Feb. 14, 1939. S. C. LILLEY 2,146,965

ELASTIC STRAND FOR INCORPORATION INTO ELASTIC FABRICS

Filed July 22, 1937

Fig. 1.

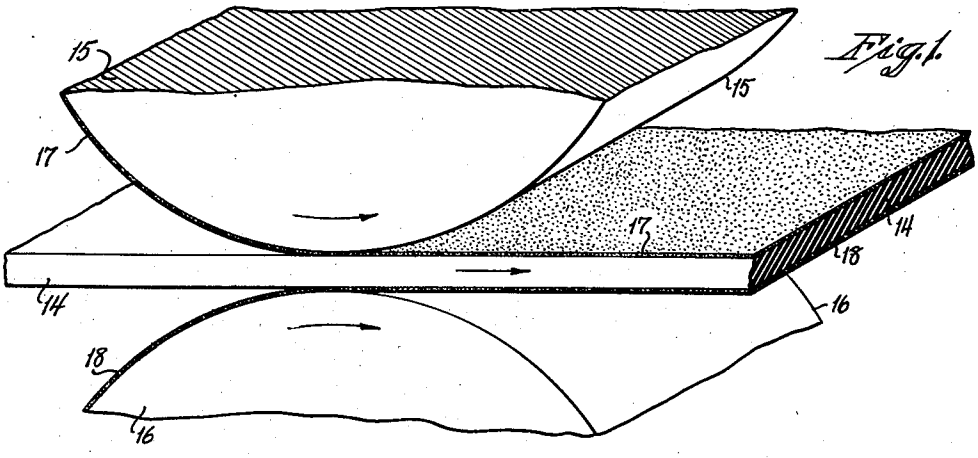


Fig. 2.

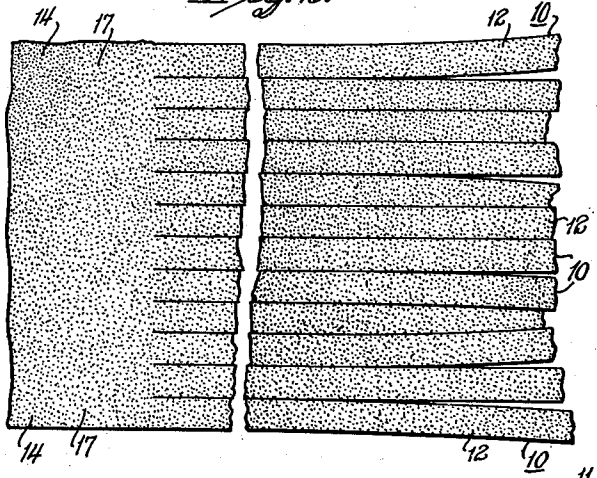


Fig. 3.

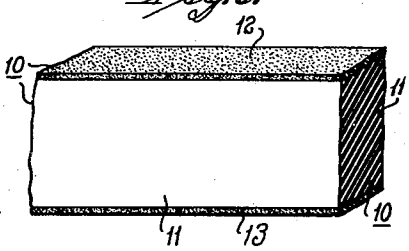


Fig. 4.

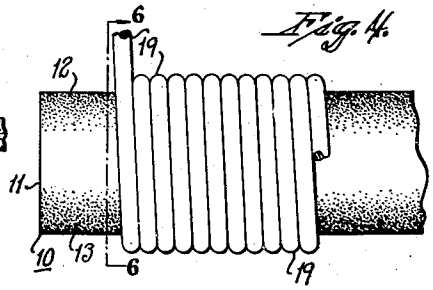


Fig. 5.

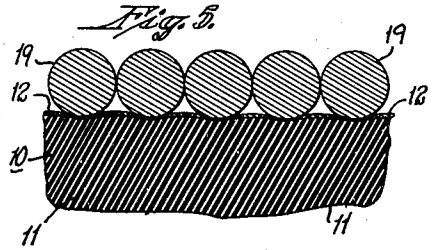


Fig. 6.

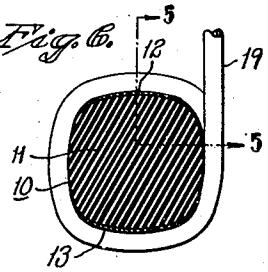
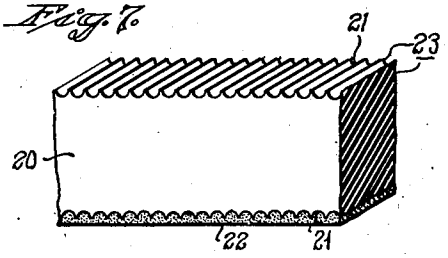


Fig. 7.



