Nov. 17, 1970 A. FRÖHLICH 3,540,084

SLIDE-FASTENER ASSEMBLY FOR BED LINEN AND THE LIKE

Filed Jan. 22, 1968 2 Sheets-Sheet 1

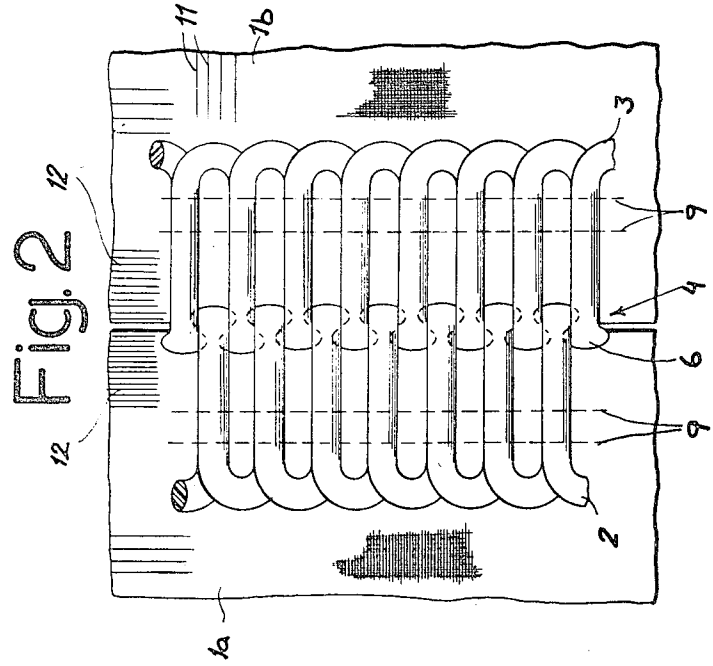


Fig. 2

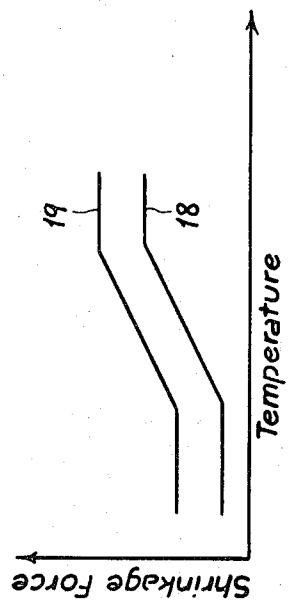


Fig. 4

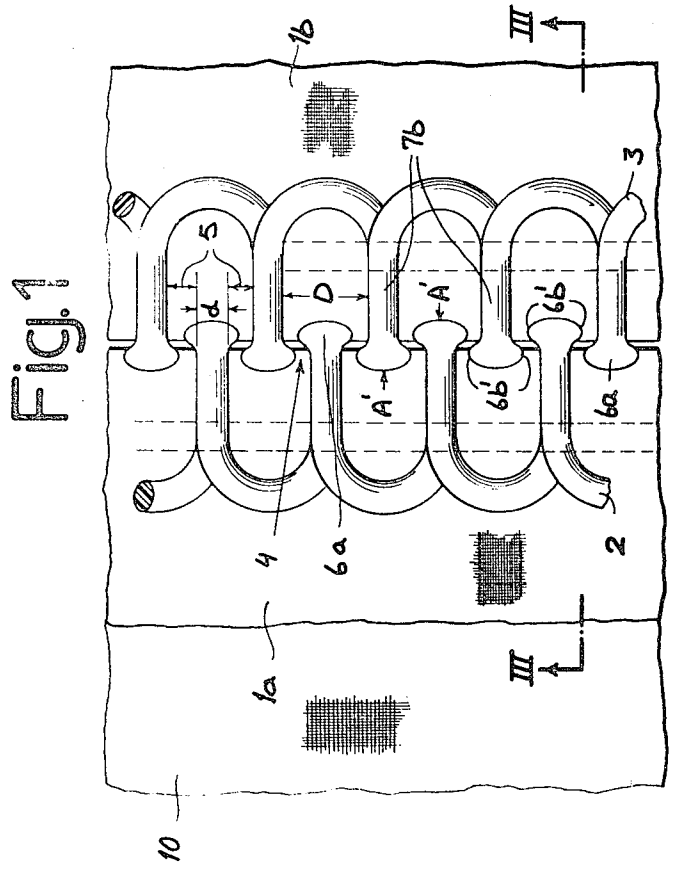


Fig. 1

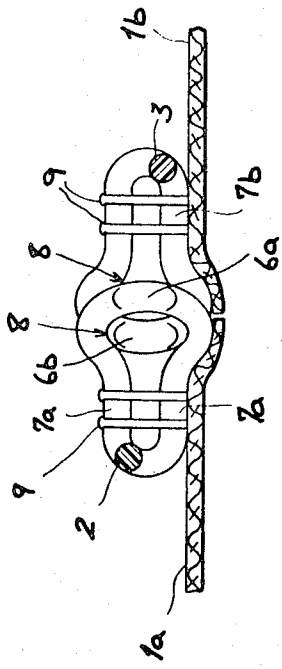


Fig. 3

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SLIDE-FASTENER ASSEMBLY FOR BED LINEN AND THE LIKE

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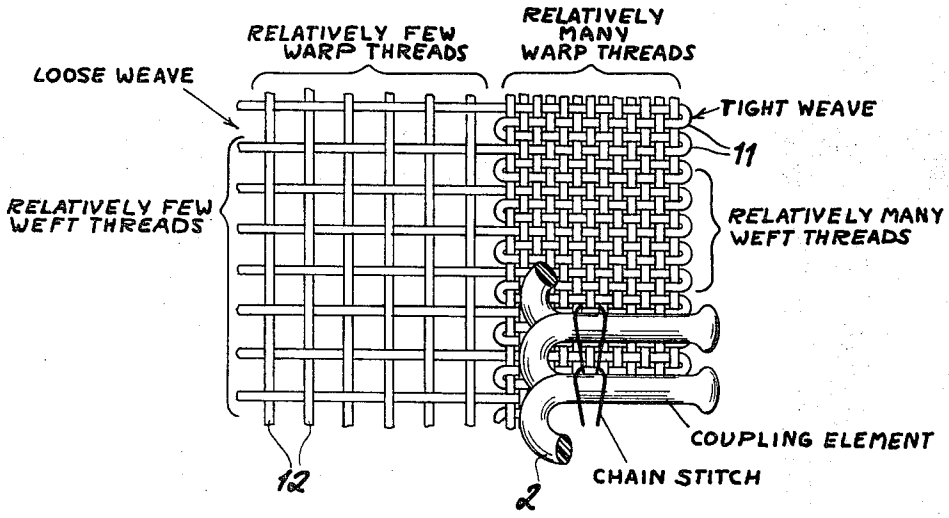


FIG. 1A

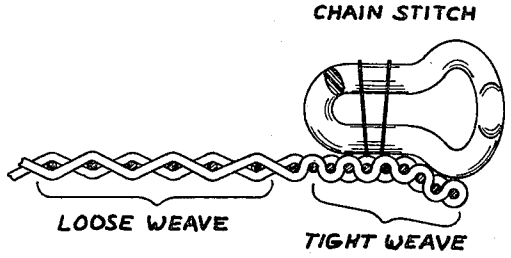


FIG. 1B

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SLIDE-FASTENER ASSEMBLY FOR BED LINEN AND THE LIKE

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Claims priority, application Germany, Jan. 21, 1967, O 12,243
Int. Cl. A44b 19/10
U.S. Cl. 24—205.1 4 Claims

ABSTRACT OF THE DISCLOSURE

A slide-fastener stringer whose shrinkable fabric bands are attached to a fabric article (i.e. bed linen) the shrinkage force of the bands in the longitudinal direction being less than that of the fabric article; the bands are of increased density in the region of the coupling elements and weft threads limiting the curling of the bands and composed of thermoplastic monofilament or coated with an elastomeric material.

My present invention relates to a slide-fastener stringer for bed linen and other fabric articles of a shrinkable material.

The use of slide fasteners in garments and other fabric articles and in upholstery, pillow covers and the like has had wide-spread acceptance although similar use of closures of this nature has hardly entered the field of bed linen. It has indeed been proposed to make use of modern types of slide fasteners, i.e. closures using continuous coupling elements of meandering or helical configuration on respective support tapes, but considerable difficulties were presented when conventional slide-fastener stringers where applied to bed linen and the like. Bed linen is generally characterized by a high cotton content and is for the most part woven so as to withstand rigorous cleaning treatments. During fabrication processes, the fabric is treated at elevated temperatures in such manner as to give rise to a 10% or more shrinkage in the length or width of the fabric. Where attempts were made to mount conventional slide-fastener stringers on fabrics for use in contoured sheets, mattress covers, pillow slips and blanket covers, for example, it was found that the thermoplastic slide fastener, once stitched in place, produced considerable wrinkling and stressing of the fabric as a result of such shrinkage.

