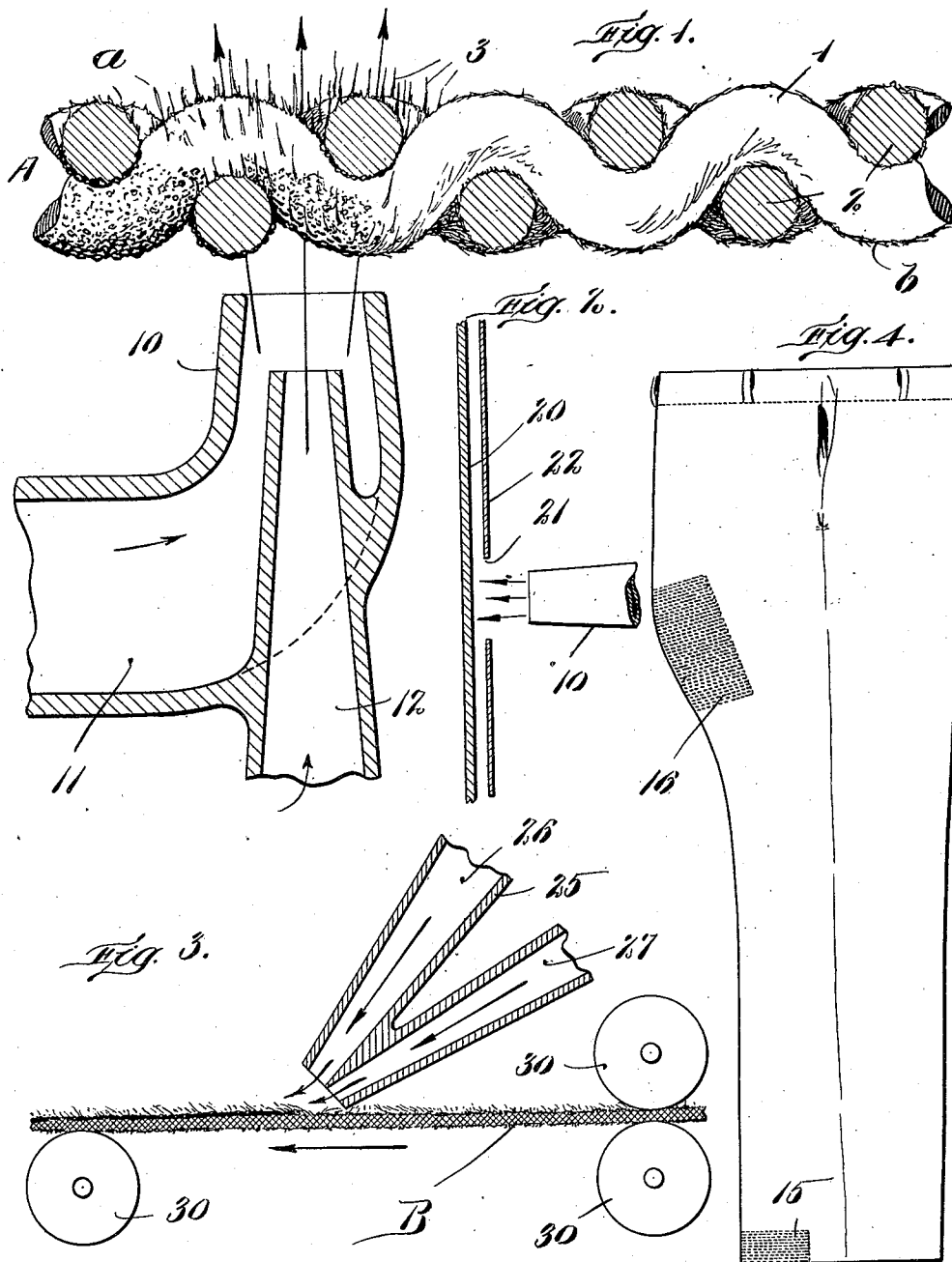


F. W. TULLY.
METHOD OF CLOTH FINISHING AND PRODUCT THEREOF.
APPLICATION FILED APR. 19, 1920.

1,417,587.

Patented May 30, 1922.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 5.

