May 30, 1933. H. S. MILLER 1,911,841

SHOE STIFFENER MANUFACTURE

Filed March 10, 1930

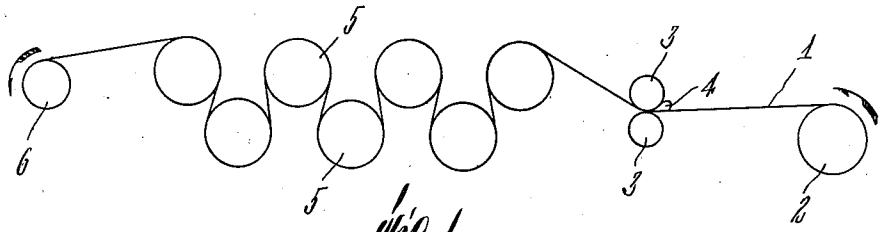


Fig. 1.

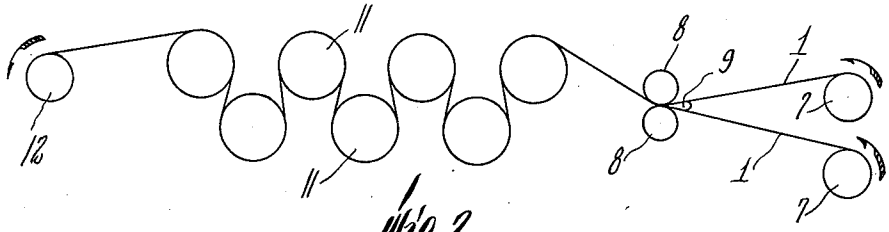


Fig. 2.

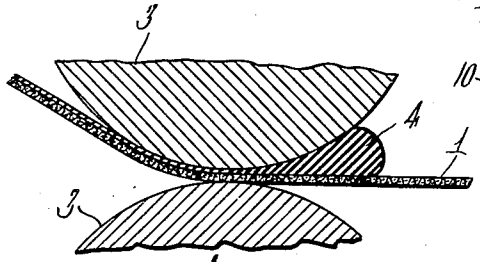


Fig. 3.

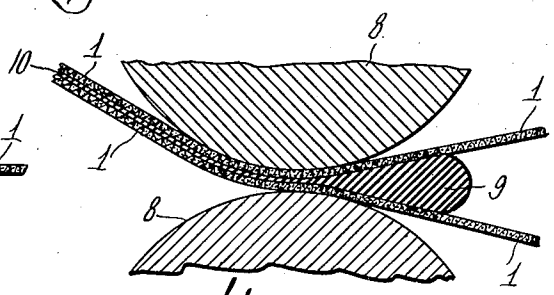


Fig. 4.

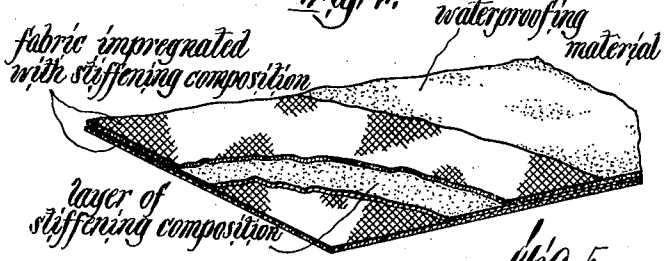


Fig. 5.

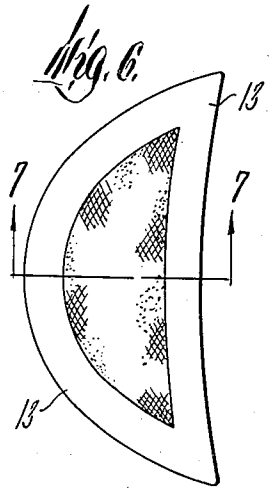


Fig. 6.



Fig. 7.