Moreover, conventional methods of making the slide-fastener assemblies have required that the coupling heads formed on the meandered ribs or the successive turns of a helicoidal filament be laid in practically contacting relationship so that no clearance or play is found between the interengaged heads. Only in this manner, has it been possible to insure a sufficient tight junction between coupling elements and to provide the necessary transverse strength resisting separation of the coupling elements.

It is, therefore, the principal object of the present invention to provide a slide-fastener stringer which is especially suitable for use in bed linen and other fabric articles which may be subjected to high shrinkage phenomena.

It is another object of my present invention to extend the principles of the commonly assigned copending application Ser. No. 699,583 filed concurrently herewith.

Another object of this invention is to provide improved slide-fastener stringers for fabric articles with relatively high transversed or shear strength resisting separation of the interengaged coupling elements.

Still another object is to provide an improved method of making a slide-fastener assembly.

I have now found that it is possible to fabricate articles of a shrinkable fabric with slide-fastener stringers whose chains or rows of coupling heads are formed from a continuous thermoplastic monofilament with an interhead spacing exceeding the normal spacing necessary for proper interfitting of the coupling heads and dimensioned such that, upon shrinkage of the fabric band carrying the coupling elements, the gap between heads is reduced to the desired tolerance for tight fit. It has been found, for example, that the slide-fastener stringers for bed linen and the like can comprise a pair of support or carrying bands or tapes, advantageously composed of a fabric shrinkable to the same extent as that of the bed linen in the direction in which these bands extend, the tapes being provided along their approaching longitudinal edges with continuous coupling elements whose heads are spaced upon by an amount exceeding the normal head width but such that, with shrinkage up to about 10% in the overall length of the band (preferably about 5% shrinkage), the gap between heads is shortened such that the heads of the other coupling element are engaged in a tight-fitting manner.

In accordance with a preferred embodiment of this invention, the coupling elements are coupled of synthetic-resin monofilaments (e.g. a nylon polyamide) with a filament diameter of 0.2 to about 0.6 mm., the shrinkage step reading to a decrease in a gap width of about 0.1 mm. so that the overall shrinkage of the coupling chain 0.1N mm. where N is the number of coupling heads and the shrinkage is 0.1 mm. per coupling head. I have chosen the term "foreshortening play" to indicate the amount by which the interhead width exceeds the width of the head and, therefore, the amount by which each gap must be reduced to bring the heads defining it into tight-fitting engagement with the head of the other coupling element received in this gap.

The present invention is based upon the fact, disclosed originally in the aforementioned concurrently filed application, that coupling elements of the continuous type, i.e. formed with a continuous chain of coupling heads molded by heat and pressure in the respective turns of a coupling-element coil of thermoplastic synthetic resin, is able to be subjected to elastic deformation in the longitudinal direction because the successive turns constitute in effect a coil spring. Thus the shrinkage of the fabric upon which the coils are mounted can be used directly or indirectly to condense the coils through the clearance or play originally provided between the heads, thereby bringing each pair of coupling heads into tight-fitting or hugging engagement with the coupling head of the opposing element which previously was only loosely received in the interhead space. When reference is made hereinafter to an indirect shrinkage effect upon the coupling coils, it will be understood that reference is intended to the use of a support band or tape between the coupling elements which, in a direct-action system, are mounted upon the fabric of the article without an intermediate band. When the band is used, however, I prefer to constitute it of a shrinkable material adapted to sustain at least the same degree of shrinkage as the fabric article to which it is attached. The shrinkage of the band and fabric article, during the usual fabric-handling treatments which give rise to such shrinkage in the longitudinal direction of the coil, mechanically condenses the coil and brings each coil into tight-fitting engagement with the heads of the opposing coil. When the fabric-handling treatment involves heat of a sufficient degree to set the thermoplastic elements, the latter are locked in their tight-fitting engagement during (i.e. concurrently with) the fabric-handling shrinkage treatment. Thus, within the prin-

ciples of the present invention, the slide-fastener elements may be fixed directly or indirectly along opposite edges of a shrinkage-fabric article (e.g. bed linen and the like composed of cotton or mixtures of cotton with other fibers) and need not interfit tightly; the resistance of the slide fastener to separation and its transverse strength are both minimum. When, however, after the fabric article is subjected to its first washing, (i.e. a fabric-handling treatment producing shrinkage), the coupling heads are drawn together by the fabric shrinkage and hug the heads of the opposing element therebetween.

