Dec. 4, 1945. E. L. BECKWITH ET AL 2,390,347

SHOE STIFFENER AND PROCESS OF MAKING THE SAME

Filed Jan. 21, 1941

Fig. 1.

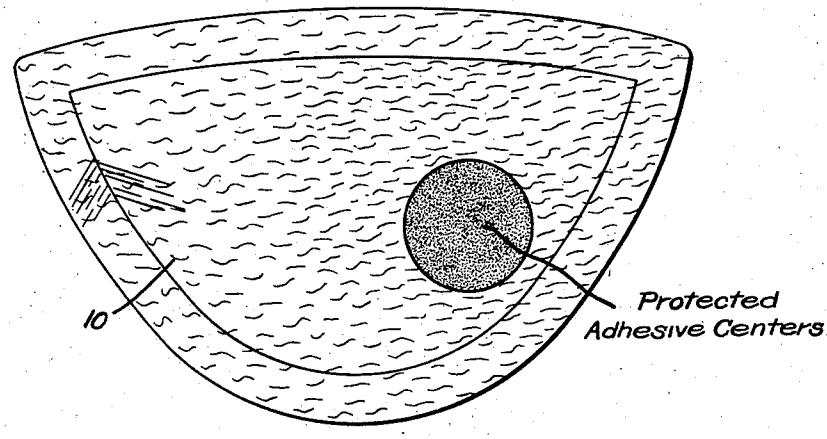
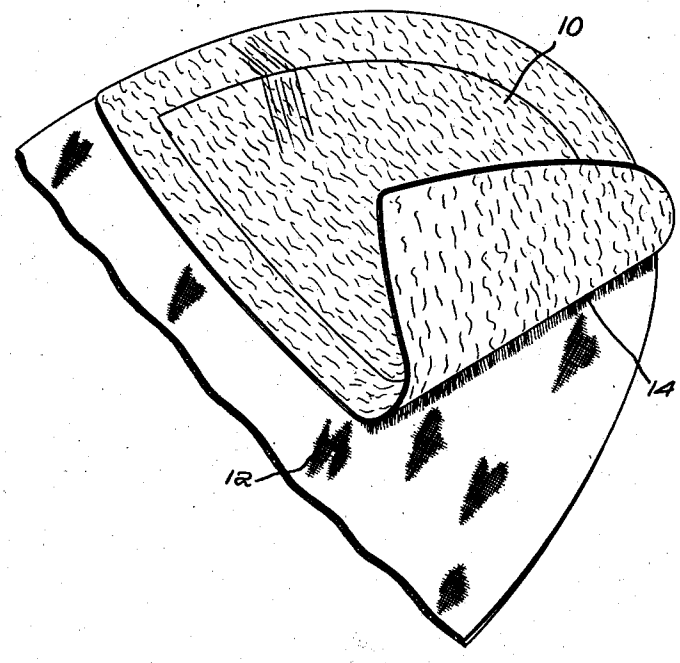


Fig. 2.



Inventors.
Edwin L. Beckwith & Adelbert P. Swett.
By Kenway & Witter.
Attorneys

Patented Dec. 4, 1945 2,390,347

UNITED STATES PATENT OFFICE

2,390,347

SHOE STIFFENER AND PROCESS OF MAKING THE SAME

Edwin L. Beckwith, Brookline, and Adelbert P. Swett, Westwood, Mass., assignors to Beckwith Manufacturing Company, Dover, N. H., a corporation of New Hampshire

Application January 21, 1941, Serial No. 375,204

12 Claims. (Cl. 36—77)

The present invention, in one aspect, consists in a new and improved shoe stiffener of the heat responsive type. It includes within its scope, however, the novel process herein disclosed of making shoe stiffeners or sheet material having latent adhesive characteristics, as well as the novel sheet material itself.

Shoe stiffeners of the type to which our invention relates have been made heretofore by saturating or coating a fabric base with molten blend or mixture of waxes, resins, rubber and the like, thus providing a thermosplastic blank which is stiff under normal conditions of temperature, but which may be rendered temporarily plastic and adhesive to a mild degree by the application of moderate heat in the shoemaking process. It is desirable that shoe stiffeners, particularly box toes, should provide in the completed shoe a hard, tough, resilient arch and also that the box toe blank should be united in a permanent adhesive bond to the contiguous parts of the upper. The resinous compounds heretofore used tend to be brittle, particularly during winter conditions, and a bond depending upon them alone is likely to be fractured during the multiple shocks which a shoe normally receives in wear. Thus, even though the adhesion of such a stiffener, for example to the lining and doubler or lining and upper leather may appear satisfactory when the shoe is first made, it may nevertheless lack permanence, and failure is likely to allow the lining to sag or bag down on the toes of the wearer or at least to loosen and wrinkle. It is moreover, important that shoe stiffener blanks should not, at normal temperatures, be adhesive because then the blanks have a tendency to stick together or block when stacked for shipment or to soften or exude under conditions of summer heat. One object of the present invention is to combine in a shoe stiffener these hitherto incompatible characteristics and to provide a commercially satisfactory and desirable stiffener having optimum characteristics both in respect to its hardness and resiliency in the shoe and its capacity to form a permanent bond with the upper.