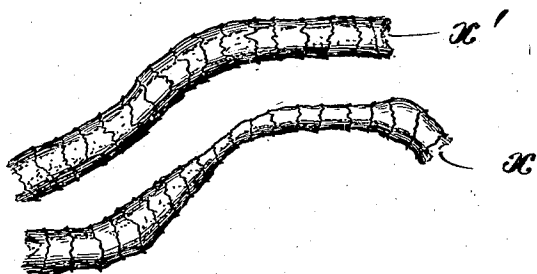


Fig. 6.

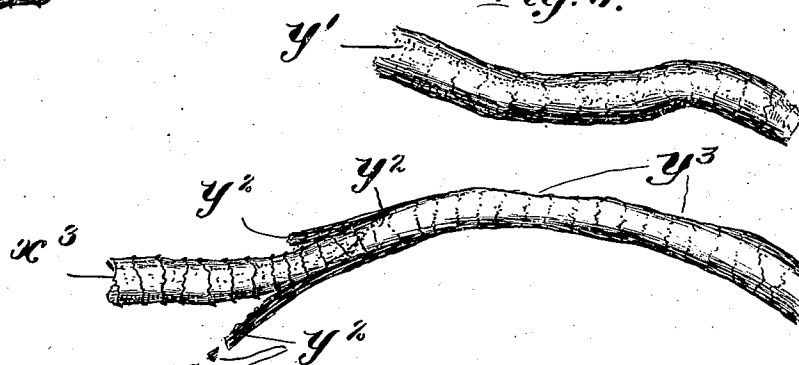


Fig. 7.

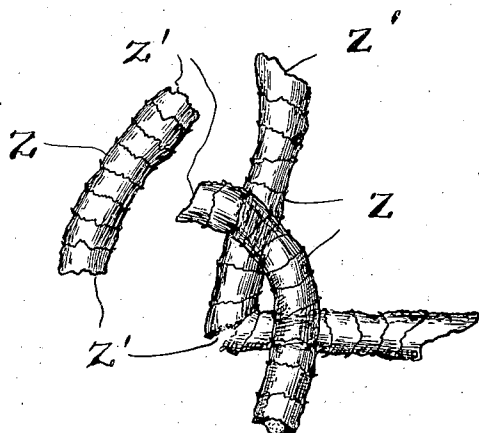
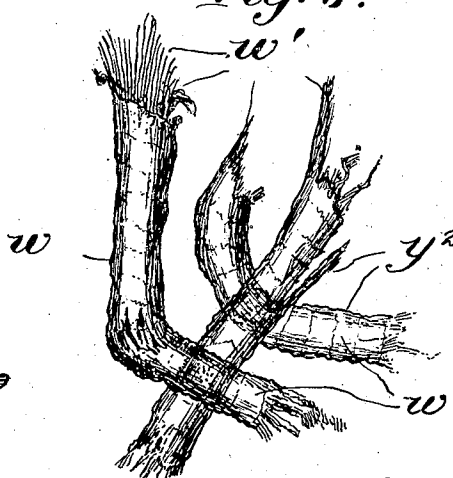


Fig. 8.



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UNITED STATES PATENT OFFICE.

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METHOD OF CLOTH FINISHING AND PRODUCT THEREOF.

1,417,587.

Specification of Letters Patent.

Patented May 30, 1922.

Application filed April 19, 1920. Serial No. 374,928.

To all whom it may concern:

Be it known that I, FRANCIS W. TULLY, a citizen of the United States of America, and resident of Chestnut Hill, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Methods of Cloth Finishing and Products Thereof, of which the following is a specification.

10 This invention relates to the improvement and reinforcement of textile fabrics by treatment applicable to the assembled fabric and especially applicable to woven cloth of textile materials intended for wearing apparel, and to articles of wearing apparel made of such fabrics after their manufacture.

Apparel, such as men's, women's and boys' outer clothing, cloth shoes, leggings, gloves and hosiery, and the pockets and linings of these articles, wears at certain places more rapidly than at other places. Bad appearance and lack of utility due to wear thus result long before the major portion of the garment is much affected or damaged at all. For example, the bottom edges of men's trousers, the sleeves at the cuffs and elbows of coats, and the knees and seats of boys' or men's trousers and the bottoms of pockets either have the nap worn off, or wear through, or fray, long before the greater part of the garment is enough worn to be discarded. Effort to repair garments in such condition is not only expensive, but generally results in obvious darns or patches hurtful to the pride of the wearer. To cope with these conditions unsatisfactory expedients only have heretofore been available, such as making the garments with double thicknesses of the same fabric, or with attached wear-taking reinforces of materials such as leather or felt, or structural reinforces of the fabric inserted at the susceptible parts; tapes have been sewed or cemented at the wear-taking edges. Even these expedients are not applicable to many of the places most exposed to wear, such as sleeve cuffs. In all such instances of which I am aware, the additions to the garment are palliative rather than remedial, suspending for a time but not sufficiently the wear primarily caused by the mutual friction of the yarns within, and the wear against itself or other surfaces to which the outer surfaces of the fabric is exposed.