According to a more specific feature of this invention, the coupling element is composed of a nylon-tape monofilamentary polyamide having a circular cross-section and shaped into generally flat coils whose opposite longitudinal sides run parallel to the juxtaposed edges of the fabric band or the fabric article upon which the coupling elements are mounted. The coupling heads are formed by plastic deformation (i.e. under heat and pressure) of the turns of the flattened coil along the corresponding edge as has been described in application Ser. No. 651,757 and the host of prior patents dealing with helicoidal and meandering coupling chains; to provide the clearance or play between each pair of heads and the interfitting head of the opposing coupling elements, I coil the circular cross-section monofilament thread with an interturn spacing or pitch in excess of the cross-sectional diameter of the thread or filament, the amount which the turn spacing exceeds the thread diameter being the play.

Alternatively, the longitudinal extent of the deformed portions or heads of the turns may be less than the corresponding gap between the heads whereby the diameter of the receiving portion of the coupling elements is larger than the length of the coupling surfaces of the coupling head to form thereby the play mentioned earlier. It is possible to provide a structure of this nature by a one-sided deformation of the coupling elements, i.e. by pressing the flattened turns in the plane of their major diameters transversely to the longitudinal direction with heat and pressure. The resulting coils may be of pear-shaped cross-section. It has also been found advantageous to provide coupling elements which are composed of monofilamentary threads of thermoplastic synthetic resin with elliptical or sickle (crescent) shaped configuration, the turns being designed such that the individual coupling heads are inclined in the longitudinal direction and interengage, the heads being spaced such that shrinkage of the engageable slide fastener upon the fabric-handling treatment discussed earlier, permits the interengaged heads to penetrate deeper into the interhead spaces.

It has been found that a variety of methods can be used effectively to secure the coupling elements to the fabric article or the support bands, typical methods including stitching, interweaving or interknitting of the coupling elements, or simply inserting the coupling heads or turns through a ladderlike array of openings previously formed in the fabric at the spacing of the heads prior to shrinkage. Generally, in the latter case, the turns will not be materially deformed. It has been observed that, with shrinkage of the fabric formed with the ladderlike array of openings, each turn is positively positioned by the web of material between the openings with the shanks of the flattened coils being practically contiguous with one another. When stitching techniques are employed, double-chain stitches may be used with a single continuous thread row or a plurality of parallel row, the threads for the stitching operation having a shrinkage corresponding to that of the band and the article. The shrinkage of the stitching threads can be selected by proper choice of the yarn and fiber content, by adjustment of the thread tension or by selection of an appropriate spinning or twisting degree.

In accordance with the principles of the present invention, the support bands of the slide-fastener stringer for bed linen and the like are composed of a material which

is shrinkable at least in the longitudinal direction, the fabric of the band being loosely woven or knitted to the extent that the shrinkage force of the support band is relatively small by comparison to the shrinkage force of the fabric article to which the band is secured. The term "shrinkage force" is used herein to denote the contraction force generated upon shrinkage of the fabric. It will be appreciated that tightly woven cotton materials which may have a shrinkage of up to 10% in either direction, have a greater contractile force upon a shrinkage treatment than those loosely woven or loosely knitted fabric of the same material in spite of the fact that the degree of shrinkage overall may be the same. It suffices, in accordance with a specific feature of the present invention, to provide means for limiting the shrinkage force by interweaving in the weft or transverse direction weft threads of thermoplastic monofilament or of cotton or the like coated with an elastomeric material to render these threads more or less elastic. The less shrinkage and elastic thread, which may be partly wrapped around or fitted between the coupling heads as described in my copending applications Ser. Nos. 619,833 and 624,647, both filed Mar. 1, 1967, also reinforces and protects the stringer against the several washing and mangle ironing of the fabric. A similar reinforcement can be obtained by providing a more dense fabric construction in the weft direction along the edge of the band upon which the coupling element is mounted, e.g. by increasing the number of warp threads running through the band in this region.

