringer tape, thereby occasioning additional manufacturing tolerances. In addition to these disadvantages, which reflect directly on the performance of the finished sliding clasp fasteners, there is the manufacturing problem as such, viz., the cost of handling two lengths of stringer tape for the sewing process. By no means the least of the disadvantages is the consequent limitation on operating speeds during the sewing of the rows of interlocking elements to the lengths of stringer tape. Constant production controls must be maintained, and efforts to automate the process are significantly thwarted.

The disadvantages just described, in relation to woven lengths of stringer tapes for sliding clasp fasteners, apply in even greater force to knitted lengths of stringer tape, because

the tendency of the looped structure to stretch in knitted goods is influenced by the tension maintained during manufacture and the tolerances already referred to become even wider. Moreover, such lengths of stringer tape frequently and readily roll up transversely, causing additional difficulties in the stage of sewing the rows of interlocking elements to them. This combination of circumstances probably explains the almost complete lack of sliding clasp fasteners with knitted stringer tapes in commerce, despite the fact that knitted lengths of stringer tape are usually cheaper to make than woven.

The object of the invention is to devise a process for the manufacture of fabric for providing individual stringers for sliding clasp fasteners, which process is less costly at the same or increased operated speeds and provides sliding clasp fasteners of better quality.

According to the present invention, a process for the manufacture of sliding clasp fasteners, comprises simultaneously knitting at least one pair of stringer tapes from warp chain threads, transverse lapping threads and inlaid lapping threads to form a waled structure with the inlaid lapping threads extending across at least three wales, the tapes being knitted side-by-side on the same knitting machine with their selvages interconnected by connecting threads and subsequently parting the connecting threads to separate the stringer tapes during or after the attachment of rows of interlocking elements of the sliding clasp fastener.

The above-mentioned tolerance problems are eliminated by manufacturing the interconnected stringer tapes for given sliding clasp fasteners at the same time and place, provided that after making the stringer tapes they are allowed to remain as a pair until such time as the rows of interlocking elements are or have been attached to them. In other words, the invention proposes a method in which the two textile stringer tapes for any one fastener are made together on one and the same knitting machine. It is within the scope of the invention to make more than one pair of stringer tapes together, side-by-side with connecting threads as described above. The process can readily be carried out on flat (Tricot or Raschel) knitting machines or circular knitting machines. The various stringer tapes united into a single fabric in this way are joined together by connecting threads, which are parted as required to separate the individual stringer tapes.

Since the connecting threads are not parted until the rows of interlocking elements are being or have been attached, the two simultaneously made stringer tapes remain united up to a certain point in time, i.e., they undergo the same handling throughout. In particular, the stringer tapes undergo the same pulling action in a feeding device of equipment for

attaching the rows of interlocking elements. The features of the invention ensure that both the stringer tapes experience the same pull in the feeding device and are under the same tension when the rows of interlocking elements are attached. This makes it possible to position the rows of interlocking elements and stringer tapes for the two halves of a sliding clasp fastener very precisely and very uniformly, with a highly advantageous effect on the pitch, which substantially improves the quality of the sliding clasp fastener.

It is possible, notably by varying the thread gauge and the lays of the warp chain, transverse lapping and inlaid lapping threads, to obtain better properties in the sliding clasp fasteners. Preferably, both the strength and the elastic properties of sliding clasp fasteners are regulated at the early stage of making the knitted stringer tapes, by reinforcing the selvedge threads of the stringer tapes in the warp chain threads and/or the transverse lapping threads and/or the inlaid lapping threads. Reinforcement can be effected by doubling the threads concerned or including thicker threads. In any case, this offers the means of adapting the properties of the knitted stringer tapes to the functional and manufacturing requirements. Moreover, the same means contribute to the elimination of thickness variations across the width of the stringer tapes. According to a further feature of the invention, a similar adaptation of the thickness distribution can be achieved by means characterised in that some of the inlaid lapping threads near the middle are omitted to make the centre of the stringer tapes approximately the same thickness as their selvages. This procedure is particularly preferred when there are no special requirements as to the strength and stretch properties of the stringer tapes. In any case, as the inlaid lapping threads extend over at least three and preferably four wales, this brings the tendency of the knitted stringer tapes to stretch in the transverse direction to a particularly low level. If the inlaid lapping threads extended over less than three wales, the transverse stretching would increase very substantially, to undesirably high levels for the stringer tapes used in sliding clasp fasteners.

