

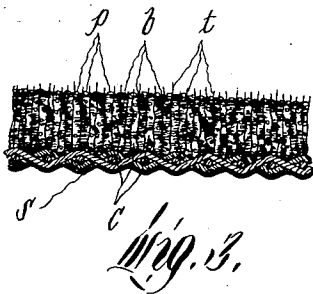
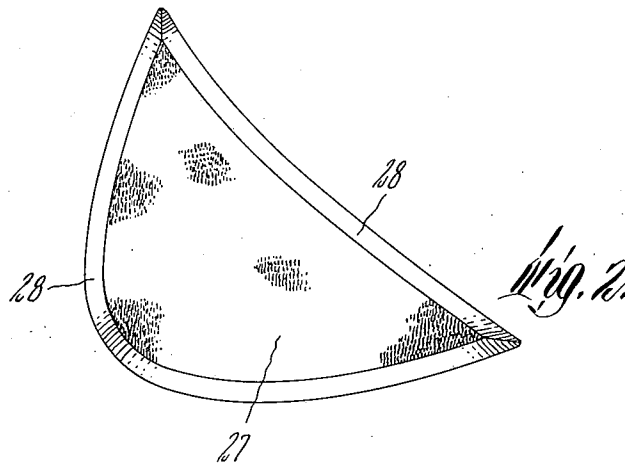
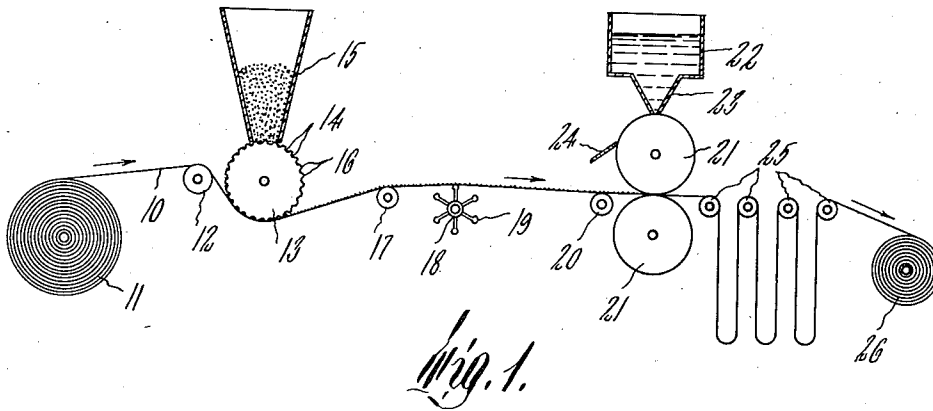
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MANUFACTURE OF SHOE STIFFENER MATERIAL

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MANUFACTURE OF SHOE STIFFENER
MATERIAL

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The subject of this invention is shoe stiffener material such as can advantageously serve for box toes, counters, or other shoe stiffener parts. It deals more particularly with that class of shoe stiffener consisting of a suitable fibrous base loaded with a stiffening agent that is amenable to gelatinization by treatment with a volatile liquid, in consequence of which the stiffener may be brought by such treatment to a limp and moldable condition, assembled while in such condition with the shoe upper and the assembly conformed to the last in the course of shoemaking, and the conformed stiffener permitted to dry and set in the shoe.

There are various practices now in vogue for the production of the foregoing class of shoe stiffeners. Those stiffeners that have met with the best reception in the shoe-making trade are the ones that are quickly acted upon by the volatile liquid, for instance, the ones that need only a momentary immersion in the volatile liquid to be conditioned for assembly with the shoe uppers. Indeed, so-called box toe conditioning machines now being used in many shoe factories next to the pulling-over machines are designed to put box toe blanks through an immersion in a bath of the appropriate volatile liquid and to deliver the blanks appropriately conditioned to the operator of the pulling-over machines so that the operator can take a conditioned blank, incorporate it into a shoe upper, and proceed with the pulling-over operation.

