

Sept. 23, 1952

J. J. BROPHY ET AL
STIFFENING UPPERS OF SHOES

2,611,195

Filed June 16, 1951

Fig. 2

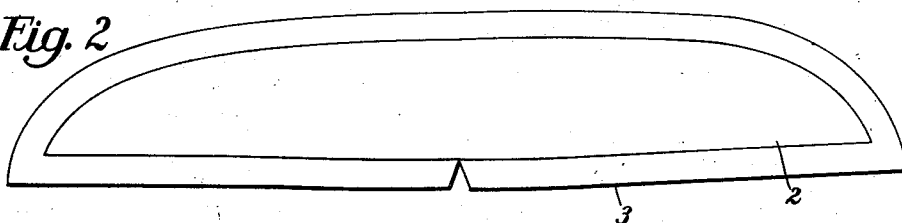


Fig. 1

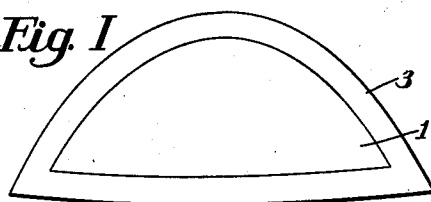


Fig. 4

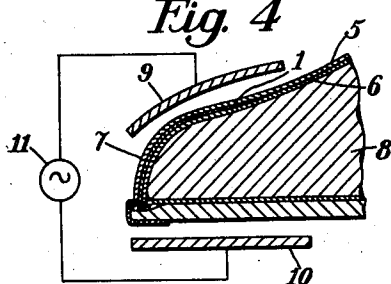


Fig. 3

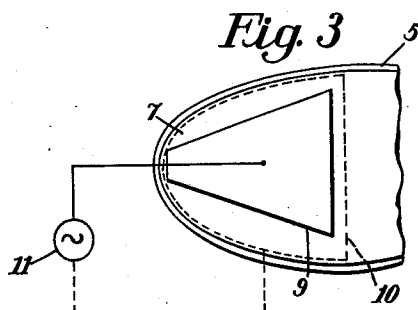


Fig. 6

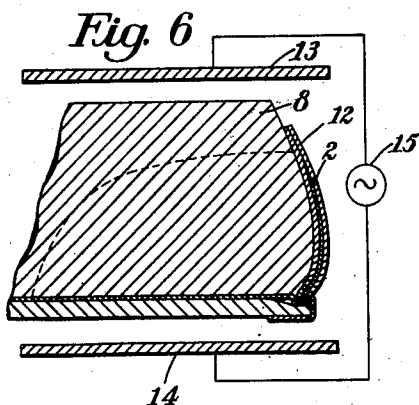
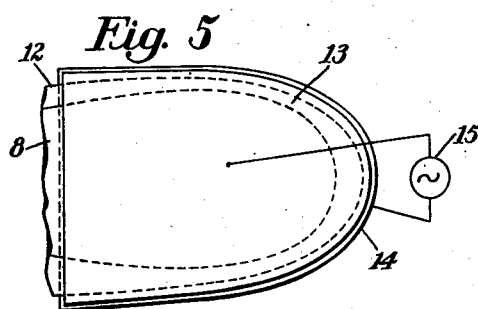


Fig. 5



Inventors

John J Brophy

Charles G Newton Jr

By their Attorney

Henry J. Casey

UNITED STATES PATENT OFFICE

2,611,195

STIFFENING UPPERS OF SHOES

John J. Brophy, Salem, and Charles G. Newton, Jr., Newburyport, Mass., assignors to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application June 16, 1951, Serial No. 231,953

10 Claims. (Cl. 36—68)

1

2

This invention relates to stiffening selected portions of the uppers of shoes and particularly to new methods and articles for stiffening toe portions and rear portions of the uppers of shoes.

In the stiffening of uppers, it is common practice to incorporate in an assembled upper a toe stiffener blank. This blank ordinarily is a fabric base impregnated with a stiffening substance which is softened and rendered limp by the action of a solvent or of heat. The assembled upper with the softened blank in place is conformed to a last and the blank then becomes hard and resilient in its lasted shape upon evaporation of the solvent or upon dissipation of the heat.

