Feb. 14, 1939. S. C. LILLEY 2,146,966

ELASTIC STRAND FOR ELASTIC FABRICS AND METHOD OF PRODUCING THE SAME

Filed Nov. 22, 1937

Fig. 2.

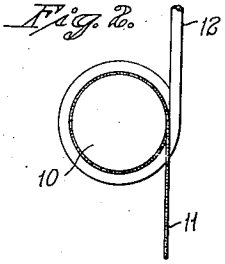


Fig. 1.

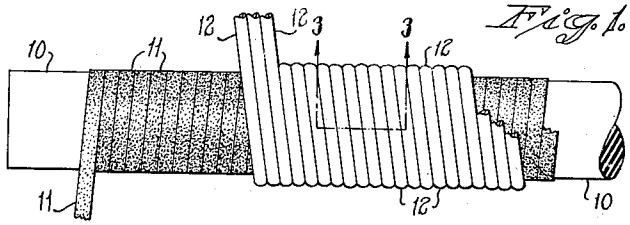


Fig. 3.

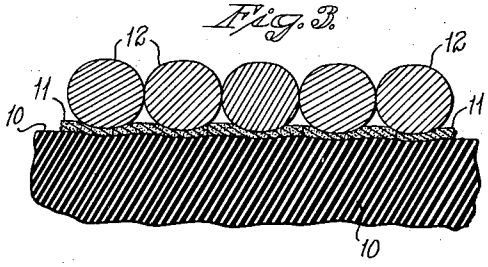


Fig. 4.

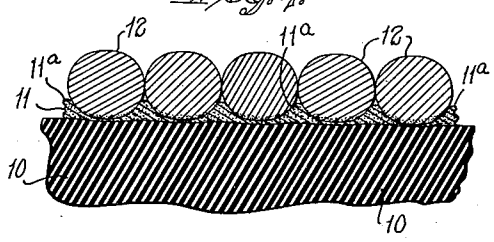


Fig. 6.

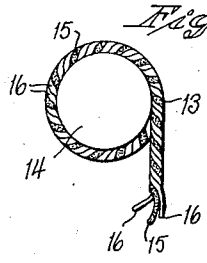


Fig. 5.

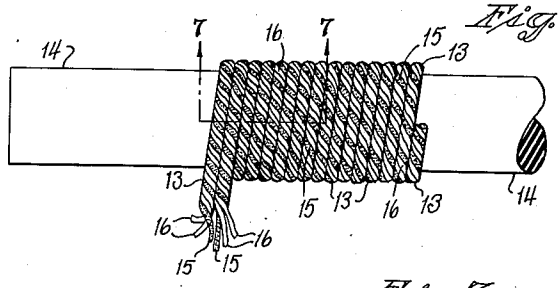


Fig. 8.

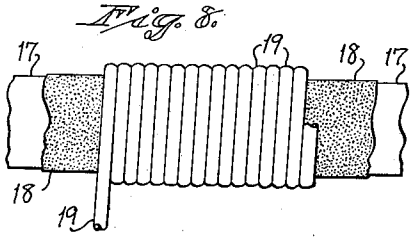


Fig. 7.

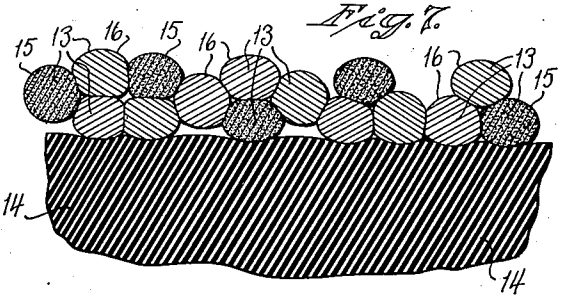
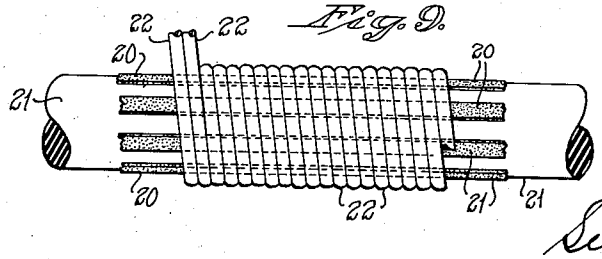


Fig. 9.