It is therefore highly desirable to provide

for treating either the completed garment or the cloth before manufacture of the garment in such a way as to reduce the effect of wear at the exposed portions, as well as to provide a treatment for cloth capable of local application to the completed garment at the places where excessive wear is expected. In either case, the reinforcement of the cloth within its substance and at its face surface without altering its texture or appearance to a material extent is the end sought.

Treatment for these purposes should be susceptible of being carried out without materially altering the appearance or decreasing the qualities of porosity, insulation against heat conduction, and resistance to soiling by retention of dust and dirt.

Objects of this invention are primarily to provide a mode of treatment for cloth adapted markedly to increase its resistance to wear without materially affecting either its surface appearance or heat-insulating power; and to provide for increasing the resistance of the cloth to soiling and absorption of moisture. Other objects are to provide a method of treating cloth having a nap or pile in such a manner as to preserve the surface appearance of the cloth, to substantially retain and reinforce the nap, and thereby to increase the durability of the nap as well as that of the cloth. Other objects are to provide a fabric having certain areas only changed from their original condition by being made more resistant to wear, and to provide a method of treating garments or the like to provide anti-wear patches or areas.

The new method results in new products included within my invention, and comprising cloth, cloth articles and garments.

I have attained these objects by applying to the cloth, according to a mode of application hereinafter explained, one of a class of substances adapted to coat or partly to coat the individual fibres with a dry, non-sticky and elastic horny pellicle or film not very different in physical character from the natural integument of the fibres. This pellicle or film so formed is insoluble in water; and not only provides a new surface on each fibre to resist wear and abrasion, protecting the fibres, but also serves to lessen the frequency of transverse fracture of the fibres under intense wear, changing the character of breaking to that of a green-stick break or flexible hinge; mutual movement of fibre on

5 fibre and yarn on yarn is made more difficult; and by these results the yarns of which the cloth is composed are strengthened without altering the arrangement of the fibres, or
 5 changing the appearance of the surface to the naked eye.

10 The nap or surface texture depending on the position of fibres at or projecting from the general surface, is retained and made to resist wear; these results are accomplished
 15 without closing the natural pores and interstices of the cloth to an extent material to its air-entrapping and heat-insulating power, without material change of color,
 20 and with decrease of the tendency of the cloth to hold grease, dust and dirt. After prolonged wear sufficient to reduce the tensile strength of untreated cloth to from sixteen to twenty-one percentum of its original
 25 strength, cloth treated according to this invention retains from forty-six to eighty-five percentum of its original tensile strength.

I shall now describe in illustration of the genus comprising the invention specific instances only of steps taken in order to practice the generic process or method, and instances only of the products made by the practice of the method.

30 In the accompanying drawings,—
 Figure 1 is a diagram cross section through a piece of cloth under treatment, also showing in section part of one of the forms of apparatus recommended to be employed;

35 Figure 2 illustrates modified steps for treating a limited area of a piece of cloth;

Figure 3 illustrates a modification applicable to cloths of certain specific types;

40 Figure 4 is a diagram elevation of a pair of trousers illustrating a typical article of manufacture corresponding to the invention; and

45 Figures 5, 6, 7 and 8 are diagrams explaining the photomicrographic appearance of the fibres or hairs of woolen yarns, treated and untreated, which have been subjected to wear.

50 The treatment about to be explained is applicable to any kind of cloth. It has been so devised as to accomplish its effect with a minimum of change of the customary structure or appearance, and a considerable increase in the hardness of "feel" of the cloth. Its net results, beside reaching the important
 55 factors of durability above mentioned are to increase the initial tensile strength, slightly to increase the stiffness, especially as a reaction of ironing or pressing heats, and slightly to increase that harshness or hardness of
 60 touch familiar to appraisers of fabrics as a rough indication of the quality of the wool or other fibre.