When a fabric article is subjected to fabric shrinkage treatment, there occurs a condensation in the weft and in the warp directions which is characterized by a "shrinkage force" depending upon shrinkability and composition of the fibers, any preshrinkage treatment, etc. Just as two metals may have different degrees of coefficients of thermal expansion and may be joined to form a bismetallic element which bends in one or another direction on heating because of the difference in the coefficients of thermal expansion, two or more fabric layers in face-to-face relationship may have different shrinkage forces either in the weft or warp direction with the assembly shrinking to the degree determined by the fabric with the least degree of shrinkage or greatest resistance to shrinkage. Hence a low shrinkage force loosely woven fabric, applied to a high shrinkage force tightly woven fabric, will upon shrinkage of the latter be drawn together but will not bunch or impede the shrinkage of the more tightly woven material.

This system has the advantage that the band may follow the shrinkage of the fabric article to which it is attached without wrinkle and without weakening of the support in the region of the coupling element so that distortion of the latter is not possible. It is not, however, necessary, when a loose weave or knit is employed and the shrinkage force of the band is less than that of the fabric article, to have the overall shrinkage of the band identical to that of the article inasmuch as the shrinkage of the article will determine the shrinkage of the band attached thereto.

Thus the latter arrangement has the significant advantage that a single stringer may be used on fabric articles with a wide range of shrinkage potential and on fabric articles of widely differing materials. The stringer should be provided with an ironable slider of the type described and claimed in my copending application Ser. No. 651,757 of July 7, 1967 or my application Ser. No. 698,226 filed Jan. 16, 1968 and entitled "Slider With Cantilevered Guide Formations for Slide-Fastener Closures."

The above and other objects, features and advantages of the present invention will become readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a plan view, somewhat in diagrammatic form, of a slide-fastener stringer in a preliminary stage of manufacture and prior to shrinkage of the fabric article upon which it is provided;

FIG. 1A is a detail view in plan as in FIG. 1 both illustrating diagrammatically and in greater detail the relatively dense and relatively loose weaves of the support band;

FIG. 1B is a cross-sectional view in the transverse direction through the detail of FIG. 1A;

FIG. 2 is a view similar to FIG. 1 showing the stringer after such shrinkage;

FIG. 3 is a cross-sectional view taken along the line III—III of FIG. 1; and

FIG. 4 is a diagram comparing the shrinkage force of a support band for the coupling element with the shrinking force of the fabric article (bed linen).

In my copending applications Ser. Nos. 619,833 and 624,647, filed Mar. 1, 1967, and Ser. No. 653,402, filed July 14, 1967, I have pointed out the advantages of ladder-like arrays of openings for rceiving the individual heads of a continuous coupling element for a slide-fastener stringer of the general character described above. In those applications and in the present case, similar principles are involved, namely, the coupling elements are in part anchored in place by shrinkage of a fabric material.

In FIG. 1 of the present case, I show a fabric support comprising a pair of bands **1***a* and **1***b* which represent a shrinkage fabric to which a pair of continuous coupling elements **2** and **3** are attached by parallel rows of double-chain stitches **9** whose paths are shown in broken lines in FIG. 1. The stitches are represented in structural terms in FIG. 3. The support **1***a*, **1***b* is secured to the fabric article **10** (e.g. bed linen, pillow slips, etc.) or support tapes which are to be secured to the fabric article subsequently as describde above. As is apparent from FIG. 1, the interengageable coupling heads **6***a* and **6***b* are formed on respective turns of a pear-shaped cross-section monofilamentary synthetic-resin thread by deforming these turns in the direction of arrow A and A′ under heat and pressure to create lateral protuberances **6***a*′ and **6***b*′, respectively. The heads are each located along the outer longitudinal side of the shanks **7***a* and **7***b* forming the turns, the shanks being attached to the bands **1***a* and **1***b* by the row of double-chain stitches **9** (FIG. 3).