Shoe stiffeners have been known heretofore which comprise a base fabric impregnated with a soluble cellulose derivative and such stiffeners, when treated with a proper solvent, create a lacquer which serves to cement the stiffener to the upper material with a more complete and enduring adhesive bond than it has been possible to produce heretofore where a thermoplastic shoe stiffener is employed.

In one aspect our invention is of commercial importance because it supplies for the first time a thermoplastic shoe stiffener having all the adhesive bonding advantages of solvent-treated stiffeners but without requiring the use of expensive and wasteful solvents to render it conformable during the lasting operation. The present invention therefore makes available to the shoemaker box toe stiffeners having the desirable characteristics of hardness and resiliency obtainable in a thermoplastic stiffener together with a very desirable adhesive bonding characteristic heretofore only obtainable by using solvent-treated stiffeners.

Our invention is based on the discovery that it is possible to blend certain polymerized hydrocarbons of high adhesive qualities with thermoplastic ingredients in preparing an improved thermoplastic impregnant by proceeding in the following manner; that is to say, by melting the thermoplastic ingredients while separated along the lines of their compatibility or incompatibility with respect to the adhesive addition-product that we have found it desirable to add. We prefer to use polymerized hydrocarbons of straight-chain structure, especially rubber-like polymers of isobutylene sold generally under the trade name "Vistanex," although we may employ oxidized linseed oil, sulphonated corn oil, phthallic anhydride-glycerin-fatty acid polymerization products such as "Duraplex N. D. 75," "Paraplex AL 16," alkyd type resins such as condensation products involving polybasic acids and polyhydric alcohols and the like.

Dealing specifically with polyisobutylene we have found this to be compatible with rosin, but to be less compatible with certain gums, waxes, and the like. By "compatible" we mean that polyisobutylene has the characteristic of forming with rosin a smooth homogeneous molten mixture or emulsion without tending to cause precipitation of any ingredient. Accordingly having separated our ingredients on the basis as suggested above, we render molten those that are compatible with our polyisobutylene. Based on the entire completed batch we add to the compatible ingredients between one-eighth of one percent and six or seven percent of polyisobutylene, the variation depending upon the results it is desired to produce.

The molten mass is stirred or agitated until the polyisobutylene is in apparent solution, that is to say, when a sample of the molten bath, flowed from a ladle for example, shows no graininess or separate particulation. At this point the

gum, wax and rubber ingredients hitherto set aside by reason of their incompatibility, are added. We note in this connection that those ingredients containing oxygen in their molecule seem inevitably to fall into the class of incompatibility. As this second class of ingredients melts into the molten polyisobutylene-containing mass, the polyisobutylene which previously has appeared to be in solution. becomes precipitated or segregated as very minute particles. This precipitation may comprise small agglomerates or, under ideal conditions, may have a particle size as small as seven microns.

When thoroughly molten, any desired web or base fabric may be immersed in and passed through the bath and subsequently cooled to conform to the usual shoe stiffener practice. Upon examination the added precipitated adhesive ingredient, such as polyisobutylene, is found to be distributed throughout the entire sheet, but, either due to filtration on the surface of the fabric base or possibly due to the diverse electronic charge of the fibres and the adhesive ingredient in it is localized and identifiable at the surface in spots or specks of infinitesimal size.

If such an adhesive were present on the fabric surface in exposed or unprotected condition, the sheets of material stacked one on the other for transportation, or alternatively rolled into a coil, would weld and fuse together and thus be impractical to handle. We have found, however, that the liquid bath now solidifies in such a manner as to provide a coating of extremely thin film measurement between and over the adhesive particles and that thus our shoe stiffener material may be stored and transported without the blocking or fusing of one sheet to another.

When after the normal subsequent operations of cutting and skiving, such a stiffener is heated in the shoe factory, we find the overlying and surrounding film of normal compound melts away or withdraws itself, exposing innumerable particles of our adhesive. In this naked condition the shoe stiffener is incorporated into the shoe upper and the subsequent adhesion to contiguous surfaces is inevitably achieved in a permanent and highly desirable manner.

Furthermore, it has long been noted by us that many thermoplastic shoe stiffeners commercially used attain a higher degree of adhesion when softened by dry heat than when softened by steam or moist heat. This we believe to be due to the condensed film of water deposited when steam is the heating medium; yet steam is in general more readily available to the shoemaker and more generally used than is dry heat. Our new and improved stiffener attains equally good adhesion in the upper whether dry or wet heat is employed and it thus allows greater flexibility and freedom to the shoemaker and gives a greater guarantee of uniform and satisfactory results in use.