In order that shoe stiffeners undergo quick conditioning as hereinbefore described, it is necessary that the stiffening agent be present in the fibrous base in such a form or condition that the volatile gelatinizing or solvent liquid contact at once with a large aggregate surface of such agent. Heretofore, this condition of the stiffening agent has been attained in various ways. Thus, one important prior art practice involves saturating a fibrous base with a solution of nitrocellulose or other water-insoluble stiffening agent in a water-miscible organic solvent, precipitating the stiffening agent in situ in the base by the action of water, and finally drying. The difficulty with such practice, however, is that the resulting precipitate-loaded base is of uncontrolled and excessive porosity and hence soaks up an excessive amount of the expensive organic volatile solvent with which it is subsequently treated. Besides, the excess solvent tends to render the shoe stiffener blanks quite flabby and difficult to handle and assemble properly with the shoe uppers, to smudge the operator's fingers with the

gelatinized stiffening agent and so give rise to the danger of the operator soiling the shoe uppers, and to be squeezed out of the base together with gelatinized stiffening agent under the pressures of the pulling-over and bed-lasting operations into the shoe lining or into other places where not desired. Another prior art practice involves preparing an aqueous paste or suspension of powdered nitrocellulose, cellulose acetate, or other water-insoluble stiffening agent and a binder of the nature of rosin size and/or rubber latex, impregnating a fibrous base with such paste, and drying the impregnated base. In such case, the binder anchors the particles of stiffening agent to the fibers of the base and all of such particles are substantially uniformly coated by the binder.

In accordance with the present invention, we produce a shoe stiffener material of controlled porosity and of practically instantaneous response to the action of a volatile gelatinizing or solvent liquid by first embedding or entrapping substantially dry particles of mechanically powdered stiffening agent in the pores and interstices of a suitable fibrous base, then treating the base with a fixation liquid or suitable liquid binder, and causing the binder to set and thereby to bond the particles of stiffening agent to the fibers of the base. We preferably use as the binder a solid that is soluble in the same volatile liquid medium that gelatinizes the powdered stiffening agent embedded in the fibrous base, but we preferably apply such binder in the form of a solution whose solvent is a non-solvent of the powdered stiffening agent, wherefore, such agent can be preserved in the fibrous base in a state of attenuation or porosity such that gelatinizing or solvent liquid will get at it and at the binder quickly and uniformly throughout the base. The binder is preferably at least as soluble or gelatinizable as the stiffening agent in the volatile liquid medium that is used for gelatinizing the stiffening agent so that such liquid medium can quickly dissolve or gelatinize the binder and exert the desired dissolving or gelatinizing action on the stiffening agent. The solution of binder is applied to the fibrous base containing the powdered stiffening agent entrapped therein preferably under conditions such that when the binder-solvent is evaporated, the particles of stiffening agent are bonded to the fibers of the base as a porous mass, and the resulting porous shoe stiffener material soaks up little more than the limited amount of volatile gelatinizing liquid that is necessary to gelatinize the powdered stiffening

agent and binder present therein and thereby to transfer it to the desired limp and moldable condition. The set binder not only keeps the particles of stiffening agent from shedding or dusting out of the fibrous base but lends to the shoe stiffener material that degree of rigidity or stiffness that makes such material handle well in the dieing or cutting out of shoe stiffener blanks therefrom and in the machines which do the work of skiving the marginal areas of the blanks.

While not limited thereto, the fibrous base to be used accordant with our invention may advantageously be a napped or pile fabric such as offers considerable loose or fluffy fibers in and between which the powdered stiffening agent may be readily embedded or entrapped. Cotton flannel and wool or cotton felt are typical inexpensive fabrics falling into this category. The stiffening agent in the form of a substantially dry powder of a particle size of preferably about 200 or finer mesh is introduced with substantial uniformity in and between the fibers, whereupon a solution of suitable binder in a volatile solvent is applied uniformly to the surface of the fabric. In the case of cellulose acetate, cellulose nitrate, or similar cellulose ester powder, which constitute preferred stiffening agents to be used in accordance with our invention, we preferably employ a binder solution in an organic solvent, as the cellulose ester powders enumerated have so little tendency to be wetted by water that solutions of aqueous binders such as glue or gum arabic do not function to best advantage even though they are to be included as falling within the purview of our invention. An effective binder solution for powdered cellulose acetate is a solution of so-called ester gum in benzol or other hydrocarbon solvent which does not by itself gelatinize the cellulose acetate. It is possible to use other binder solutions, the particular one used depending upon the powdered stiffening agent used in the fabric. For instance, we may employ such other binders as cumar resin (paracoumarone), burgundy pitch, petroleum wax tailings, and rosin residue, which binders are soluble in various liquid media that are non-solvents of cellulose acetate and are at the same time as soluble as cellulose acetate or even more so in various cellulose acetate solvents.