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ELASTIC STRAND FOR ELASTIC FABRICS AND METHOD OF PRODUCING THE SAME

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Application November 22, 1937, Serial No. 175,925

14 Claims. (Cl. 117—34.5)

This invention relates to improvements in elastic strands for elastic fabrics, and the methods of producing such strands, and is primarily concerned with providing for the securement of elastic strands to textile covering material, and vice versa.

This application constitutes a continuation in part of my co-pending application filed October 20, 1936, Serial No. 106,581.

Methods for anchoring textile covering material to elastic strands have been proposed prior to the present invention, but such proposals have been open to serious objections, such, for instance, as high cost, unsightliness of the product, interference with covering, weaving, or other fabricating operations, etc.

As will be apparent from the following, the present invention contemplates providing for the securement of textile covering material to elastic strands by means of a thermo-plastic or heat-activatable adhesive-forming material, rather than by a wet cement, as heretofore proposed.

One of the objects of the present invention is to provide a superior method for securing elastic strands to textile covering material, wherein the securement or anchorage referred to is accomplished in a manner which will be effective but which will not occasion objectionable alterations in the appearance of the textile covering material overlying the said strand.

A further object of the present invention is to provide a superior method for the manufacture of covered elastic strands, in which textile covering material and the elastic strand-bodies are effectively anchored or secured to the covering material to guard against creeping or recession of the former with respect to the latter.

Another object of the present invention is to provide a superior method for producing covered elastic strands (comprising an elastic strand-body and a textile covering anchored thereto) which may be readily processed without materially interfering with the satisfactory operation of the covering, weaving or other fabricating apparatus.

A still further object of the present invention is to provide a superior covered elastic strand in which the elastic strand-body is effectively secured to a textile covering envelope, but in such manner as not to materially interfere with weaving or otherwise incorporating such covered elastic strands into elastic fabric.

Another object is to provide a superior elastic strand for incorporation into elastic fabric, which is provided with heat-activatable means which will firmly adhere the said elastic strand to textile covering material which may extend around the strands or across the same, as for instance, in the case of the weft strands of an elastic fabric.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawing, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a broken view in side elevation showing a thermo-plastic adhesive-forming ribbon and covering-strands applied to an elastic strand-body preparatory to softening or activating the said adhesive-forming ribbon by means of heat to adhere the covering-strands to the elastic strand-body;

Fig. 2 is an end view thereof;

Fig. 3 is a broken, longitudinal, sectional view thereof taken on the line 3—3 of Fig. 1 but on a larger scale;

Fig. 4 is a broken view substantially corresponding to Fig. 3 but showing the covered strand after the dry adhesive-forming ribbon has been activated by heat to adhere the covering-strands to the elastic strand-body;

Fig. 5 is a broken view in side elevation illustrating another mode of applying thermo-plastic adhesive-forming material and covering material to an elastic strand-body;

Fig. 6 is an end view thereof;

Fig. 7 is a broken, longitudinal, sectional view taken on the line 7—7 of Fig. 5 but on a larger scale;

Fig. 8 is a broken view in side elevation illustrating another mode of adhering covering material to an elastic strand-body; and

Fig. 9 is a similar view of still another manner in which covering material and adhesive-forming material may be applied to an elastic strand-body.

The particular covered elastic strand herein chosen for illustration in Figs. 1 to 4 inclusive, includes an elastic strand-body 10 which may be of round, rectangular or other cross-sectional form. The said elastic strand-body, whatever its cross-sectional shape, is of such dimension as will permit it to be readily woven, knitted or otherwise incorporated into elastic fabrics.