The spacing D between the turns of the coupling elements **2** and **3** exceeds the diameter *d* of the monofilamentary material by amounts represented at **5** which correspond to the play between each pair of heads of one coupling element and the head of the other coupling element received between them. The gaps **4** are designed to amount to up to 10% of the overall length of the coupling element and preferably about 5% thereof with about 0.1 mm. per interhead space. Consequently, the interengaged coupling elements of FIG. 1, prior to shrinkage, fit with considerable looseness. It is desirable, moreover, that the protuberances **6***a*′ and **6***b*′ project outwardly from the respective heads in the longitudinal direction by approximately 0.1 mm. The cross-section of the coupling-element threads is substantially similar while each turn is deformed into a pear-shaped cross-section (FIG. 3) such that the diameter of the socket **8** of the coupling members at **4** is greater than the length of the coupling protuberances **6***a*′ and **6***b*′. The one-sided pressure upon the coupling turns in the direction of arrows A and A′ causes an inward bowing of the shanks **7***a* and **7***b* of each turn toward one another, thereby permitting the diameter of the receptacle **8** to be larger than that possible when the shanks will bend away from one another. When the fabric support **1***a*, **1***b* is subjected to its first washing after the attachment of the coupling elements to the fabric article, the fabric shrinks substantially (FIG. 2) (preferably about 5%) to mechanically condense the coupling-element coils **2** and **3** and thereby provide the tight fit shown in FIG. 2.

As can be seen from FIGS. 1A and 1B, the more dense and tighter weave of the fabric band in the region of the coupling elements may be formed by an increase in the number of weft threads and/or an increase in the number of warp threads in this region whereas the region rearwardly of the coupling element is provided with relatively few warp or weft threads and thereby constitutes a looser weave.

From the foregoing, it will be apparent that applicant provides a loosely woven support band so that, upon shrinkage of the fabric article, the contraction of this band will not constitute a limiting factor in the contraction of the coupling elements mounted thereon and the contraction will occur free from bunching or distortion. Thus the shrinkage of the article controls both the condensation of the support band and the contraction of the coupling heads so that the turns or heads are provided with their operable guage only upon shrinkage of the article. Prior to such shrinkage, the assembly has an interhead spacing which exceeds the operable gauge of the coupling heads by the predeterminable amount of shrinkage of the article per coupling head.

In FIG. 4, I show the shrinkage force **19** of the fabric article and the shrinkage force **18** of the fabric band plotted along the ordinate while the temperature of the fabric-handling treatment is plotted along the abscissa. The temperature has reference to the shrinkage treatment which generally is a boiling of the fabric in the course of fabrication, the boiling following attachment of the band **1***a*, **1***b* to the article **10**. From this diagram, it will be evident that the shrinkage force of the band, which is loosely woven or knitted, is substantially less than the shrinkage force of the fabric article. Thus, during shrinkage the band **1***a*, **1***b* follows the shrinkage of the article. At **12**, I show the warp threads of the band in diagrammatic form, these warp threads being more closely spaced along the edge of the band in the region of the coupling elements **2** and **3** than in the remainder of the band. In the transverse direction, the weft threads **11** of thermoplastic monofilament or rubber-coated cotton are disposed to prevent the bands from turning or lifting during the fabric handling treatment.

I claim:

1. A slide fastener assembly comprising, in combination, a woven fabric article shrinkable in a longitudinal direction upon fabric treatment to a predeterminable degree; and respective continuous coupling elements extending in longitudinal direction along confronting edges of said article and having interengageable turns affixed to the fabric of said article, the turns forming respective coupling heads with an interhead spacing prior to a shrinkage treatment of the fabric exceeding the operable interhead gauge of the coupling heads by the predeterminable amount of shrinkage of the article per coupling head.

2. A slide-fastener assembly comprising, in combination, a woven fabric article shrinkable in a longitudinal direction upon fabric treatment to a predeterminable degree; respective continuous coupling elements extending in longitudinal direction along confronting edges of said article and having interengageable turns affixed to the fabric of said article, the turns forming respective coupling heads with an interhead spacing prior to a shrinkage treatment of the fabric exceeding the operable interhead gauge of the coupling heads by the predeterminable amout of shrinkag of the article per coupling head; and a respective support band composed of a shrinkage fabric between each of said coupling elements and said article and extending longitudinally along said coupling elements, the shrinkage force of said bands at least in the longitudinal direction being less than the shrinkage force of said article whereby shrinkage of the article contracts said bands in the longitudinal direction and draws the coupling heads together to produce said operable interhead gauge of the coupling heads, the fabric of said bands being of loosely woven constructiton over at least part of each band by comparison with the weave of the article, said bands having weft and warp threads extending respectively in a transverse and in a longitudinal direction with the warp thread being of increased number

of a portion of the width of the bands in the region of the respective coupling elements and of increased density in this region.

3. The assembly defined in claim 2 wherein said warp threads are at least in part composed of a thermoplastic monofilament.

4. The assembly defined in claim 2 wherein said warp threads are composed in part of threads coated with an elastomeric material.

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