There are certain disadvantages involved in the use of stiffener blanks of the general type outlined above. The stiffener blanks are rendered temporarily limp by a special solvent-applying or heat-applying apparatus, and become hard and resilient as soon as the solvent has evaporated or the heat dissipated. It has been found difficult to maintain them limp, and hence in condition for being conformed to the last, for just the right time, and then to have them become hard soon afterward so that the last may be removed from the upper. Also, very considerable difficulties are encountered in the use of such blanks as counter stiffeners so that, although toe stiffeners of the general type under discussion are widely used, no shoe manufacturer, so far as we are aware, uses them as counter stiffeners. Blanks which consist of a fabric base impregnated with a stiffening material are not stretchable or at least not freely stretchable due to the substantial nonstretchability of the fabric base and are thus not so readily conformable to the lasts as a blank which contains no fabric base.

The general object of the present invention is to provide a new stiffener blank and a method of stiffening, by means of this blank, selected portions of the uppers of shoes.

According to a feature of the invention, there is provided a limp stretchable stiffener blank comprising a thermoplastic material and a compound which in its untreated state acts as a plasticizer but is capable upon being treated, for example by heat, of converting the whole mass to a nonplastic, nontacky, less soluble condition wherein it is hard and resilient. There may be used in this mass, in addition to the thermoplastic material and the convertible compound, plasticizers for the material which are not convertible like the compound, fillers, catalysts, etc.

According to another feature of the invention the limp, stretchable blank is incorporated in a selected portion of the upper of a shoe, conformed

to a last, and, while it is so held, treated with heat to render it hard and resilient. Preferably, electronic heat is used which hardens the stiffener blank very quickly and does not subject the materials of the upper to any considerable or sustained heating.

These and other features of the invention, including certain details of composition and procedure, will be set forth in the specification in connection with an illustrated stiffener blank and method of using it and pointed out in the appended claims.

This application is a continuation in part of our application Serial No. 714,812, filed December 7, 1946, entitled "Improvements in Stiffening Uppers of Shoes," now abandoned.

Reference is made to the copending application Serial No. 564,605, filed November 22, 1944, which has matured into Patent No. 2,492,413 granted December 27, 1949, and Patent No. 2,406,738, granted September 3, 1946, both in the name of John J. Brophy, which disclose, respectively, a blank and method, and an apparatus for stiffening portions of the uppers of shoes making use of a high-frequency field.

Referring now to the accompanying drawings,

Fig. 1 is a plan of a toe stiffener blank according to the present invention;

Fig. 2 is a similar view of a counter stiffener blank;

Fig. 3 is a diagrammatic plan view of an apparatus for subjecting the front portion of the upper of a lasted shoe to the heating effect of a high-frequency field, a shoe being shown in place;

Fig. 4 is a diagrammatic, vertical longitudinal section, taken on the line IV—IV of Fig. 3;

Fig. 5 is a diagrammatic plan view of an apparatus for subjecting the rear portion of the upper of a lasted shoe to the heating effect of a high-frequency field, a shoe being shown in place; and

Fig. 6 is a diagrammatic, vertical longitudinal section, taken on the line VI—VI of Fig. 5.

The stiffener blanks 1 and 2 (Figs. 1 and 2) are cut from a limp sheet comprising a thermoplastic material, a compound which in its untreated state acts as a plasticizer for the thermoplastic material but which is capable, upon being treated, for example by heat, of converting the whole mass to a nonplastic, nontacky, less soluble condition wherein it is hard and resilient, and a catalyst material for the hardenable plasticizer. The composition may include non-convertible plasticizers for the thermoplastic material, as well as fillers and other agents. The catalyst may be an organic peroxide, such as benzoyl peroxide. The limp sheet may be an unsupported layer of the

above components or may be associated with a fibrous supporting sheet.

The thermoplastic material is selected from materials which are relatively strong and stiff at normal atmospheric temperatures but which soften within the range of about 150° to 210° F. A thermoplastic material or mixture of such materials is preferred whose softening temperature will allow convenient working of the mixture at temperatures about 15° F. below the conversion temperature of the convertible plasticizer, so that the hardenable plasticizer component of the mixture will not be hardened during mixing. For example, where the plasticizer is convertible at 160° F., working will be carried out at 145° F. or below. Among the materials which have been found suitable are ethyl cellulose, benzyl cellulose, and vinyl chloride-vinyl acetate copolymer resins containing from about 88% to about 95% of vinyl chloride. These materials may be used alone or in mixture.

In the manufacture of milled compositions, volatile solvents, such as butyl acetate or methyl ethyl ketone may be included in amounts up to as high as 100% by weight of the thermoplastic material to permit milling of higher softening point thermoplastic materials at temperatures below the conversion temperature of the convertible plasticizer. For unsupported plastic sheet materials, the solvent will be removed by evaporation after milling is complete.