Again, there are several possible ways of laying the connecting threads that unite the stringer tapes into a single broader fabric. Thus, the connecting threads may be laid as inlaid lapping threads or loop-forming threads, fed to a guide bar with individualised tension. The last feature is particularly significant in view of the scope it provides for different ways of attaching the rows of interlocking elements to the stringer tape, as will emerge from the further description below.

The rows of interlocking elements are attached to the stringer tapes in equipment into which pairs of the tapes are fed in the

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united condition, the rows of interlocking elements being attached to the stringer tapes by sewing, insertion, adhesive bonding, or welding. By adopting these ways and means the stringer tapes, still united by the connecting threads, can be fed exactly centrally and under the same tension to the rows of interlocking elements. The pair of interconnected united stringer tapes can be separated from a broader fabric containing more than one such pair, so that manufacturing tolerances in the transverse direction will have no adverse effect.

When the rows of interlocking elements are attached to the stringer tapes by sewing, according to the invention various structural features can be introduced into the stringer tapes when they are knitted, in order to simplify the subsequent attachment process. Knitted stringer tapes display a distinctive structure because of the inter-wale grooves left between the individual wales. The parts of the tapes forming the bases of the grooves consist solely of transverse inlaid lapping threads and the transverse lapping threads, which are also transversely laid in these regions. Hence when sewing is used to attach the rows of interlocking elements to the stringer tapes, the attachment threads can be embedded in the grooves and effectively protected from outside contact. The tape selvages on which the rows of interlocking elements are laid can consist of one or more wales, according to the width of the rows. The sewing can then be protected in a groove in the tape selvedge. However, the breadth of the grooves in the very fine sliding clasp fasteners as now developed, with correspondingly finely knitted stringer tapes, is often less than the gauge of the sewing needle used. Accordingly, it is preferred to displace a wale in one selvedge of each stringer tape in the direction of the adjacent selvedge of the adjacent stringer tape with strong tensioning of the connecting threads in the knitting machine, thereby extending the endmost groove and providing space for insertion of the sewing needle into it. After parting of the connecting threads the wales forming the grooves move back into place and thereby cover the sewing thread.

In the case of sliding clasp fasteners in which the rows of interlocking elements are attached to knitted stringer tapes by inserting them in holes, a pre-determined disposition of holes can be made during knitting. Thus, in each tape holes may be made in ladder-like formation in a loop-free zone that only contains the transverse threads connecting one wide and one narrow longitudinal region of a stringer tape which region also contains warp chain threads as well as transversely extending threads. In order not to weaken the stringer tape with a ladder of excessively large holes, which must be large enough to accommodate

the rows of interlocking elements, and at the same time to facilitate insertion of the said rows in the fabric, it is preferred to displace the loop-forming threads in the narrower regions of the stringer tapes towards each other so as to broaden the holes with strong tensioning of the connecting threads. After parting of the connecting threads holding the stringer tapes together the ladders of holes in the loop-free zone close up, wholly or in part, and thus more firmly secure the rows of interlocking elements.

By means of the invention, the manufacture of stringer tapes united into broad fabric promotes a substantially better utilisation of the looms or knitting machines used for the process, with manufacturing tolerances arising from the manufacture of stringer tapes for the same sliding clasp fastener at different times and places largely eliminated. This leads to substantially more rational production techniques for the further important reason that additional production controls can be abandoned, thereby greatly easing the problems of automation in sliding clasp fastener manufacture and in the final analysis permitting the use of higher operating speeds. Moreover, the performance of the sliding clasp fasteners made by the process of the invention is substantially improved.