These and other characteristics of our invention will be best understood and appreciated from consideration of the following specific example selected for purposes of illustration. A box toe stiffener exemplifying our invention is shown in the accompanying drawing in which—

Fig. 1 is a plan view representing a portion of the stiffener as seen in the field of a microscope, and

Fig. 2 is a fragmentary view showing the stiffener partially separated from the lining of an upper.

One illustrative formula which may be employed in accordance with our invention is as follows:

Percentage	Ingredient	Melting order
37.5	Rosin	1
20	Calcium resinate	3
15	Montan wax	5
15	Rubber (smoked sheet or crepe)	6
10	Gum copal	4
2.5	Polyisobutylene	2

From the foregoing formula it will be noted that the rosin, calcium resinate and polyisobutylene, which are the mutually compatible ingredients, make up about 60% of the complete mixture, while the incompatible ingredients constitute the remaining 40%. While this formula is the best now known to us the percentages of the various ingredients may be varied to meet different industrial requirements all within the scope of our invention.

In proceeding under the formula above given the rosin, which may be any commercial rosin, is first reduced to molten condition and the polyisobutylene is added to the molten bath followed by the addition of limed rosin or calcium resinate as a hardener to raise the melting point of the entire mix. These three ingredients are compatible and form a smooth, homogeneous molten solution in which no trace of the polyisobutylene is visible. The gum copal is next added to the molten bath and with the addition of this ingredient a slight granulation may be detected therein. The montan wax, or in its place any hard wax, and rubber ingredients may now be added to the bath in the order stated or together, and upon the addition of these ingredients a very definite granulation in the solution may be detected due to a precipitation or coagulation of the polyisobutylene. The particle size of the polyisobutylene, as already noted is extremely fine, that is, in the order of 6 or 8 microns and these particles are apparently distributed more or less uniformly throughout the molten bath.

Any desired fabric base may be employed in providing the sheet material from which to form the shoe stiffeners such for example, as wool felt or "Windsor" cloth. The base is passed through the molten bath and thereby saturated and coated with the molten material. This is then cooled and indurated by the stiffening of the impregnant at normal temperature. The polyisobutylene particles as already noted are distributed throughout the surfaces of the sheet material as adhesive centers and these are protected by a thin surface film of the wax-rosin-rubber ingredients of the impregnant. They thus exist as a multiplicity of generally distributed adhesive centers or points protected for the time being so that in the normal handling and storage of the sheets even at summer temperature, there is no objectionable tendency of the sheets to stick together or to exude adhesive. Subsequently the indurated sheets may be cut into box toe or counter blanks and skived as is customary for shoemaking requirements.

In Fig. 1 of the drawing a box toe blank 10 is shown and a portion of the blank is represented somewhat conventionally and imaginatively as seen in the field of a microscope presenting a multiplicity of protected adhesive centers in its surface. In Fig. 2 the blank 10 is represented as having been heated and then partially separated from a portion 12 of the woven textile fabric of the lining of a shoe upper. In this operation

many of the adhesive centers in the box toe blank are drawn out as a group of rubber-like adhesive threads 14. If the blank is heated and momentarily doubled on itself this phenomenon of a multiplicity of extremely fine connecting threads may be observed, while of course, at normal temperature no such adhesive bonding occurs.

Whether or not the specific ingredients named are theoretically more or less compatible with the adhesive hydro-carbon used in the molten mixture, nevertheless it is our intention to blend into the molten bath polyisobutylene with those ingredients which we have found in practice to result in a smooth homogeneous solution and then to bring about a dispersion of the polyisobutylene particles by adding to the molten bath ingredients that have the desired reaction in the solution.

We have disclosed herein one process of producing a heat-responsive shoe stiffener in which an adhesive ingredient is present in non-continuous phase. Such a stiffener is a novel article of manufacture and is claimed as our invention by whatever process it may be produced.

Moreover, sheet material having adhesive ingredients present in discontinuous phase and in protected condition in available locations throughout its surface is not limited in its use to shoe stiffeners but may be advantageously employed in adhesive tape or wherever sheet material of latent adhesive characteristics is required. For example, it may take the place of adhesive tape or sheets now supplied with a masking ply which must be removed and wasted to make the adhesive surface accessible. In the material of our invention the protective film or sheet may be removed by heat, pressure or by scraping or otherwise.

Having thus disclosed our invention and described certain specific embodiments thereof for purposes of illustration, but not in any limiting sense, we claim as new and desire to secure by Letters Patent:

1. The process of making shoe stiffeners, which consists in first making a homogeneous solution of the polyisobutylene "Vistanex" in a molten compatible resinous medium, adding to the homogeneous solution a lesser amount of an incompatible heat-responsive stiffening gum and thereby precipitating the "Vistanex" as discrete particles in the molten bath, impregnating a fabric base therein, cooling and stiffening the impregnated material thus rendering it normally non-adhesive, and cutting shoe stiffeners therefrom.