A specific practice for the production of box toe stiffeners in accordance with our invention may be substantially as follows. A single napped cotton flannel may be used as the fibrous base and, if desired, may be sized or coated on its smooth face with shellac, glue, latex, rosin size or other suitable coating or film-forming material that closes or obstructs the openings between its yarns and thereby prevents the sifting of powdered stiffening agent therethrough. Substantially dry, powdered cellulose acetate of a particle size of about 200 mesh is substantially uniformly introduced in and between the fibers constituting the nap in the amount of about 7 ounces of acetate per square yard of fabric and the surface of the nap is then uniformly wetted with a solution of ester gum in benzol in amount to add about $3\frac{1}{2}$ ounces of ester gum per square yard of fabric. The solution of ester gum may be one prepared by dissolving about 15 parts by weight of the ester gum, which is a chemical combination of colophony and glycerol, in 85 parts by weight of benzol. The fabric is then dried and cut into box toe blanks. These blanks are characterized by the particles of cellulose acetate being bonded to the fibers of the base as a porous

mass quickly penetrated and gelatinized by cellulose acetate solvents. Some of the fibers project through the bonded particles of cellulose acetate. When the box toe blanks are immersed in a bath of acetone or other cellulose acetate solvents, they are immediately transformed to a limp and moldable condition, the solvent penetrating into and throughout the blanks and immediately gelatinizing the binder and the particles of cellulose acetate. The binder is in fact even more soluble than the cellulose acetate in acetone and in other cellulose acetate solvents. Not only is the mass of bonded cellulose acetate particles immediately penetrated by the solvent on account of its porosity, but the fibers protruding therethrough serve as wicks to carry the solvent by capillary action practically instantaneously therethroughout. Yet, the blanks are not so porous and absorptive as to soak up an excessive amount of solvent so that one handling the conditioned blanks has difficulty in assembling them properly with shoe uppers or has his fingers smudged by gelatinized cellulose acetate or binder. Nor do the blanks lose a significant amount of gelatinized cellulose acetate or binder when the pressures of the pulling-over and the bed-lasting operations are brought to bear upon them.

On the accompanying drawing,—

Figure 1 illustrates diagrammatically and conventionally instrumentalities by which the method of our invention may be practiced.

Figure 2 shows in perspective a finished box toe blank embodying our invention.

Figure 3 represents an enlarged section through a fragment of the blank.

As shown in Figure 1, a web of suitable pile fabric 10, for instance, cotton flannel, may be progressively unwound from a roll 11, passed over a guide roll 12, and under a powder-distributing roll 13 which serves to distribute the dry powdered stiffening agent substantially uniformly in and between the fibers constituting the pile or nap of the fabric. The under surface of the fabric may be comparatively smooth and coated with a suitable sizing material to prevent sifting of the powder particles therethrough, as already described. The periphery of the roll 13 is preferably provided with closely spaced transverse grooves or recesses 14 which receive the powdered stiffening agent from a hopper 15 filled with such agent as the roll 14 rotates, the discharge end of the hopper making a nice sliding fit with the ribs 16 defining the periphery of the roll and the recesses 14. The recesses or grooves 14 are thus filled progressively and uniformly with powdered stiffening agent to the surface of the ribs 16 and, as the periphery of the roll contacts with the pile or nap of the fabric, the powdered stiffening agent is substantially uniformly embedded in and between the fibers constituting the pile or nap. In order to perfect the distribution of the powdered stiffening agent throughout the pile or nap of the fabric, the fabric, as shown, preferably passes from the distributing roll 13 over a guide and tension roll 17 and thence over a suitable tapping or vibrating instrument 18 which serves to shake the fabric and its charge of powdered stiffening agent so as to distribute the agent substantially uniformly throughout the fibers constituting the pile or nap as well as to cause any excess agent on the surface to work uniformly downwardly through the fibers or to be dislodged or shaken free from the fabric.