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ELASTIC STRAND FOR INCORPORATION INTO ELASTIC FABRICS

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7 Claims. (Cl. 117—57)

This invention relates to an improvement in elastic strands for incorporation into elastic fabrics, and more particularly to an improved elastic strand for the purpose referred to, which elastic strands are provided with a localized coating of heat-softenable adhesive-forming material, by which the elastic strands may be anchored to a covering material or to the cross-strands of a fabric in which the elastic strands are incorporated.

The present invention, as will be apparent from the following, contemplates an elastic strand of rectangular form in cross-section and designed for incorporation into elastic fabrics and having one or more of its angularly-related faces provided with a longitudinally-extending coating or area of heat-softenable adhesive-forming thermoplastic material which is capable of being rendered actively adhesive by heat, so that covering material or cross-strands of a fabric may be anchored to the elastic strands.

One of the objects of the present invention is to provide a superior elastic strand having a localized area or coating of heat-softenable adhesive-forming material fixedly united therewith.

A further object is to provide a superior elastic strand of the character above referred to, which is economical to produce and convenient to use.

Another object of the present invention is to provide a superior elastic strand which includes heat-softenable or thermo-plastic adhesive-forming material and which will not mar the appearance of covering material applied thereto nor similarly affect fabrics in which the strand is incorporated.

A still further object of the present invention is to provide a superior elastic strand for incorporation into elastic fabrics, and having an adhesive-forming coating so located that an excess thereof is guarded against to thus avoid impairing the appearance of covering material which may be applied to the strands or impairing the appearance of the fabric in which the strands may be incorporated.

Another object of the present invention is to provide a superior elastic strand which includes heat-softenable or thermo-plastic adhesive-forming material and which will not mar the appearance of covering material applied thereto nor similarly affect fabrics in which the strand is incorporated.

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 and which are not claimed by me in a separate application.

In the accompanying drawing:

Fig. 1 is a broken schematic perspective view illustrating a mode of applying thermo-plastic adhesive-forming layers or coatings to the respective opposite faces of a sheet of elastic body-material;

Fig. 2 is a broken face view of the sheet material shown in Fig. 1 after the same has been coated and has been partially slitted to produce a plurality of individual elastic strands of rectangular form in cross-section;

Fig. 3 is a perspective view on an enlarged scale of a section of elastic strand cut from the sheet of Fig. 2;

Fig. 4 is a broken view in side elevation showing the strand of Fig. 3 with a helical wrapping of covering strand material applied and thermoplastically adhered thereto;

Fig. 5 is a broken longitudinal sectional view thereof taken on the line 5—5 of Fig. 6, but on a greatly-enlarged scale;

Fig. 6 is a transverse sectional view taken on the line 6—6 of Fig. 4 and also shown on a greatly-enlarged scale; and

Fig. 7 is a perspective view of another form of elastic strand embodying the present invention.

The particular elastic strand herein chosen for the illustration of the present invention in the figures including and preceding Fig. 6, is generally designated by the reference character 10, and includes a body 11 of elastic material and layers or coatings 12 and 13 fixedly secured to two of its respective opposite faces, as is especially well shown in Fig. 3.

The elastic bodies 11 above referred to, may be made of a variety of elastic materials, such, for instance, as the vulcanized rubber compounds common in the textile art, and preferably having a heat-softening or disintegrating point materially above the temperature at which the thermoplastic adhesive-forming material 12 and 13 used in conjunction with the body 11, will effectively soften.

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 body-strands when cured for about forty-five minutes at approximately two hundred sixty degrees Fahrenheit:

	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 material may be constituted, in accordance with the present invention, may vary widely, but preferably, should embody all of the following features:

(*a*) Water insolubility to permit the laundering of the fabric in which the covered strands of the present invention are incorporated;

(*b*) An effective softening-point below the temperature at which the core-strand would be harmfully affected, in order to avoid the weakening or disintegration of the said strand when the partly-finished covering-strand is subjected to heat;

(*c*) An effective softening-point at temperatures above 212 degrees F., in order to permit the laundering of fabrics in which covered-strands of the present invention are incorporated in boiling water;

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

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-toluelene-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 mehanically 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 it may be sheeted or otherwise applied to the body-sheet or body-strands in a heat-softenable state, and when subsequently heated for approximately three minutes to adhere the covering material, in the manner hereinafter described, it then becomes vulcanized or set at about 220 degrees F., and is not again softenable except at temperatures very materially beyond those encountered in any normal use to which elastic fabrics would be put.