A butadiene-acrylonitrile copolymer which may contain up to about 40% of acrylonitrile has been found satisfactory as a nonconvertible plasticizer component for a mixture comprising the vinyl copolymer resins. Other plasticizers which may be used with any of the base thermoplastic materials include ester type compounds, such as dioctyl phthalate and tricresylphosphate, and resinous plasticizers, such as chlorinated diphenyls and hydrogenated resins. These plasticizers may be employed in proportion of about 5% to about 20% of the thermoplastic. The proportion used is sufficient to prevent brittleness in the stiffened material, but not sufficient to soften the final product excessively.

Any conventional, finely divided mineral filler may be employed in milled compositions. However, it is preferred to employ titanium dioxide because of its excellent covering properties which reduce the action of light on the heat convertible plasticizer components of the mixture during storage. Also, titanium dioxide possesses a high dielectric constant and the property of increasing the heating effect within the composition when it is subjected to a high-frequency field. From about 15 parts to about 50 parts of the mineral filler will be employed with 100 parts of the thermoplastic material in milled compositions.

The polymerizable ingredient of the composition, which is convertible to a condition in which the entire mixture stiffens to a strong resilient condition, is preferably a compound having a relatively low vapor pressure. Such a compound in unpolymerized state is compatible with and softens the resinous constituents of the mixture so that they can be readily mixed and sheeted, but may be polymerized or hardened by the action of heat, light, or other treatments. From about 5 parts to about 75 parts of this polymerizable ingredient will be employed in combination with 100 parts of the thermoplastic material. Suitable compounds are those containing the polymerizable group $=C=CH_2$ and at least one other

polymerizable olefinic group separated therefrom by at least one intervening atom so that the double bonds do not form a conjugated system. Polymerizable constituents which have been found highly satisfactory for use in combination with a thermoplastic material such as a vinyl copolymer which may contain nonconvertible plasticizers such as butadiene-acrylonitrile copolymer or dioctyl phthalate, are the liquid dimethacrylic acid esters of polyethylene glycols. A particularly suitable polymerizable constituent is polyethylene glycol 200 dimethacrylate, which is a mixture of monomeric esters which may be prepared by the esterification of methacrylic acid with polyethylene glycol 200, which is a mixture of various glycols, said mixture having an average molecular weight of 200 ± 15 . Other suitable polymerizable ingredients are diallyl phthalate, tetraethylene glycol dimethacrylate, pentaethylene glycol dimethacrylate and divinyl benzene. Mixtures of two or more polymerizable compounds are just as suitable for use as the polymerizable ingredient in this invention as is a single compound.

As hardening catalysts where heat is used to harden the compound, organic peroxides such as benzoyl peroxide, or di-*t*-butyl peroxide in amount from about 0.4% to about 2.3% by weight of the hardenable plasticizer have been found suitable. Other catalysts may be used where other hardening treatments are used.

The thermoplastic material, convertible plasticizer, catalysts, and any other desired material, such as nonconvertible plasticizers and fillers, where used, are combined, and, where a milled composition is desired, may be formed into a sheet of from about 0.020" to about 0.040" in thickness for box toe stiffeners for women, and from about 0.080" to about 0.020" in thickness for box toes for men. Sheets of greater or less thickness may of course be formed. The materials may also be dissolved in a volatile organic solvent and used to impregnate a porous, fibrous sheet material such as a felt, or a flannel or duck cloth. The material may also be calendered on a porous, fibrous sheet such as duck. Where the composition is used in conjunction with a fibrous sheet material the composition may constitute from 40% to 85%, preferably 60% to 85% by weight of the combined weight of the fibrous sheet and composition.

For stiffening toes and counters of shoe uppers, limp, stretchable stiffener blanks, for example, a toe stiffener blank 1 (Fig. 1), and a counter stiffener blank 2 (Fig. 2), are cut from the sheet material. If desired, the edges of these blanks may be skived to provide tapering edges 3 for the stiffener. These blanks may be incorporated in the upper of a shoe at any suitable stage in the manufacture of the shoe. Conveniently, the blanks may be incorporated in and become part of the upper during the assembling of parts of the upper in the stitching room. It has been found that a stiffener blank may be adhered to a portion of the shoe upper 5, for example, a tip doubler 6 or the tip or toe portion 7, by applying an adhesive, e. g., a 20% solution of "Acryloid B-7," an acrylic resin made by Resinous Products & Chemical Corporation, of Philadelphia, Pa., dissolved in ethylene dichloride, to the stiffener blank and portion of the shoe upper.