In place of the vibrating instrument 18, a 75

power-brush acting on the opposite or pile face of the fabric may be prepared to do the work of uniformly distributing the powdered stiffening agent throughout the pile of the fabric. Such particles as are dislodged or shaken free from the fabric may, of course, be recovered and returned to the hopper 15. The tapping instrument shown consists of a spider whose spokes are headed with spherical tapping elements which, as the spider progressively rotates, impart a succession of taps or vibrations to the progressively travelling fabric. It is preferable that the fabric be comparatively taut as it contacts with the spherical tapping members so that the desired vibration may be imparted to the fabric. From the tapping instrument the fabric is shown passing over a guide roll 20 and into the nip of a pair of rolls 21, the upper roll of which serves as an applicator for the solution of binder and the lower roll of which simply serves as a bed or support. The binder solution may be delivered onto the periphery of the upper roll 21 from a supply tank 22 having a tapered feed nozzle 23 through the constricted outlet of which the solution flows onto the periphery of the roll 21. The thickness of the film or coating of solution delivered to the periphery of the roll may be varied by adjusting the clearance between the outlet of the nozzle 23 and the periphery of the roll 21 or by an adjustable doctor blade shown conventionally at 24 and located so as to remove excess solution of binder before the roll 21 makes contact with the surface of the fabric. The fabric wet with the solution of binder may then be festooned over a series of rolls 25, during which festooning period the solvent of the binder solution may be evaporated and the binder set, the fabric being swept by warm air, if desired, to promote its drying. The dried fabric may then be accumulated as in the form of a roll 26. It may be withdrawn from the roll 26 and cut into box toe blanks or other shoe stiffener parts by gang dies in the customary manner.

A finished box toe blank 27 cut from the shoe stiffener material of the present invention is shown in Figure 2. It is preferably skived at its margins 28 to provide the desired feather edges. As shown in Figure 3, particles of stiffening agent *p* are bonded together and to the fibers of the base by the binder *b* which coats or envelops substantially all the particles of binder as a mass containing numerous canals or openings *c* therein. The particles are kept from sifting through the fabric before they are bonded together by the coating or sizing *s* on the under face of the fabric. The tips *t* of some of the fibers are shown protruding beyond the mass of binder and particles of stiffening agent, which tips serve as wicks to foster an instantaneous influx of volatile gelatinizing liquid to the sub-surface particles of stiffening agent.

As already indicated, the volatile gelatinizing liquid for shoe stiffening material of the present invention containing powdered cellulose acetate as the stiffening agent may be acetone or other usual cellulose acetate solvents. When powdered cellulose nitrate is used as the stiffening agent, ethyl acetate or other conventional cellulose nitrate solvents may be employed. It is possible to use powdered stiffening agents other than cellulose esters; for instance, such agents as powdered shellac and powdered dextrin, in shoe stiffener material embodying our invention, in which case, the appropriate volatile solvent or gelatinizing liquid for the stiffening agent may be chosen,

ethyl alcohol being suitable for shellac, and water being suitable for dextrin. With powdered shellac as the stiffening agent, a solution of ester gum can be used as the settable liquid binder. With dextrin flour as the stiffening agent, an alcoholic solution of shellac containing borax or caustic soda can be used as the settable liquid binder, the alkali acting to render the entire mass water-soluble upon the evaporation of the alcohol.

The principles of the present invention are applicable to a fabric provided with a nap or pile on both faces, in which case the nap or pile fibers of each face may be put through the successive steps of our method. In other words, the substantially dry powdered stiffening agent may first be embedded in and between the pile fibers of one face, the particles of stiffening agent wet non-uniformly with the fixation fluid or settable liquid binder, the fabric dried, and the steps repeated on the pile fibers of the opposite face. The treatment of a fabric having a pile on only one face, as hereinbefore described, is, however, economical and satisfactory for most purposes.