In producing the elastic strands of the present invention, a body-sheet **14** of previously-vulcanized elastic material may be passed between complemental sheeting-rolls **15** and **16**, as is schematically illustrated in Fig. 1. The body-sheet **14**, before passing between the sheeting-rolls **15** and **16**, should be thoroughly cleansed and freed of talc. Interposed between the sheeting-roll **15** and the upper surface of the elastic body-sheet **14** is a very thin coating-sheet **17** of thermo-plastic adhesive-forming material which is preferably about .002" to about .003" thick and which is preferably pressed against the body-sheet **14** while in a tacky condition, so as to firmly adhere to the previously-cleaned surface of the said body-sheet and thus become to all intents and purposes a unitary part thereof.

In a similar manner, a coating-sheet **18** of the same general character as the coating-sheet **17**, is pressed against the under surface of the previously-cleansed body-sheet **14** by the lower sheeting-roll **16**, so as also to become in effect an integral part of the said body-sheet **14**.

The now-completed sheet, which includes the parts **14**, **17** and **18**, is now passed through a suitable slitting machine (common in the art) so as to be cut into a plurality of strands **10**. The layers or coating-sheets **12** and **13**, as will be obvious from the foregoing, may be aptly designated as "potential adhesive-forming" material, inasmuch as the said material is but a potential adhesive which will become fully effective only when subjected to heat.

The strand **10**, in its naked condition, may now be woven, knitted or otherwise incorporated into a fabric, and after the fabric has been completed, the same may be heated to convert the potential adhesive-forming material **12** and **13** into an active adhesive which will serve to anchor the strand **10** to the cross-threads of the fabric, so that in the event that a given elastic strand should become severed, it will not creep back in the fabric to a harmful degree owing to its being anchored to the strands thereof.

For many of the high-class elastic fabrics, it is desirable to provide the elastic strands with a covering material which will serve to conceal the elastic strand itself. In applying covering material to the elastic strand **10**, the said strand is preferably partly stretched, and while in this condition, one or more covering-strands **19** of suitable textile material are helically wrapped therearound. The covering-strands **19** may be formed of a variety of textile materials, such, for instance, as cotton, wool, silk, regenerated cellulose, etc.

The tension at which the covering-strands **19** are applied to the strands **10** is preferably sufficient to press in the four corners of the rectangular strand **10** into substantially the form shown in Fig. 6. The elastic strand **10** as thus covered may now be subjected to the action of heat (either before or after its incorporation into a fabric), which heat will render the layers **12** and **13** sufficiently soft or tacky to adhere the covering-strands **19** or their equivalent, to the elastic body **11**, as is schematically illustrated in Fig. 6.

It is exceedingly difficult to insure a sufficiently-thin coating of adhesive-forming material upon the body **11** of an elastic strand, without resorting to relatively-thick coatings of such

adhesive material 12 and 13. It has been found, however, that by applying the coatings as above described, so as to leave two or more of the faces of the body 11 bare, the coatings may be of such appreciable thickness as to be convenient to apply without the likelihood of their deleteriously affecting the appearance of the covering material or of the fabric, when heated.

By so applying the thermo-plastic adhesive-forming material to the body 11 that certain portions of the said body 11 are left bare of such adhesive material, the danger of discoloring or otherwise harmfully affecting the appearance of the covering material, or of the fabric in which the strand 10 is incorporated, is reduced to a minimum, since to some extent the layers 12 and 13 will flow around the uncovered faces of the body 11 and thus reduce the amount of adhesive-forming material on the opposed faces of the body 11, as initially covered or coated with the said adhesive-forming material.

If desired, and as shown in Fig. 7, an elastic body 20 may be employed which is provided on its respective opposite faces with transverse anchoring-grooves 21 which may be produced by pressing the material of which the body 20 is formed between sheets of fabric having prominent weft strands upon their surfaces. The anchoring grooves 21, of course, are formed preferably before the curing or vulcanizing of the elastic material of which the body 20 is formed. Suitably applied to one of the grooved faces 21 of the body 20 is a layer or sheet 22 (preferably about .0045" thick) of thermo-plastic adhesive-forming material which is to thoroughly united with the said body 20 as to virtually be a part thereof.