65 A recommended procedure consists in the application to the rear or reverse face of the fabric after its formation of an air or gas

stream carrying fine particles of a varnish of certain qualities, preferably consisting of a gum or other soluble colloid or amorphous gummy substance in a volatile solution characterized by a high excess of solvent, so that the treating solution is a thin or weak solution adapted to deposit a thin film only; and further, so that the flowing power or capacity to enter capillary passages of the treating solution is abnormally high.

70 A preferred solution may be prepared by adding eighty parts of commercial alcohol, preferably containing not more than 10% of water, denaturing or other impurities, to 18 parts of a rich varnish of gum shellac, such as the "shellac in alcohol" of commerce, consisting of a viscid solution in alcohol of orange or white gum shellac. To the above ingredients I prefer to add two parts of castor oil, more or less, for the purpose of somewhat decreasing the stiffness and resiliency of the colloid coating, resulting when the volatile ingredients have been evaporated, and especially somewhat to lessen the effect of stiffness resulting after pressing with heat.

75 The best mode of application known to me is illustrated in the drawings. Fig. 1 shows a transverse section of the cloth in diagram at A, the section being assumed to be taken in the direction of the warps 1 and across the wefts 2, the upper face *a* of the cloth shown in the figure being its display or right face and having as a characteristic of its surface texture a nap of stray fibres 3 projected by brushing or other means from the warps 1 and the wefts 2.

80 The treating solution is applied on the rear face *b* of such a cloth in such a manner as not to distort the pile 3 especially during such time as the treating agent is wet.

85 Fig. 1 also illustrates a preferred procedure for securing this result. As shown, an atomizer 10 comprising an air duct 11 delivering an excess of air at high velocity aspirates upon the fabric the solution fed through a liquid duct 12 according to the well-known operation of such instruments. The effect of this application is to maintain the pile on the cloth in a state of erection during the application of the atomized liquid supplied through the duct 12, and to begin the evaporation of the volatile element of the liquid while maintaining the pile fibres or nap in their desired erect position.

90 Woolen or cotton cloth having a pile treated in this manner upon drying betrays no visible difference or texture as between the treated and untreated portions; this is especially the case when the materials are selected to avoid discoloration of light colored cloth, and is particularly the case with the neutral or dark cloths representing the wider range of apparel fabrics.

95 When, as will usually be the case, it is de-

sired to treat only a portion of the cloth such as the leg and seat patches 15 and 16 of the pair of trousers illustrated in Fig. 4, this may be accomplished either by manipulating

5 such an atomizer as that shown at 10 or by employing the device illustrated in Fig. 2, in which the cloth or garment 20 is exposed behind an opening 21 in a stencil 22 adapted to the garment.

10 When the fabric to be treated has a high pile or when the structure of the cloth is of high density such as is the case in upholstery fabric, imitation furs and pile fabric over-

15 treating solution through another type of atomizer 25 having a duct 26 for an atomized solution corresponding to the product of the instrument 10 and also having at an angle thereto a duct 27 for a supply of air

20 under pressure. As illustrated in Fig. 3, this instrument may deliver at an angle substantially as illustrated on the face side of the fabric, the effect of the blast through the duct 27 being to spread open the pile to

25 receive the treatment-liquid spray from the duct 26. Preferably as illustrated, this treatment is carried out progressively by motion either of the instrument 25 or of the cloth B, as by rolls 30, moving the cloth in the direction of the arrow. The treated cloth dries rapidly and may or may not be pressed before use or sale.

The quantity of the treating liquid delivered upon the cloth will depend upon the

35 result desired, but should not be so large as to produce a glistening state of wetness on the front face of the fabric.

The aim of the treatment is to supply to the capillary interstices of the yarn and

40 upon the exteriors of the fibres composing the yarns, a treating liquid, containing an excess, for instance of from 80% to 90% by volume, of a volatile solvent, which when evaporated will leave behind it solids much

45 smaller in volume than that occupied by it as a liquid. The effect is to coat the ultimate fibres or hairs with a new integument rather than to fill the capillary interstices with the colloid or amorphous solid result-

50 ing from the evaporation. This will be understood by reference to the photomicrographic diagram Figs. 5, 6, 7 and 8. Fig. 5 shows a worn woolen fibre x and an unworn woolen fibre x' in their untreated or natural

55 state. Fig. 6 shows at x'' a similar woolen fibre after treatment and great wear, and a treated but unworn fibre y' . It will be observed that in Fig. 5 the horny integument of the fibre is worn through; under the same

60 amount of wear the treated fibre, Fig. 6, is still substantially intact, but the coating y^2 has been worn through at y^3 . The coating is shown stripped from the fibre at the left side of this figure.