The invention will now be further described with reference to the accompanying drawings, in which:—

Figure 1 shows the thread lay in a fabric providing a pair of stringer tapes for a sliding clasp fastener connected side-by-side;

Figure 2 is a modification of Figure 1, the fabric moreover embracing more than one pair of stringer tapes;

Figure 3 is another modification of Figure 1;

Figure 4 shows details of the thread lays in the stringer tapes of Figures 1 to 3, and likewise Figures 6, 8 and 9;

Figure 5 corresponds to Figure 2, but shows a fabric with reinforcements near the selvages of the stringer tapes;

Figure 6 shows the thread lay of a single tape with a reduced number of inlaid lapping threads, the connection to an adjoining tape being omitted;

Figure 7 is a perspective view of equipment for attaching rows of interlocking elements to pairs of interconnected stringer tapes;

Figure 8 is a transverse section through two stringer tapes complete with the rows of interlocking elements;

Figure 9 is another modification of Figure 1 with loop-free zones in the tapes; and

Figure 10 is a perspective view showing the progressive attachment of the rows of interlocking elements in holes in the stringer tapes.

The fabric 1 of Figures 1, 8 and 10 provides a pair of interconnected stringer tapes

for sliding clasp fasteners, and in Figures 2 and 5 more than one pair of interconnected tapes, for the attachment of rows 2 of plastics monofilament interlocking elements. The fabric 1 is a texture of threads with wales 3, and is formed from warp chain threads 4, transverse lapping threads 5, and inlaid lapping threads 6. Each pair of stringer tapes 7, to be used in one and the same sliding clasp fastener, is made simultaneously on one and the same knitting machine and united by separable connecting threads 8. By parting the connecting threads 8, the fabric 1 can be separated into the stringer tapes 7 with selvages. The connecting threads 8 are not parted until the rows 2 of interlocking elements are being or have been attached to the corresponding stringer tapes 7. Whereas the warp chain threads 4, the transverse lapping threads 5, and the inlaid lapping threads 6 forming the texture can be all of the same gauge, some or all of the various threads 4, 5 and 6 can be reinforced. Thus, the threads 4 and 5 bordering the selvages 9 of the stringer tapes 7 in Figure 2 are shown reinforced. This may be by the use of thicker threads, as indicated by the thicker lines, or it may be effected by providing two or more threads. On the one hand, reinforcement improves the strength and elastic properties of the stringer tapes 7, but on the other hand it also thickens the stringer tapes 7 near the selvages 9, so as to attain an almost uniform thickness over the entire width of the stringer tapes 7. Alternatively, uniform thickness over the entire width can be obtained by omitting some of the inlaid lapping threads 6 near the middles of the stringer tapes 7, as indicated in Figure 6.

In knitting the fabric 1 the individual threads are laid in accordance with a definite pattern, as shown by Figure 4. The notation used to describe the lays is interpreted as follows: The combination of digits describes the repeat pattern for each thread lay, which repeats periodically. In the example given, the pattern covers two courses of loops. The pair of digits before the oblique stroke specifies how many wales 3 are crossed over by the thread in the direction across the fabric 1, moving in both directions within one course of loops; the pair of digits after the oblique stroke specifies the corresponding thread lay in the next course of loops along the fabric 1. Figure 4 also gives the threading pattern for the guide bars. The knitted fabric 1 is preferably made with four guide bars. The 1st guide bar works on the 4-4/0-0 lay and carries the inlaid lapping threads 6, while the 2nd works on the 2-2/0-0 lay and carries the connecting threads 8. The 3rd guide bar works on the lay 2-0/0-2, carrying the transverse lapping thread 5, and the 4th forms the warp chain thread 4 in the lay 0-1/1-0. The scope for varying the lay of the various

threads can be seen by comparing Figures 1, 2, 3, 5, 6, and 9, in which reinforcements are throughout indicated by thicker lines. The lay 2-2/0-0 or 4-4/0-0 is preferred for the connecting threads 8, because they then run so to speak parallel to the inlaid lapping threads 6 and are incorporated without difficulty in the fabric. It is however also possible to proceed as in Figure 2, where the connecting threads 8 are adapted as loop-forming transverse lapping threads in the lay 2-0/0-2.