When the strand 23 of Fig. 7 is provided with helically-applied covering-strands or is incorporated in the naked condition into a fabric, the transverse anchoring-grooves 21 will serve to minimize the slippage of the strands with respect to the material of the fabric or the covering strands wrapped about them.

It will be seen from the foregoing that by means of the present invention an elastic strand having thermo-plastic adhesive-forming material, is provided which does not require that the said adhesive-forming material be almost impalpably thin in order to avoid an excess thereof which might deleteriously affect the appearance of the covering material or the strands of the fabric in which the elastic strand is incorporated.

In covering elastic strands, it is customary to wind numerous parallel strands upon a single reel, and in the event that it should be found under any given set of conditions that the adhesive-forming coating of the strands of the present invention, prior to covering, are apt to adhere to each other, such adhesion may be remedied in various ways. For instance, the coated strands, before being wound upon the reel with companion strands, may be passed through a bath of water-soluble gum combined with talc. A suitable gum for this purpose is locust bean gum. Another mode of overcoming any tendency of the unvulcanized rubber coatings of elastic strands to stick together, prior to their being covered, comprises passing the strands through a dilute vapor of sulphur chloride and carbon tetrachloride, which will effect only a slight surface or skin cure of the unvulcanized rubber coating.

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 caming within the meaning and equivalancy range of the appended claims are intended to be embraced therein.

I claim:

1. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body of rectangular form in cross-section; and a coating of thermo-plastic adhesive-forming material fixedly united to at least one of the angularly-related faces of the said elastic strand-body; certain of the angularly-related faces of the said elastic strand-body being free of said thermo-plastic adhesive-forming material to thereby minimize the undue exudation of the said thermo-plastic adhesive-forming material between covering strands or the like when the latter is applied to the elastic strand.

2. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body of rectangular form in cross-section; and a coating of thermo-plastic adhesive-forming material fixedly united to only one of the four angularly-related faces of the said rectangular elastic strand-body; three of the four angularly-related faces of the said rectangular elastic strand-body being free of the said thermo-plastic adhesive-forming material to thereby minimize the undue exudation of the said thermo-plastic adhesive-forming material between covering strands or the like when the latter is applied to the elastic strand.

3. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body of rectangular form in cross-section; and a coating of thermo-plastic adhesive-forming material fixedly united to two alternate and opposed faces of the said rectangular elastic strand-body; the remaining two alternate and opposed faces of the said strand-body being free of such thermo-plastic adhesive-forming material to thereby minimize the undue exudation of the said thermo-plastic adhesive-forming material between covering strands or the like when the latter is applied to the elastic strand.

4. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body of rectangular form in cross-section; and a coating of elastic water-insoluble thermo-plastic adhesive-forming material fixedly united to at least one of the angularly-related faces of the said elastic strand-body; certain of the angularly-related faces of the said elastic strand-body being free of such thermo-plastic adhesive-forming material to thereby minimize the undue exudation of the said thermo-plastic adhesive-forming material between covering strands or the like when the latter is applied to the elastic strand; the said elastic water-insoluble thermo-plastic adhesive-forming material having an effective softening point at a temperature above the boiling point of water and below the heat-disintegrating temperature of the said elastic strand-body.

5. A covered elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body of rectangular form in cross-section; an elastic water-insoluble thermo-plastic adhesive-forming material fixedly united to at least one of the angularly-related faces of the said rectangular strand-body; cer-

tain of the other angularly-related faces of the said strand-body being free of such thermo-plastic adhesive-forming material; and covering material in strand form helically applied around the said strand-body and the localized adhesive-forming material thereon and bonded to the said strand-body by the latter.

6. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body; a coating of thermo-plastic adhesive-forming material fixedly united to a longitudinally-extending zone covering but a portion of the perimeter of the said elastic strand-body to thus leave a longitudinally-extending zone on a portion of the said elastic strand-body relatively free of such thermo-plastic adhesive-forming material to thereby minimize the undue exudation of the said thermo-plastic adhesive-forming material between covering strands or the like when the latter is applied thereto.

7. An elastic strand of the type adapted to be woven or knitted into elastic fabrics, comprising: an elastic strand-body; a coating of adhesive material adhered to a longitudinally-extending zone covering but a portion of the perimeter of the said elastic strand-body to thus leave a longitudinally-extending zone on a portion of the said elastic strand-body relatively free of such adhesive material to thereby minimize the undue exudation of the said adhesive material between covering strands or the like when the latter is applied thereto.

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