65 The effect of the pellicle or coating y^2 on

the ultimate fibres of the fabric is not only to provide an armor against wear as illustrated above, but to avoid a certain class of breakage, which I have determined by experiment to be caused by wear and to represent a large part of the loss of weight and tensile strength characteristic of worn fabrics. Fig. 7, for instance, shows fragments z shaken from a worn woolen fabric. These short lengths of the woolen fibres are broken

70 across, or are torn off at the tapered ends, as shown at z' . Such breakages are the result of bending or rubbing, and occur with growing frequency as the fibre becomes fatigued from repeated bendings or rub-

80 bings.

Fig. 8 illustrates fibres taken from a long worn section of the fabric treated according to this invention. Their elastic horny coatings y^2 have so protected the fibres that the

85 repeated bendings of wear have not resulted in abrupt breakage, but where broken ends can be found the fibres have been separated into longitudinal striæ or splits w' which undoubtedly weaken the fibre against elastic

90 recovery of its shape, but which have retained the connection between the ends of the fragments of fibre during many subsequent bendings, like the breakages of a green sapling or stick.

95

I regard this behavior of the fibres as one of the more valuable features of the new treatment, since to it I am able to attribute a large part of the observed preservation of tensile strength under intense wear, which is

100 rapidly destructive of untreated cloth.

While I have mentioned above the preferred solution, it will be understood that other colloid or amorphous substances adapted to dry in a horny pellicle, or capable of being applied in other limpid solutions adapted to readily evaporate, are capable of use. For instance, in my copending application Serial No. 335,035 filed November 1, 1919, I have described a solution containing cellulose acetate dissolved in acetone, with a clarifier of methyl alcohol and benzol and a softener of salol and triphenyl phosphate, which is well adapted for the particular purpose of stiffening the loops of

105 knit fabrics therein described; this solution also is well adapted to my present purposes. Still other gums, resins, and substances of the non-crystalline or colloid type capable of solution in volatile reagents and adapted

120 to the purposes herein disclosed may be substituted according to the results to be expected by those skilled in the art as flowing from the altered character of the deposited films.

125

While I believe my invention to be adapted to a large field of utility in the wear-protection of exposed parts of garments, I am not to be understood as limiting its application to this use; for instance, the shaping of

130

garments by pressing is a factor of appearance in clothing; cloth treated according to my invention retains its shape more resiliently and for a longer time than cloth not so treated; clothing merchants and dealers will find it useful to apply the treatment herein described along the creases and folds intended to be pressed in such articles as have to retain their pressed form. The linings of boots and shoes when treated according to my process are greatly increased in durability, without loss of their protective quality to the feet of the wearer; the pockets of clothing are protected from wear by the application of my solutions, and seams sewed with inferior thread may be greatly strengthened by subsequent application according to this invention.

I claim:—

1. The art of treating textile fabrics comprising as a step providing an artificial integument for discrete fibres of the structural yarns of the fabric by evaporation of a sparingly applied limpid solution containing an elastic horny substance and an excess of solvent, and avoiding matting or adhesion of the fibres together.

2. The art of treating textile fabrics having interstices comprising as a step applying to discrete fibres of the structural yarns of the fabric in solution an artificial colloid integument, and drying the fabric while the fibres remain in their original relative positions.

3. The art of treating textile fabrics comprising as a step applying to discrete fibres of the structural yarns of the fabric an artificial integument insoluble in water, the step comprising the application of a sufficient quantity only of a solution of the integumental substance in a state adapted to free capillary flow.

4. The art of treating textile fabrics comprising as a step applying to discrete fibres of the structural yarns of the fabric by evaporation of a sparingly applied limpid solution containing an elastic horny substance and an excess of solvent, a resilient artificial integument adapted to be softened under pressing heats.

5. The art of treating cloth comprising coating the individual fibres only of portions thereof with a waterproof varnish, by the application of a predetermined quantity of a limpid solution containing the varnish as a residue and being in a state inducing free capillary flow, and drying the cloth while the component fibres and yarns remain in their original relative positions.

6. The art of treating cloth comprising coating the individual fibres only of portions thereof with a waterproof varnish containing a hard colloid substance insoluble in water, the treatment comprising the application to the cloth of a solution of the

substance in an excess of solvent, the amount of solution applied being insufficient to provide a dried residue filling the structural interstices of the cloth or of its component yarns.