We claim:—

1. A method which comprises embedding substantially dry, mechanically powdered cellulose acetate in and between the pile fibers of a pile fabric, treating the pile fibers with a solution of ester gum that does not gelatinize the cellulose acetate particles under conditions to bond said particles to the fibers as a porous mass, drying the treated foundation, and cutting it into shoe stiffener parts.

2. Shoe stiffener material comprising a pile fabric foundation, powdered cellulose acetate contained in and between the fibers of the pile, and ester gum serving to bond the particles of the cellulose acetate as a porous mass to said foundation.

3. Shoe stiffener material comprising a pile fabric foundation, powdered cellulose acetate contained in and between the fibers of the pile, and ester gum serving to bond the particles of the cellulose acetate as a porous mass to said foundation, the tips of at least some of the fibers of the pile protruding through said mass.

4. Shoe stiffener material comprising a textile fabric having a pile on only one face thereof and openings therethrough between its yarns and containing powdered, organic stiffening agent amenable to gelatinization by a volatile solvent locked in and between the pile fibers, and a coating on the smooth face of said fabric serving to obstruct the openings between its yarns, said powdered stiffening agent being of such fine particle size that at least some of the particles would tend to sift through said openings if left unobstructed.

5. Shoe stiffener material comprising a textile fabric having a pile on only one face thereof and openings therethrough between its yarns and containing in and between the pile fibers powdered cellulose derivative amenable to gelatinization by a volatile solvent, a binder gelatinizable by the same volatile solvent as the cellulose derivative serving to bond the particles of cellulose derivative to the pile fibers, and a coating on the smooth face of said fabric serving to obstruct the openings between its yarns.

6. A method which comprises coating the smooth face of a textile fabric having pile fibers on only one face thereof so as to obstruct the openings between its yarns, introducing substantially dry, organic stiffening agent powder amenable to gelatinization by a volatile solvent

into and between said pile fibers, treating said pile fibers with settable liquid binder to bond the powdered particles to said pile fibers as a porous mass upon the setting of said binder, the set binder being amenable to gelatinization by a volatile solvent medium that gelatinizes said stiffening agent powder, and causing said binder to set.

7. A method which comprises coating the smooth face of a textile fabric having pile fibers on only one face thereof so as to obstruct the openings between its yarns, introducing substantially dry, cellulose derivative powder amenable to gelatinization by a volatile solvent into and between said pile fibers, treating said pile fibers with a liquid solution of binder to bond said powder particles to said pile fibers as a porous mass upon the setting of said binder, the liquid solvent of said binder solution being volatile and being a non-solvent of said powder particles but said binder being gelatinizable by a volatile solvent medium that gelatinizes said powder particles, drying the fabric so treated with said binder solution to cause said binder to set, and cutting the dried fabric into shoe stiffener parts.

8. A method which comprises coating one face of a highly porous fibrous base to obstruct the pores and openings presented by said face, introducing through the pores and openings presented by the opposite face into and between the

fibers of said base substantially dry, organic stiffening agent powder amenable to gelatinization by a volatile solvent, treating said second-named face with settable liquid binder to bond the powder particles to the fibers of said base as a porous mass upon the setting of said binder, the set binder being amenable to gelatinization by a volatile solvent medium that gelatinizes said stiffening agent powder, and causing said binder to set.

9. A method which comprises coating one face of a highly porous fibrous base to obstruct the pores and openings presented by said face, introducing through the pores and openings presented by the opposite face into and between the fibers of said base substantially dry, cellulose derivative powder amenable to gelatinization by a volatile solvent, treating said second-named face with a liquid solution of binder to bond said powder particles to the fibers of said base as a porous mass upon the setting of said binder, the liquid solvent of said binder solution being volatile and being a non-solvent of said powder particles but said binder being gelatinizable by a volatile solvent medium that gelatinizes said powder particles, drying the base so treated with said binder solution to cause said binder to set, and cutting the dried base into shoe stiffener parts.

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