2. The process of making shoe stiffening material, which includes the steps of first making a homogeneous solution of polyisobutylene in a molten compatible resinous stiffening medium, precipitating the polyisobutylene by adding to the homogeneous solution a smaller amount of an incompatible resinous stiffening ingredient, saturating and coating a fabric base with the molten mixture, thereby distributing isolated particles of polyisobutylene thereupon, and then cooling the treated fabric thereby rendering it normally non-adhesive.

3. The process of making shoe stiffening material, which consists in making a smooth homogeneous solution of a polymerized hydrocarbon of high adhesive quality selected from the group isobutylene, oxidized linseed oil, sulphonated corn oil, phthallic anhydride-glycerin-fatty acid polymerization products, alkyd type resins and polyhydric alcohols in a compatible resin, precipitating the hydrocarbon by adding to the molten bath a hard wax which is incompatible with the said hydrocarbon, and then saturating a fabric base in the molten mixture and cooling it, thereby distributing upon the base adhesive particles of the hydrocarbon which are protected by an indurated non-tacky surface film.

4. The process of making shoe stiffener material, which consists in dispersing a polymerized hydrocarbon selected from the group isobutylene, oxidized linseed oil, sulphonated corn oil, phthallic anhydride-glycerin-fatty acid polymerization products, alkyd type resins and polyhydric alcohols in a molten bath of a compatible resin, precipitating said hydrocarbon in discrete particles by adding to the molten bath a smaller amount of hard wax and rubber ingredients which are incompatible with the hydrocarbon, and then saturating a fabric base in the molten mixture and cooling it, thereby distributing a multiplicity of adhesive hydrocarbon particles protected by a non-adhesive film over both surfaces of the base.

5. The process of making shoe stiffener material, which consists in making a homogeneous solution of approximately 2½% of the polyisobutylene "Vistanex," 37½% molten rosin and 20% calcium resinate, subsequently adding about 10% gum copal and about 30% montan wax and rubber to the molten bath and thereby precipitating the "Vistanex" as discrete particles in the molten bath, then impregnating a fabric base therein and thereby distributing the "Vistanex" particles as adhesive centers throughout both faces of the material and then cooling the impregnated fabric, thus rendering it normally non-tacky.

6. A shoe stiffener comprising a fabric base coated and saturated with an indurated mixture of resin and wax including as approximately 2% of the whole a multiplicity of particles of a polymerized hydrocarbon of high adhesive quality distributed throughout its surface and protected at normal temperature by a superficial indurated non-adhesive film of a resin-wax mixture.

7. A heat-responsive shoe stiffener, comprising a fabric base carrying a normally stiff and non-adhesive heat-responsive resin-wax impregnation having an adhesive ingredient comprising about 2% of a polymerized hydrocarbon of high adhesive quality distributed in separate spots therein and protected by a hard surface film of said impregnation.

8. A shoe stiffener comprising a fabric base carrying a normally stiff and normally heat-responsive resin-wax impregnation, said impregnant having distributed beneath its surface a multiplicity of adhesive centers comprising a polymerized hydrocarbon of high adhesive quality so dispersed as to become accessible to surface contact when a stiffener is heated and the surface layer of the stiff impregnant removed from its protecting relation to the said adhesive centers.

9. The sheet material for shoe stiffeners or the like having latent adhesive characteristics and comprising a thin flexible base fabric coated and saturated with an indurated mixture of resin and wax and having a multiplicity of adhesive particles of a polymerized hydrocarbon of high adhesive quality distributed throughout its surface and protected by a thin removable and normally non-adhesive film of the said indurated mixture.

10. Sheet material for shoe stiffeners or the like, normally stiff and non-adhesive, but having latent adhesive characteristics and comprising a thin flexible base of fabric coated and saturated with a mixture of wax and rosin, on the one hand,

and a polymerized hydrocarbon of high adhesive quality immiscible therewith, on the other hand, blended and dispersed one in the other and indurated by the former ingredients and with a surface film thereof masking the hydrocarbon ingredient.

11. A heat-responsive shoe stiffener, including in its structure a fabric base having in its composition a non-continuous adhesive ingredient consisting of a polymerized hydrocarbon of high adhesive quality protected at normal temperature by an indurated film of non-adhesive resin-wax mixture.

12. A heat-responsive shoe stiffener, including in its structure a fabric base having polyisobutylene distributed in its composition as a non-continuous adhesive ingredient protected at normal temperature by an indurated film of non-adhesive rosin and montan wax.

EDWIN L. BECKWITH.
ADELBERT P. SWETT.