According to another method, the blanks 1 and 2 may be positioned on the proper portions of the upper 5 of a shoe and may be bonded thereto by applying a controlled heat and pres-

sure at selected points on the stiffeners and shoe portions to effect a bond without causing the stiffener blanks to be converted to their final, stiff, resilient condition. If desired, a tapering edge 3 or scarf may be formed along any desired edges, for example, along the edge of a toe stiffener blank 1 remote from the toe of the shoe by heating and pressing the edge between platens shaped to provide the desired taper. Heating and pressing to effect bonding and/or tapering may be effected between electrodes connected to a high-frequency power source.

With the stiffener blanks 1 and 2 in position, the upper 5 may then go through the regular shoe manufacturing operations, including being mounted upon and conformed to a last 8. The shoe upper 5 may be subjected to the heating effect of a high-frequency field or to other treatment to harden the blanks at any time after the lasting has been completed while the portions of the shoe upper to be stiffened are maintained in the desired shape by the last.

Apparatus for high-frequency heating of the assembled shoe upper 5 is shown diagrammatically in Figs. 3 to 6. Figs. 3 and 4 illustrate the toe portion 7 of a lasted shoe upper 5 disposed between and in spaced relation to an upper electrode 9 and a lower electrode 10, the electrodes 9 and 10 being connected to a high-frequency source of power 11. As shown in Figs. 3 and 4, the electrode 9 disposed adjacent the top of the toe portion 7 may be curved to correspond generally with the curvature of the lasted toe; while the electrode 10 adjacent the bottom of the toe portion may be flat. The electrode 9 adjacent the top and the electrode 10 adjacent the bottom of the lasted toe have such dimensions in relation to the size and shape of the lasted toe as to insure a substantially uniform heating effect in the stiffener blank 1 in the lasted shoe.

Figs. 5 and 6 show the counter portion 12 of a lasted shoe upper 5 disposed between an upper electrode 13 and a lower electrode 14, the electrodes being connected to a high-frequency power source 15. The upper and lower electrodes 13 and 14 are shaped to provide a substantially uniform heating effect throughout the stiffener blank 2.

To produce the desired heating in order to convert the stiffener blank to its hardened condition, it has been found that a heating period of the order of about 10 seconds may be effective where the frequency of the field is from about 75 to about 250 megacycles or higher and the voltage is from about 3 to about 4 kilovolts. Lower frequencies and lower voltages may be employed but they have been found to be less efficient and less satisfactory, generally, than the values noted above.

The following examples of compositions from which the new stiffener blanks may be cut are given as illustrative only, to aid in understanding the invention. It is to be understood that the invention is not limited to the constituents or proportions of the compositions of the examples.

Example 1

	Parts by weight
Vinylite VYNS	100
Polyethylene glycol 200 dimethacrylate monomer	65
Hycar OR 15	18
Titanox	50
Benzoyl peroxide	1.5

Vinylite VYNS is a copolymer of vinyl chloride and vinyl acetate comprising about 12.5% vinyl acetate and is produced by Carbide and Carbon Chemicals Corporation, of New York. Hycar, a synthetic elastomer, is a butadiene-acrylonitrile copolymer containing in the neighborhood of about 40% by weight of acrylonitrile and about 60% by weight of butadiene put out by the Hycar Chemical Company, of Akron, Ohio. Titanox is a titanium dioxide sold by the Titanium Pigment Corporation, of New York, N. Y.

The mixture of the above ingredients, after milling and mixing on rolls, was sheeted to a thickness of 0.030 inch, and toe stiffener blanks 1 were cut therefrom. These stiffener blanks 1 were disposed in proper relation to tip doublers 6 and were secured thereto at a number of spaced points by pressing these points together between electrodes connected to a high-frequency source of power. The uppers, including the bonded tips 7, doublers 6, and stiffener blanks 1, were then passed through shoe manufacturing operations including being mounted upon and conformed to lasts 8. The toes of the shoes with the stiffener blanks 1 therein were placed between electrodes 9 and 10, shown in Figs. 3 and 4, and were subjected for a period of 10 seconds to the heating action of a field created by applying 3 kilovolts at a frequency of 165 megacycles to the electrodes. The heating was then discontinued, and the lasted shoes were permitted to cool. The lasts were removed after cooling of the shoes and it was found that the toes were stiff and resiliently resistant to deformation.

Example 2

	Parts by weight
Vinylite VYNU	100
Polyethylene glycol 200 dimethacrylate monomer	22
Kronisol	14
Titanium dioxide	20
Benzoyl peroxide	0.12
Agerite powder	0.01
Butyl acetate	55.0

The above materials were milled together and formed into a sheet 0.030 inch in thickness. The butyl acetate was then permitted to evaporate from the sheet. Toe stiffener blanks were cut from the sheet and were bonded to tip doublers by means of an adhesive solution comprising an acrylic resin solution in ethylene dichloride. The tip doublers and associated blanks were assembled in shoe uppers, lasted and heated in a high-frequency field as in Example 1. On removal of the lasts it was found that the toes were stiff and resiliently resistant to deformation.