Figure 7 shows equipment for attaching rows of interlocking elements to pairs of interconnected stringer tapes. The equipment comprises a feeding device 10 which receives both the rows 2 of interlocking elements and two pairs of stringer tapes 7, an attachment device 11 in the form of a sewing machine 13, and a take-off device 12. The two pairs of tapes 7, all united together by connecting threads 8 (not shown in the Figure), are fed simultaneously to the sewing machine 13 by the feeding device 10, the fabric 1 consisting of the four tapes 7 being however split by a separator 14 into the two independent pairs of tapes before reaching the sewing machine 13. This is necessary in order to prevent the manufacturing variations across the stringer tapes 7 from having any adverse effect. In other words, the equipment shown feeds united pairs of the stringer tapes 7 together with the corresponding rows 2 of interlocking elements to the respective pairs of needles of the sewing machine 13, where they are sewn. After sewing, the connecting threads 8 between the stringer tapes 7 of each pair are parted so that the stringer tapes 7 become completely separated.

In the transverse section through two stringer tapes 7 complete with the rows 2 of interlocking elements shown in Figure 8, the profiled structure of the knitted tapes 7 is shown, the individual wales 3 being separated one from the next by inter-wale grooves 15. The sewing threads pass through the grooves 15 nearest the tape selvages 9. In this case, the wale 3 forming each of the tape selvages 9 is displaced in the direction of the adjacent selvedge of the adjacent stringer tape, with the tension in the connecting threads 8 increased when the stringer tapes 7 are knitted, so that sufficient space is provided in the grooves 15 for insertion of a sewing needle. After sewing, the sewing thread 16 is embedded in the groove 15, effectively out of external contact. After parting of the connecting threads 8, the wales 3 forming the tape selvages 9 move back into place, thereby at least partially covering and protecting the sewing thread 16.

Figure 9 shows the lay pattern for a fabric, in which the stringer tapes comprise holes 20 for securing the rows 2 of interlocking elements by insertion, the holes being in ladder-

like formation in a loop-free zone 17 of each tape that only contains the transverse threads connecting one broad region 18 and one narrow region 19 of the stringer tape. These ladder-like holes 20 are formed by omitting the second warp chain thread 4 and the first transverse lapping thread 5 on opposing tape selvages 9. By strongly tensioning the connecting threads 8, the loop-forming threads are displaced towards the further tape regions 19, broadening the holes 20 so that the rows 2 of interlocking elements can be inserted more easily into them. After parting of the connecting threads 8 the holes 20 close up spontaneously and secure the inserted rows 2 of interlocking elements. This is indicated in Figure 10.

Reference is directed to Patent Specifications 25056/70, 25058/70, 25059/70, 25060/70, 25061/70, 25062/70, 25063/70 and 25064/70 of even date herewith (Serial Nos. 1,299,912, 1,299,914, 1,299,915, 1,299,916, 1,299,917, 1,299,918, 1,299,919, 1,299,920).

25 WHAT WE CLAIM IS:—

1. A process for the manufacture of sliding clasp fasteners, comprising simultaneously knitting at least one pair of stringer tapes from warp chain threads, transverse lapping threads and inlaid lapping threads to form a waled structure with the inlaid lapping threads extending across at least three wales, the tapes being knitted side-by-side on the same knitting machine with their selvages interconnected by connecting threads and subsequently parting the connecting threads to separate the stringer tapes during or after the attachment of rows of interlocking elements of the sliding clasp fastener.

2. A process as in Claim 1, wherein the selvedge threads of the stringer tapes are reinforced in the warp chain threads, and/or the transverse lapping threads, and/or the inlaid lapping threads.

3. A process as in either Claim 1 or 2, wherein some of the inlaid lapping threads near the middle of the stringer tape are omitted to make the centre of the stringer tape approximately the same thickness as their selvages.

4. A process as in any one of Claims 1

to 3, wherein the inlaid lapping threads extend over four wales.

5. A process as in any one of Claims 1 to 4, wherein the connecting threads are laid as inlaid lapping threads or loop-forming threads, and are fed to a guide bar with individualised tension.

6. A process as in any one of Claims 1 to 5, wherein the stringer tapes are fed into attachment equipment in the united condition, for the rows of interlocking elements to be attached to the stringer tapes by sewing, insertion, adhesive bonding, or welding.

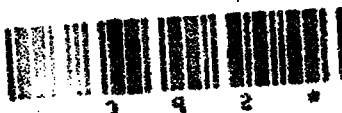
7. A process as in any of Claims 1 to 6 for the case when the rows of interlocking elements are to be attached by sewing to knitted stringer tapes with selvages formed by one or more wales, characterised in that the connecting threads during the knitting of the tapes are tensioned more tightly than the other threads, thereby broadening the inter-wale grooves nearest the tape selvages and providing sufficient space for insertion of a sewing needle into the grooves.