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UNITED STATES PATENT OFFICE

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SHOE STIFFENER MANUFACTURE

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In the manufacture of shoe stiffeners, fibrous sheet material is impregnated with stiffening agents which may be softened or plasticized under certain conditions to impart a limp condition to the sheet. Such sheet material is cut into stiffeners such as box toe blanks which, after being rendered limp, are assembled with the shoe uppers before the pulling-over and lasting operations. One widely used type of stiffener is impregnated with suitable thermoplastic stiffening material which becomes limp under the action of heat, but there are certain delicate upper leathers, such as snakeskin, which may be injured by the heat normally used for conditioning so-called thermoplastic box toes for the lasting operation. Another type of stiffener is impregnated with cellulose esters such as nitrocellulose, and is thus capable of being rendered limp by the action of volatile solvents. This type is expensive and its manufacture and use is accompanied by fire and explosion hazard. Still another type of stiffener is impregnated with water-soluble stiffening agents such as starches and/or glues, so that it is capable of being softened by soaking in water. This type is inexpensive, but it is incapable of withstanding much flexure without "breaking." It is further characterized by a marked tendency to absorb moisture from the inside and outside of the shoe, under the action of which and under the stresses of use, it soon becomes punky and distorted. Again, this type of stiffener is faulty, in that it does not readily "pick up" or stick to the lining of the shoe upper after the soaking operation, and further in that when composed of a plurality of plies it tends to split into individual plies after prolonged soaking.

An object of the present invention is to provide a shoe stiffener such as a box toe blank which is rendered both limp and tacky by the action of water, so that it may be successfully assembled with a shoe upper and formed to the desired shape, which possesses to a high degree the properties of resiliency and flexibility, which is not subject to deterioration under the action of such moisture as contacts therewith while in the shoe, and which when in multi-ply form will not split or separate into independent plies under prolonged soaking in water. In accordance with the present invention, such an article is obtained by impregnating the fibrous foundation with an aqueous dispersion of rubber containing water-soluble stiffening agents, such as starches, preferably far in excess of the rubber content of the dispersion. This composition is preferably of sufficient solids content to possess a paste-like consistency, so that as much solids and as little water as possible are incorporated into the sheet during the impregnating operation. The sheet is then dried, as a result of which it becomes uniformly stiff, and is then cut into shoe stiffeners such as box toe blanks, which may be skived as usual at their marginal portions. When such blanks are soaked in water for a sufficient period of time, they become limp and acquire sticky surfaces readily adherent to the linings of the shoe uppers.

While it is difficult to state with precision the action of water on the composition, it is believed that during soaking the water dissolves some of the water-soluble stiffening agent, which, being a protective colloid, promotes an incipient redispersion of the rubber. This is accompanied by the conversion of the composition to a plastic state, so that the blank impregnated therewith may be moulded to the shape of the last, whereupon, after moulding and drying, the rubber component sets to impart the desired resiliency and flexibility, and the water-soluble stiffening agent sets to stiffen the blank.

Various types of fibrous foundations may be employed, including woven or knitted fabrics or felts such as produced on textile or papermaking machinery. The preferred fibrous foundation consists of two or more plies of woven fabric, which are preferably independently impregnated with the composition and are then adhesively united by the composition, which is preferably deposited between the plies as a layer of substantial thickness to enhance rigidity. The impregnated multi-ply sheet is then dried, the rubber component of the composition between the plies serving to bond together the plies

with sufficient tenacity to prevent de-plying when blanks cut from the multi-ply sheet are soaked in water prior to assembly with the shoe uppers. The use of two or more comparatively thin plies of fabric in making the sheet from which the stiffeners are cut permits a uniform distribution of the composition throughout the sheet, as each ply may be readily impregnated throughout with the composition, when it has the preferred, paste-like consistency. In preparing the stiffening composition, various water-dispersed rubbers may be employed, including natural or vulcanized latices or artificial dispersions of crude or reclaimed rubber. Various water-soluble stiffening materials, such as starches, glue, gum arabic, dextrin, water-soluble caseins, and water-soluble lacs or lacquers, may be mixed with the water-dispersed rubber to produce the composition. The composition for laying in between the plies is, however, preferably of higher starch content than the impregnating composition, as this increases the rigidity of the product.