The elastic strand-body 10, above referred to, has helically wrapped around it one or more ribbon-like strands 11 of a suitable heat-activatable adhesive-forming material (specific examples of which are hereinafter given) which may be converted into an effectively-active adhesive when subjected to heat. The said strand 11 for the purpose of convenience of description may be aptly designated as heat-activatable or thermo-plastic or heat-activatable thermo-plastic adhesive-forming material, inasmuch as the said material may be viewed as but a potential adhesive which is substantially dry and nonliquid at ordinary temperatures and which will not become

fully effective as an adhesive until subjected to the action of heat.

Helically wrapped over the ribbon-like strand 11 of adhesive-forming material and preferably inclined in a direction opposite to the inclination thereof are a plurality of covering-strands 12 of suitable textile material such, for instance, as cotton, regenerated cellulose, silk, wool, etc.

After both the thermo-plastic adhesive-forming material 11 and the covering material 12 are in place upon the elastic strand-body 10, the partly-finished assembly may be subjected to heat, either before or after its introduction into a fabric, in any convenient manner which will render the adhesive-forming strands 11 or their equivalent sufficiently soft or fluid to adhere the covering-strands 12 or their equivalent to the elastic strand-body as is schematically illustrated in Fig. 4, in which it will be noted that the adhesive displaces outwardly to form stabilizing-ridges 11a between the convolutions of the covering-strands 12.

Before the covering material such as the covering-strand 12 are applied over the thermo-plastic adhesive-forming material such as the strands 11, the said strands 11 or their equivalent thermo-plastic material are preferably treated to minimize the adhesiveness or tackiness of their outer surfaces at normal temperatures by any one of a variety of adhesiveness-reducing treatments, such for instance as by passing the strand 11 either before or after its application to the strand-body 10, through a bath of water-soluble gum combined with talc or by dusting with a mixture of equal parts of cornstarch and talc. A suitable gum for this purpose is locust-bean gum. Another mode of reducing the adhesiveness of the surfaces of the thermo-plastice strand 11 at normal temperature comprises passing the said strands 11 through a dilute vapor of sulphur-chlorine and carbon tetrachloride so as to effect only a slight surface or skin cure of the said thermo-plastic material 11.

The thermo-plastic material 11 is usually sufficiently soft to permit the covering material 12, when the latter is applied under tension, to yield and slightly displace, as shown in Fig. 3, though the said material 11 does not substantially penetrate the material 12 until heat is applied as described. The thermo-plastic adhesive-forming strands such as 11 may be caused to substantially lose their identity as strands (Fig. 4) by employing a sufficient degree of heat over a relatively-long period of time though with some of the preferred thermo-plastic compounds the compound may be caused to sufficiently penetrate the inner surface portions of the covering material such as 12 as shown in Fig. 4, by a relatively-brief heating at moderate temperatures (a temperature intermediate the boiling point of water and about 260° F.).

The elastic strand-bodies 10 and the others herein referred to may be made of a wide variety of elastic materials such for instance as the vulcanized rubber compounds common in the textile art and preferably having a heat-disintegrating-point at a temperature materially above the temperature at which the thermo-plastic adhesive-forming material used in conjunction with the said body-strand 11 will effectively soften or become active as an adhesive for the purpose intended.

In addition to the usual and other elastic compounds in the textile art, the following compound may be mentioned as particularly suitable for the production of elastic strand-bodies when cured for about forty-five minutes at approximately 260° F.:

	Parts by weight
Rubber	100
Sulphur	3⅔
Stearic acid	1
Symmetrical di-beta-naphthyl-para-phenylenediamine	1
Zinc sulphide	5
Phenylhydrazine	½
90% zinc salt of mercaptobenzothiazole, 10% di-ortho-tolylguanidine	1
Zinc oxide	5
Methylacrylic ester	20