8. A process as in any one of Claims 1 to 5, for the case when the rows of interlocking elements are to be attached by insertion, each stringer tape being made with holes for inserting the rows of interlocking elements, the holes being in ladder-like formation in a loop-free zone of each tape that only contains the transverse threads connecting one broad region and one narrow region of the length of tape which regions also contain warp chain threads as well as transversely extending threads.

9. A process as in Claim 8, wherein the loop-forming threads in the narrow regions of the tapes are displaced towards each other so as to broaden the holes with strong tensioning of the connecting threads.

10. A process for the manufacture of sliding clasp fasteners substantially as hereinbefore described with reference to Figures 1 and 4; 2 and 4; 3 and 4; 4 and 6; 4 and 8; 4 and 9; 5; and 7 and 10 of the accompanying drawings.

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like formation in a loop-free zone 17 of each tape that only contains the transverse threads connecting one broad region 18 and one narrow region 19 of the stringer tape. These ladder-like holes 20 are formed by omitting the second warp chain thread 4 and the first transverse lapping thread 5 on opposing tape selvages 9. By strongly tensioning the connecting threads 8, the loop-forming threads are displaced towards the further tape regions 19, broadening the holes 20 so that the rows 2 of interlocking elements can be inserted more easily into them. After parting of the connecting threads 8 the holes 20 close up spontaneously and secure the inserted rows 2 of interlocking elements. This is indicated in Figure 10.

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1. A process for the manufacture of sliding clasp fasteners, comprising simultaneously knitting at least one pair of stringer tapes from warp chain threads, transverse lapping threads and inlaid lapping threads to form a waled structure with the inlaid lapping threads extending across at least three wales, the tapes being knitted side-by-side on the same knitting machine with their selvages interconnected by connecting threads and subsequently parting the connecting threads to separate the stringer tapes during or after the attachment of rows of interlocking elements of the sliding clasp fastener.

2. A process as in Claim 1, wherein the selvedge threads of the stringer tapes are reinforced in the warp chain threads, and/or the transverse lapping threads, and/or the inlaid lapping threads.

3. A process as in either Claim 1 or 2, wherein some of the inlaid lapping threads near the middle of the stringer tape are omitted to make the centre of the stringer tape approximately the same thickness as their selvages.

4. A process as in any one of Claims 1

to 3, wherein the inlaid lapping threads extend over four wales.

5. A process as in any one of Claims 1 to 4, wherein the connecting threads are laid as inlaid lapping threads or loop-forming threads, and are fed to a guide bar with individualised tension.

6. A process as in any one of Claims 1 to 5, wherein the stringer tapes are fed into attachment equipment in the united condition, for the rows of interlocking elements to be attached to the stringer tapes by sewing, insertion, adhesive bonding, or welding.

7. A process as in any of Claims 1 to 6 for the case when the rows of interlocking elements are to be attached by sewing to knitted stringer tapes with selvages formed by one or more wales, characterised in that the connecting threads during the knitting of the tapes are tensioned more tightly than the other threads, thereby broadening the inter-wale grooves nearest the tape selvages and providing sufficient space for insertion of a sewing needle into the grooves.

8. A process as in any one of Claims 1 to 5, for the case when the rows of interlocking elements are to be attached by insertion, each stringer tape being made with holes for inserting the rows of interlocking elements, the holes being in ladder-like formation in a loop-free zone of each tape that only contains the transverse threads connecting one broad region and one narrow region of the length of tape which regions also contain warp chain threads as well as transversely extending threads.

9. A process as in Claim 8, wherein the loop-forming threads in the narrow regions of the tapes are displaced towards each other so as to broaden the holes with strong tensioning of the connecting threads.

10. A process for the manufacture of sliding clasp fasteners substantially as hereinbefore described with reference to Figures 1 and 4; 2 and 4; 3 and 4; 4 and 6; 4 and 8; 4 and 9; 5; and 7 and 10 of the accompanying drawings.

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