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METHOD OF MAKING SHOE STIFFENERS

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This invention relates to a method of making shoe stiffeners, such as box toes and counter blanks, carrying a stiffening compound which is adapted to be softened or "tempered" by a suitable solvent to permit incorporation in shoes.

A shoe stiffener should be hard, resilient and flexible so that it will impart to a shoe a maximum degree of firmness and yet not be brittle, so that it will not crack upon being bent or indented. A stiffener blank should adhere to adjacent parts of a shoe to form a unitary structure but it is imperative that such adhesion be not accompanied by staining. To fit in the rapid routine of modern shoe manufacture, stiffener blanks must be adapted to be rendered soft, or tempered, quickly, and when in a softened condition, they must be capable of being "wiped" over a last with little effort on the part of the operator. In order that a shoe will keep its shape, the stiffening material in a blank should not be softened by temperatures normally encountered in store windows and wear. This resistance to heat conditions has rendered cellulose ester stiffening materials satisfactory because such materials do not become plastic at the relatively low temperatures of store windows or encountered in wear.

A stiffener and method of making the same is described and claimed in Lovell Patent No. 1,353,599. However, there are disadvantages connected with the use of present processes, chief among which are fire hazard and processing uncertainties. A tremendous fire hazard is present when a bath of dissolved nitrocellulose is used. This solution may be ignited by a spark or by the frictional heat of moving parts in the "dope" or solution tank. According to the practice now followed, a base web of villous fabric is first coated with a nitrocellulose dope and then run to a water bath to effect displacement of the nitrocellulose solvent or solvents. Frequent testing is necessary to determine when solvent displacement is complete and this occasions delay and injects an element of uncertainty into the process. For the product of these processes to be satisfactory, it is essential that a villous base web be used so that individual villi will extend through the stiffening material on the surfaces of the web so that in the cut stiffeners these villi will furnish capillary channels or openings for the penetration of solvent. This type of base, therefore, reduces the amount of time required for tempering. It is important that the villi extend through the coating, for, in the coating apparatus, rolls are provided for raising the nap or pile on the fabric.

It has also been proposed to treat a web with a suspension of solid cellulose ester particles in an adhesive paste. With this method, the particles do not penetrate the body of the web, but merely adhere to the exposed surfaces thereof. As a result, there is not sufficient stiffening material present to impart the desired properties to the blank after the tempering operation.

According to my invention, a cellulose ester stiffening material is used, but the fire hazard is reduced substantially; the need for testing is obviated and the necessity for using a specific type of base fabric to obtain quick tempering is avoided by reason of the physical state of the stiffening compound in the finished, treated web. The present invention is directed to a shoe stiffener and method of making the same in which an emulsion of cellulose ester is used. The process and the apparatus are simple. A base fabric or web of felt, flannel, or the like is fed through a bath of emulsified stiffening material and is then dried. This dried web can be cut into stiffeners, such as box toes, which can be skived as is common in the art. The relatively high water content of the emulsion reduces the fire risk. No separate water bath is required to displace solvent and testing is unnecessary.

In order that my invention may be readily understood, I will describe an embodiment and a modification thereof. I have found that a satisfactory emulsion of stiffening compound can be made by using the following formula:

		Per cent by weight	
Base solution	5 sec. dry nitrocellulose	22.0	66⅔%
	2B alcohol	9.4	
	AA raw castor oil	11.0	
	Toluol	28.8	
	Ethyl acetate	28.8	
	Total	100.0	
Emulsifier	Water	98.0	33⅓%
	"Duponol"	1.0	
	Sulfonated castor oil	1.0	
	Total	100.0	

Ethyl acetate is the nitrocellulose solvent; and the castor oil is a plasticizer. 2B alcohol (United States Government formula) is ethyl alcohol having a small percentage of benzol as a denaturant. The alcohol and toluol serve as inexpensive diluents of the nitrocellulose solution "Duponol", a material of commerce, is an emulsifying agent

and is produced by sulfonating a fatty alcohol and neutralizing the sulfonated product with sodium hydroxide. The "Duponol" and sulfonated castor oil are mixed with water; and the resulting liquid and the nitrocellulose solution containing the diluents set forth above are introduced into a suitable emulsifying apparatus to form an emulsion, using two parts of cellulose ester solution (base) to one part of emulsifier by weight.