The material from which the thermo-plastic adhesive-forming strand 11 and the other thermo-plastic materials hereinafter referred to may be constituted may vary widely but preferably such material should embody all of the following features:

(a) Water-insolubility to permit the laundering of the fabrics in which the elastic strands of the present invention may be incorporated;

(b) An initial effective softening-point or heat-activatable point below the temperature at which the strand-body would be harmfully affected in order to avoid the weakening or disintegration of the said strand-body when the covered-strand is subjected to heat;

(c) An effective softening-point after it has once been activated, at temperatures above 212° F. in order to permit the laundering of fabrics in which the elastic strands of the present invention may be incorporated, in boiling water; and

(d) Characteristics which will not deleteriously affect either the covering material or the elastic strand-bodies.

The following examples of thermo-plastic adhesive-forming materials are given by way of illustration:

Example A

	Parts by weight
Blended rubber (para and/or pale crepe)	100
Zinc oxide	5
Zinc sulphide	5
Stearic acid	3
Sulphur	3½
Mercaptobenzothiazole	1½
Sym. di-beta-naphthyl-para-phenylene-diamine	1

Example B

Rubber	100
Dibutyl-ammonium-oleate	3

Example C

Rubber	100
Meta-toluene-diamine	1

Example D

Rubber	100
Di-penta-methylene-thiuram-tetra-sulphide	3

Example E

Balata.

Example F

Methyl-polyacrylate.

Example G

Gutta-percha.

Example H

Rubber	100
Fatty anhydride (stearic acid or the like)	3

The rubber content in the above Examples A,

B, C and D, should preferably be what is known in the trade as "pure rubber mix" which is mechanically worked at high temperatures to produce a tough product with a minimum breakdown of the rubber itself. The pure rubber hydrocarbon is then treated with compounds such, for instance, as those above given.

Formula A above given is preferred over the other examples listed for the reason that when subsequently heated for approximately three minutes at about 260° F. to adhere the strand-bodies to the chosen textile covering material, it then becomes vulcanized or set and is not again softenable except at temperatures very materially beyond those encountered in any normal use to which elastic fabrics would be put.

The covering material herein referred to may be composed of a wide variety of textile or fibrous materials such, for instance, as cotton, wool, regenerated cellulose, silk, etc., which specific examples are substantially-inelastic as compared to the elastic strand-bodies herein referred to.

If desired and as shown in Figs. 5 to 7 inclusive one or more composite strands, generally designated by the reference character 13, may be helically wrapped around or otherwise applied to an elastic strand-body 14. Each composite strand 13 comprises one or more filaments 15 of thermo-plastic adhesive-forming material and one or more filaments 16 of suitable textile covering material.

When the covered elastic strand structure of Figs. 5 to 7 inclusive is subjected to heat, either before or after its introduction into a fabric, the thermo-plastic adhesive-forming filaments 15 will become softened or activated and serve to adhere the filaments of covering material 16 to the elastic strand-body 14 and incidentally also to each other. When heated, as just described, the portions of the filaments 15 or their equivalent, which are at the exterior of the strand 13, will penetrate inwardly rather than outwardly as is largely the case with the other adhesive-forming materials herein described.

Instead of applying the thermo-plastic adhesive-forming material in the form of a strand or filament, an elastic strand-body 17 may be provided with an all-over coating 18 of heat-activatable or thermo-plastic adhesive-forming material as illustrated in Fig. 8 of the accompanying drawing. Positioned over the coating 18 and while the same is in a substantially-dry or non-liquid state, one or more layers of suitable covering material such, for instance, as the covering-strands 19, may be applied as shown. Upon subjecting the assembly just referred to (Fig. 8) to the action of heat, either before or after its incorporation into a fabric, the heat-activatable coating 18 may be rendered sufficiently liquid or fluid to adhere the covering material 19 to the elastic strand-body 17.