Compositions eminently suitable for producing the product of the present invention were prepared substantially as follows. Seventy-five parts by weight of "smoked sheet" was placed in a Werner & Pfleiderer mixer, and the mixer set in operation to produce a plastic rubber mass. To the plastic rubber mass in the mixer was then added 12½% by weight of casein in a water-swollen condition, together with sufficient caustic soda to render the casein water-soluble. Water was gradually added during the mixing operation until a change of phase took place and the rubber dispersed as minute particles in the aqueous medium. A small amount of beta-naphthol was added to the resulting dispersion to prevent decomposition of the casein, together with 7½ parts of zinc oxide, 5 parts of sulphur, and a small amount of accelerator, for instance, ½ part of "piperidene", to permit subsequent vulcanization of the rubber in the sheet, if desired. The resulting dispersion had a total solids content of about 53%. To 68 parts of this dispersion in the mixer was then added 125 parts of boiled starch paste containing 75 parts of dry starch to produce a paste-like impregnating composition. The composition for laying in between the plies was prepared in the same way as the impregnating composition, except that an uncooked starch paste of higher starch content was mixed with the rubber dispersion. Thus, to 68 parts of the rubber dispersion in the mixer was added 115 parts of uncooked or raw starch paste containing 75 parts of dry starch. When this composition is laid in between the impregnated plies, and the multi-ply sheet then dried, an intermediate layer which adds materially to the stiffness of the product is produced. When the drying is effected under the application of heat, the raw starch is cooked and converted to a water-soluble state, so that the composition of the intermediate layer is similar to that of the impregnating composition.

The production of the preferred product of the present invention will now be described in conjunction with the accompanying drawing, wherein

Figure 1 shows diagrammatically and conventionally apparatus for impregnating and drying a fabric ply.

Figure 2 is a similar view of apparatus for bonding together and drying two impregnated plies into a sheet from which stiffeners may be cut.

Figure 3 represents an enlarged fragmentary section through a pair of rolls used in the apparatus of Figure 1 for squeezing the stiffening composition through the fabric, a ply of fabric being shown passing into the nip of the rolls while a bank of impregnating composition is maintained on the fabric at the nip.

Figure 4 is a similar view through a pair of rolls used in the apparatus of Figure 2 for laying a layer of composition between two plies of impregnated fabric, two plies of fabric being shown passing into the nip of the rolls while a bank of stiffening composition is maintained between the plies at the nip.

Figure 5 shows in perspective a legended fragment of the multi-ply sheet with portions of the upper ply of fabric and the intermediate layer of composition broken away.

Figure 6 is a plan view of a finished box toe stiffener cut from the sheet.

Figure 7 is a section on the line 7—7 of Figure 6.

As illustrated in Figure 1 of the drawing, a ply of fabric 1, preferably cotton cloth of comparatively open weave, is progressively unwound from a roll 2 and passed into the nip of a pair of squeeze rolls 3 rotating in close contact with one another. A bank 4 of the impregnating composition is maintained on the fabric immediately in front of the nip of the rolls, as best shown in Figure 3, composition passing into the nip along with the fabric and under the pressure of the rolls being squeezed through the fabric to effect its impregnation. The impregnated fabric emerging from the rolls is passed over a series of steam-heated drums 5 to effect its drying, and the dried fabric is wound into a roll 6. The building up of the dried, impregnated fabric into a multi-ply product may be accomplished in any suitable manner, as by superposing and pressing together two or more sheets of convenient size cut from the roller, impregnated fabric, with the stiffening composition of high starch content laid in between the sheets to the desired thickness. The making of a duplex product, as illustrated in Figure 2, is preferable, how-