By reason of the liquid state of the cellulose ester stiffening material in the emulsion, the stiffening material can penetrate the body of the web as well as coat the surfaces thereof. The emulsion consists of a continuous phase of water and a dispersed phase of minute drops of nitrocellulose solution. The nitrocellulose solvent recited has a boiling point lower than that of water and is miscible or soluble in water to a limited extent. There is, therefore, a continuous movement of solvent from the dispersed phase to the continuous phase. When sufficient solvent has passed into the aqueous phase to saturate the same, the solvent, being more volatile than water, passes from the aqueous phase by surface evaporation. As the aqueous phase loses nitrocellulose solvent, additional solvent passes from the dispersed nitrocellulose solution into the aqueous phase. It will be evident, therefore, as stated above, that there is a continuous movement of solvent from the dispersed phase into the aqueous phase, from which it passes by evaporation. This movement continues until the solvent in the dispersed phase is exhausted. When this exhaustion stage is reached, the nitrocellulose goes out of solution and deposits within the body of the web and on the surfaces thereof in the form of minute, discrete, solid particles. According to prior processes, a solution is used, or solid particles are adhesively bonded to the surface of a web. In the solution process, a film, much in the nature of a paint film, is formed; and the solvent is displaced in a water bath, leaving a continuous, honeycombed deposit. As stated previously, it is this continuity of structure which has necessitated the use of a villous fabric to facilitate penetration of solvent. In the second process, the cellulose ester particles adhere to the faces of the web. In the tempering step, the particles go into solution, which is absorbed by the web, with the result that there is not sufficient material present to stiffen the blank and practically none present on the surface to bond the blank in a shoe upper during the assembling operation. The stiffening compound in the present product is deposited in the form of discrete particles within and on the web. Under the action of a solvent, the particles of stiffening material go into solution quickly because of the enormous exposed surface area thereof. This solution permeates the base and, upon evaporation of the solvent, the base becomes stiff because of the continuous structure of the stiffening material after the "tempering" or dissolving step. While in tempered condition, the dissolved nitrocellulose on the surface of the blank allows the box toe blank to be cemented firmly in the shoe.

With some types of base fabrics, there may be a tendency for the deposited nitrocellulose stiffening material to be shaken loose from the base web by rolling, handling and skiving; and I can eliminate this "dusting" tendency by using a material which will hold the residue in and on the base web. For example, I may add rubber latex to the emulsified stiffening material. The latex may be natural, synthetic, vulcanized or unvulcanized. I have found that the addition of 3.5 parts by weight of 38% latex to 100 parts by weight of emulsion eliminates any tendency toward dusting in the finished product. Latex mixes readily with the emulsion; and, upon drying, the particles of nitrocellulose are apparently bonded to the base web by a discontinuous rubber film. It has been observed that no dusting occurs, even upon twisting the finished web. It will be apparent, of course, that materials other than latex may be used, such, for example, as casein, dammar gum, waxes and resins. Materials, such as waxes and resins, may also be used as fillers.

The word "emulsion" is used herein in its technical sense of denoting a colloidal dispersion of one liquid within another; and "aqueous cellulose ester emulsion" is used herein to define an aqueous emulsion including a solution of a cellulose ester.

The theory of my invention, as set forth above, is based upon my observation and appears to me to be logical. However, I do not desire to be limited thereto since further research on the subject may prove such theory to be incorrect.

While I have described a specific embodiment of my invention, it is to be understood that this was done for purposes of illustration, and that the invention is not so limited but may be otherwise practiced or embodied within the scope of the following claims.

I claim:

1. In the method of making shoe stiffeners, the step of impregnating a readily permeable fibrous web with a water emulsion of minute drops of a solution of cellulose ester in a solvent therefor, the solvent being soluble to some extent in water and having a lower boiling point than water and the water comprising about one-third of the emulsion, and allowing the exhaustion of the solvent to cause deposition of the ester on and within the body of the web in the form of minute, discrete solid particles.

2. In the method of making shoe stiffeners, the step of impregnating a readily permeable fibrous web with a water emulsion of minute drops of a solution of cellulose ester in a solvent therefor, the solvent being soluble to some extent in water and having a lower boiling point than water and the water comprising about one-third of the emulsion, said impregnant including a material effective for bonding cellulose ester particles in place within and on the web, and allowing the exhaustion of the solvent to cause deposition of the ester on and within the body of the web in the form of minute, discrete solid particles bonded within and on the web by said bonding material.

3. In the method of making shoe stiffeners, the step of impregnating a readily permeable fibrous web with a water emulsion of minute drops of a solution of cellulose ester in a solvent therefor, the solvent being soluble to some extent in water and having a lower boiling point than water and the water comprising about one-third of the emulsion, said impregnant including rubber latex effective when dried for bonding cellulose ester particles in place within and on the web, and allowing the exhaustion of the solvent to cause deposition of the ester on and within the body of the web in the form of minute, discrete solid particles bonded within and on the web by the rubber content of said latex.

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