7. The art of treating cloth comprising coating the individual fibres only of portions thereof with a waterproof varnish containing a hard colloid substance insoluble in water and a relatively small proportion of a softener.

8. The art of treating cloth comprising coating the individual fibres only of portions thereof with a waterproof varnish containing shellac, the coating being the residue of a solution having therein a high excess of solvent.

9. The art of treating cloth comprising coating the individual fibres only of portions only thereof with a waterproof varnish containing shellac.

10. The art of treating textile fabrics having a structural web and a pile comprising the application to the fibres of the web and pile of a protective coating for the fibres in a fluid condition, the steps including maintenance of the pile in raised relation during application of the coating substance.

11. The art of treating textile fabrics comprising delivery upon and through the fabric of a limpid solution of a coating substance borne by a pneumatic current.

12. The art of treating textile fabrics comprising delivery upon and through the fabric of a volatile solution of a coating substance in a finely divided state and borne by a pneumatic current.

13. The art of treating cloth comprising applying thereto a solution of a colloid substance in a volatile solvent, the solvent being in such excess of the colloid substance as to deposit upon the fibers an integument of the substance and to leave open the interstices between the fibres upon evaporation of the solvent.

14. The art of treating cloth comprising applying thereto in a state of suspension in an air-blast, a solution of a colloid substance in a volatile solvent, the solvent being in such excess of the colloid substance as to deposit upon the fibres an integument of the substance and to leave open the interstices between the fibres upon evaporation of the solvent.

15. The art of treating cloth comprising applying thereto a solution of a hard gum in more than four parts by volume of a volatile solvent therefor.

16. The art of treating cloth comprising applying thereto a solution of shellac in more than four parts by volume of a volatile solvent therefor.

17. The art of treating cloth comprising applying thereto a solution of shellac in more than four parts by volume of alcohol

containing less than ten per centum of impurities.

18. A textile fabric reinforced against wear by the presence therein of discrete textile fibres bearing an artificial wear-resisting integument.

19. A porous textile fabric having therein individual textile fibres reinforced by an integumental layer of a waterproof varnish, the interstitial spaces of the untreated cloth remaining open in the treated cloth.

20. A textile fabric reinforced against wear by the individual strengthening of discrete fibres of the component yarns, and substantially free from adhesions between fibres.

21. A textile fabric having a nap comprising discrete fibres reinforced against wear by an artificial integument applied thereto.

22. A textile fabric having a nap comprising discrete fibres reinforced against wear by an elastic artificial integument applied thereto.

23. A textile fabric having areas distinguished from the remainder of the fabric by reinforcement against wear applied to discrete fibres of the structural yarns, the reinforced portions being porous and of uniform texture with the remainder of the fabric.

24. A textile fabric article having certain areas only characterized by the presence therein of discrete fibres bearing an integumental deposit of an elastic horny substance adapted to sustain wear and protect the fibres against transverse breakage.

25. A textile fabric article characterized by a reinforced area at a point exposed to wear, said area being of the same appearance as the remainder of the fabric, having a higher initial tensile strength and a greater endurance to wear, and comprising yarns

whose individual fibres bear an artificial integument.

26. A textile fabric article having reinforces characterized by uniform fabric-structure with the remainder of the article, and having therein discrete fibres reinforced by a coating of a wear-resisting waterproof substance, the interstices of the reinforces remaining open.

27. A textile fabric article having a napped surface and having reinforces characterized by uniform fabric-structure with the remainder of the article, and having thereon a nap comprising discrete fibres reinforced by a coating of a wear-resisting waterproof substance, the interstices of the reinforces remaining open.

28. A textile fabric garment having therein a reinforce against wear and deformation consisting of the deposit on individual fibres of the structural yarns of the fabric of an integumental pellicle of a wear-resisting varnish, the position of the fibres and the interstices between the yarns being substantially alike at the reinforced and the remaining portions of the garment.

29. A textile fabric article having a wear resisting reinforce of a hard-gum elastic varnish applied to discrete fibres of the structural yarns, the interstices between the yarns remaining open.

30. A textile fabric article having a wear resisting reinforce of shellac deposited from a volatile solution applied to discrete fibres of the structural yarns, the interstices between the yarns and between the fibres in the yarns remaining open.

Signed by me at Boston, Massachusetts, this 12th day of April 1920.

FRANCIS W. TULLY.