ever, because it is continuous and inexpensive. As shown in this figure, two rolls 7 of dried, impregnated fabric are simultaneously unwound and passed into the nip of a pair of rolls 8. A bank 9 of the stiffening composition of higher starch content is maintained between the webs of fabric immediately in front of the nip, the rolls 8 rotating at the desired clearance from each other, so that as the webs pass into the nip, the composition is rolled out as a layer 10 of the desired thickness between the webs, to bond them together into a duplex sheet. The duplex sheet is then passed over a series of steam-heated drums 11, to effect a drying or setting of the intermediate layer, and the dried sheet is wound into a roll 12. The dried sheet is cut into the desired shoe stiffeners, being eminently suitable for making box toe blanks, which, as best shown in Figures 6 and 7, may be skived at their marginal portions 13. Preferably, one or both faces of the sheet is coated with a waterproofing material such as shellac or lacquer of the nitrocellulose variety, prior to the cutting and skiving operations, so that when moisture from the outside of the shoe or perspiration from the foot contacts with the stiffener, it will not undergo softening and distortion in use. The waterproofing of the faces of the sheet material does not interfere with the softening of the stiffeners for the moulding operation, as under prolonged soaking in water sufficient water penetrates to the interior of the stiffener to render it soft and mouldable, particularly as the water contacts directly with the stiffening composition exposed at the marginal portions by the skiving operation, and is permitted sufficient time to diffuse throughout the rest of the composition to permeate the blank.

An advantage of stiffeners made as described is that they may be soaked in water at the shoe stiffener factory until they reach a mouldable condition whereat they may be packaged and shipped in hermetically sealed containers, ready for assembly with the shoe uppers, reaching the shoe factory in condition for immediate use. Inasmuch as the plies are permanently bonded together, no trouble arises as a result of a separation of the plies during storage or transit, nor does such difficulty arise at the shoe factory when it is necessary that dry blanks be soaked in water for a long period.

The term "water-soluble," as applied in characterizing the stiffening agent in both the specification and appended claims, is used in its comprehensive or generic sense, to include true and/or colloidally soluble agents.

I claim:

1. Shoe stiffener material capable of being rendered limp and mouldable under the action of water, having a fibrous foundation impregnated with solid rubber containing distributed therethrough a water-soluble stiffening agent of the protective colloid variety in an amount by weight exceeding that of the rubber and imparting to the rubber the capacity to become plastic under the action of water, said stiffener material containing sufficient rubber to be possessed of high flexibility and resiliency.

2. Shoe stiffener material capable of being rendered limp and mouldable under the action of water, having a fibrous foundation impregnated with a set and solidified stiffening composition comprising an aqueous dispersion of rubber and a water-soluble stiffening agent of the protective colloid variety in an amount by weight exceeding that of the rubber and imparting to the rubber the capacity to become plastic under the action of water, said stiffener material containing sufficient rubber to be possessed of high flexibility and resiliency.

3. A box toe blank comprising a plurality of plies of fabric impregnated and bonded together with a stiffening composition comprising solid rubber uniformly admixed with a water-soluble stiffening agent of the protective colloid variety in an amount by weight exceeding that of the rubber and imparting to the rubber the capacity to become plastic under the action of water, said blank containing sufficient rubber to be possessed of high flexibility and resiliency.

4. A box toe blank comprising a plurality of plies of fabric impregnated and bonded together with a stiffening composition comprising rubber and starch, the starch component preponderating over the rubber component.

5. A box toe blank comprising a pair of plies of fabric impregnated and bonded together with a stiffening composition comprising rubber and starch, the starch component preponderating over the rubber component, and the bonding layer of composition being richer in starch than the impregnating composition.

6. A box toe blank comprising a pair of plies of fabric impregnated and bonded together with a stiffening composition comprising rubber and starch, the starch component preponderating over the rubber component, said blank being surfaced with waterproofing material on at least one face.

In testimony whereof I have affixed my signature.

HAROLD S. MILLER.