The coating 18, above referred to, may be applied to the strand-body 17 by passing the latter through a liquid dispersion of thermo-plastic material and then drying such dispersion before the covering material is applied and preferably after the surface of the now non-liquid thermo-plastic material has been given an adhesiveness-reducing treatment such as has been hereinbefore referred to.

A satisfactory all-over coating may be applied to elastic strand-bodies by dispersing Example A of thermo-plastic adhesive-forming material above given in from about 50 to 70% of naphtha or other dispersing medium. In this connection it is to be noted that the smaller cross-sectional area of the strand-bodies which are to be coated, the less should be the thermo-plastic content in order to avoid undue thickness of the coating of thermo-plastic adhesive-forming material when the same is ultimately substantially dry.

If desired and as shown in Fig. 9, a suitable number of thermo-plastic adhesive-forming strands 20 may be extended longitudinally of an elastic strand-body 21 over which may be wrapped, braided or otherwise extended one or more strands 22 of textile covering material. The strands 20 before their application to the strand-body 21 should be suitably treated to minimize their adhesiveness at normal temperatures but in such manner as not to prevent their becoming adhesively active under the influence of heat.

When the elastic strand structure of Fig. 9 is subjected to the action of heat, either before or after being woven or the like, the substantially-longitudinal thermo-plastic adhesive-forming strands 20 may be caused to lose their identity as strands and become sufficiently fluid or adhesive to adhere the covering material 22 to the elastic strand-body 21.

If desired and as is common in the art, a second layer of textile material may be applied over the covering-material layers before described.

In each of the examples of the present invention above referred to, it will be noted that the textile covering material, whatever its character, is extended over the strand-body only while the thermo-plastic adhesive-forming material is in a non-liquid or substantially-dry state, so that the ultimately-desired degree of adhesion between the strand-body and covering material is obtained only when the covering material, thermo-plastic adhesive-forming material, and strand-body are concurrently subjected to heat.

It is also to be noted that preferably and as is the case with all of the foregoing examples of the present invention, the textile covering material is substantially unpenetrated by the thermo-plastic adhesive-forming material prior to the activating of the said thermo-plastic adhesive-forming material by heat.

Strand-bodies with their applied thermo-plastic adhesive-forming material may be conveniently stored, shipped and sold in a naked or uncovered state, and at the desired time introduced into covering machines to receive helical or braided covering or the like, or introduced directly into fabric for adhesion to the adjacent strands thereof, which strands in effect constitute covering material and when the fabric thus produced is subjected to heat, the thermo-plastic adhesive-forming material upon the strand-bodies will be activated and minimize any tendency of the said elastic strands to creep with respect to the fabric in the event that such elastic strand-bodies should be ruptured or severed, as for instance by sewing or by excessive stretching.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, compris-

ing: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material and positioning textile covering material over the said strand-body while the said adhesive-forming material is in a non-liquid state; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material of the said strand-body to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body.

2. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material and enveloping the said elastic strand-body while the adhesive-forming material thereof is in a non-liquid state with textile covering-strands; and then subjecting the assembly thus produced to the action of heat to activate the thermo-plastic adhesive-forming material of the said body-strand to cause the same to thermo-plastically adhere the said enveloping textile covering-strands to the said strand-body.

3. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material; then treating the thermo-plastic material of the said strand-body to minimize its adhesiveness at normal temperatures; then positioning textile covering material over the said elastic strand-body; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material of the said strand-body to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body.

4. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming surface; treating the adhesive-forming material of the said strand-body to minimize its adhesiveness at normal temperatures; then enveloping the said strand-body with textile covering-strands; and then subjecting the assembly thus produced to the action of heat to activate the thermo-plastic adhesive-forming material of the said body-strand to cause the same to thermo-plastically adhere the said textile covering-strands to the said strand-body.

5. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material; then treating the thermo-plastic material of the said strand-body to minimize its adhesiveness at normal temperatures; then, while the said adhesive-forming material is in a non-liquid state and after the same has been treated as just stated, positioning textile covering material over the said elastic strand-body; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material of the said strand-body to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body.

6. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming surface; treating the adhesive-forming material of the said strand-body to minimize its adhesiveness at normal temperatures; then, while the said adhesive-forming material is in a non-liquid state and after the same has been treated as just stated, enveloping the said strand-body with textile covering-strands; and then subjecting the assembly thus produced to the action of heat to activate the thermo-plastic adhesive-forming material of the said body-strand to cause the same to thermo-plastically adhere the said enveloping textile covering-strands to the said strand-body.

7. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the surface of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material having an initial melting point at a temperature materially below the melting temperature of the main portion of the said body-strand and positioning textile covering material over the said strand-body while the said adhesive-forming material is in a non-liquid state; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material of the said strand-body to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body.

8. A method of securing textile covering material to elastic strands of the type adapted to be woven or knitted into elastic fabric, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material having a melting point materially lower than the melting point of the major portion of the said strand-body; then treating the thermo-plastic material of the said strand-body to minimize its adhesiveness at normal temperatures; then positioning textile covering material over the said elastic strand-body; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material of the said strand-body to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body.

9. A method of securing textile-covering material to elastic strands of the type adapted to be woven or knitted into elastic fabrics, comprising: providing the exterior of an elastic strand-body with an elastic heat-activatable thermo-plastic adhesive-forming material and a textile covering material; and then subjecting the assembly thus produced to the action of heat to activate the said elastic thermo-plastic adhesive-forming material to cause the same to thermo-plastically adhere the said textile covering material to the said strand-body, the said textile covering material being substantially unpenetrated by the said thermo-plastic adhesive-forming material prior to subjecting the assembly to the action of heat for the purpose described.

10. As a new article of manufacture, an elastic strand of the type adapted to be adhered to textile covering material by heat and to be woven or knitted into elastic fabric, and comprising: an

elastic strand-body having its exterior provided with a non-liquid heat-activatable thermo-plastic adhesive-forming material serving to thermo-plastically adhere the strand-body to textile covering material when heated in conjunction therewith.

11. As a new article of manufacture, an elastic strand of the type adapted to be adhered to textile covering material by heat and to be woven or knitted into elastic fabric, and comprising: an elastic strand-body having its exterior provided with a non-liquid heat-activatable thermo-plastic adhesive-forming material serving to thermo-plastically adhere the strand-body to textile covering material when heated in conjunction therewith; and an adhesiveness-reducing coating extending over the surface of the said thermo-plastic adhesive-forming material and serving to minimize the adhesiveness of the surface thereof at normal temperatures.

12. As a new article of manufacture, an elastic strand of the type adapted to be adhered to textile covering material by heat and to be woven or knitted into elastic fabric, and comprising: an elastic strand-body having its exterior provided with a non-liquid heat-activatable thermo-plastic adhesive-forming material having a materially-lower melting point than the major portion of the said strand-body and serving to thermo-plastically adhere the strand-body to textile covering material when heated in conjunction therewith.

13. As a new article of manufacture, an elastic strand of the type adapted to be adhered to textile covering material by heat and to be woven or knitted into elastic fabric, and comprising: an elastic strand-body having its exterior provided with a non-liquid heat-activatable thermo-plastic adhesive-forming material having a materially-lower melting point than the major portion of the said strand-body and serving to thermo-plastically adhere the strand-body to textile covering material when heated in conjunction therewith; and an adhesive-reducing coating extending over the surface of the said thermo-plastic adhesive-forming material and serving to minimize the adhesiveness of the surface thereof at normal temperatures.

14. A covered elastic strand of the type adapted to be woven or knitted into elastic fabric and comprising: an elastic strand-body; textile covering material surrounding the said strand-body and substantially unpenetrated by dissolved adhesive; and an elastic adhesive material thermo-plastically uniting the said strand-body to the said textile covering material without substantially penetrating the latter and confined substantially entirely between the said strand-body and covering material.

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