Vinylite VYNU is a copolymer of vinyl chloride and vinyl acetate comprising 95% vinyl chloride put out by Carbide and Carbon Chemicals Corporation, of New York, N. Y. Kronisol is dibutyl cellosolve phthalate sold by Ohio Apex, Inc., of Nitro, W. Va. Agerite powder is understood to be a commercial phenyl-beta-naphthylamine.

Example 3

	Parts by weight
Vinylite VYHH	100
Polyethylene glycol 200 dimethacrylate monomer	100
Benzoyl peroxide	1.5
Acetone	250

Vinylite VYHH is a copolymer of vinyl chloride and vinyl acetate comprising about 15 percent vinyl acetate and is produced by Carbide and Carbon Chemicals Corporation, of New York.

The Vinylite and monomer are milled together and the mixture together with the catalyst is dissolved in the acetone. The resulting solution is employed to impregnate a No. 15 cotton flannel, the extent of impregnation being such that the mixture constituted 60 percent of the combined weight of the flannel and mixture.

The solvent was permitted to evaporate from the impregnated fabric.

Toe stiffener blanks having an outline shaped to encompass the toe portion of a shoe were cut from the impregnated sheet material and disposed between the layers in the toe portion of a shoe upper. The shoe upper was then disposed on a last, lasted heated in a high-frequency field and cooled as in Example 1. On removal of the last it was found that the toe was stiff and strongly and resiliently resistant to deformation.

Although the stiffening compositions of Examples 1-3 are disclosed as having been set up in a high-frequency field, it is to be understood that these stiffeners can be set up by heating as in an oven or by other means.

Having described our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. As an article of manufacture, a normally limp, stretchable stiffener blank adapted to be incorporated in an end portion of the upper of a shoe and to be conformed to a last, said blank comprising a thin, flexible sheet having an outline shaped to encompass said end portion of a shoe and comprising an intimate mixture of 100 parts of a member of the group consisting of vinyl chloride-vinyl acetate copolymer resins, ethyl cellulose and benzyl cellulose softening in the range of 150° to 210° F., from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and from 0.4% to 2.3% by weight of said dimethacrylate ester of a polymerization catalyst.

2. As an article of manufacture, a normally limp, stretchable stiffener blank adapted to be incorporated in an end portion of a shoe and to be conformed to a last, said blank comprising a fibrous sheet having an outline shaped to encompass said end portion of a shoe, and said fibrous sheet being impregnated with an intimate mixture of 100 parts of a member of the group consisting of vinyl chloride-vinyl acetate copolymer resins comprising 88% to 95% by weight of vinyl chloride, ethyl cellulose and benzyl cellulose softening in the range of 150° to 210° F., from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and from 0.4% to 2.3% by weight of said dimethacrylate ester of a polymerization catalyst.

3. As an article of manufacture, a normally limp, stretchable stiffener blank adapted to be incorporated in an end portion of the upper of a shoe and to be conformed to a last, said blank comprising a sheet from 0.02" to 0.12" in thickness having an outline shaped to encompass said end portion of a shoe, said sheet comprising an intimate mixture of a member of the group consisting of vinyl chloride-vinyl acetate copolymer resins, ethyl cellulose and benzyl cellulose softening in the range of 150° F. to 210° F., a plasticizer for said member, a mineral filler, from 5% to 75% by weight based on the weight of said member of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and from 0.4% to 2.3% on the weight of the said dimethacrylate ester of a polymerization catalyst.

4. As an article of manufacture, a normally limp, stretchable stiffener blank adapted to be incorporated in an end portion of the upper of a shoe and to be conformed to a last, said blank comprising a fabric sheet having an outline shaped to encompass said end portion of a shoe, the fabric being impregnated with an intimate mixture of a vinyl chloride-vinyl acetate copolymer resin comprising about 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., a plasticizer for said resin, a mineral filler, from 5% to 75% by weight based on the weight of said resin of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and from 0.4% to 2.3% on the weight of the polymerizable ingredient of a polymerization catalyst, said dimethacrylate ester in untreated state being compatible with and operative to plasticize said resin and being convertible by heat to a non-tacky, insoluble condition in which it hardens the composition to a stiff, resilient state.

5. As an article of manufacture, a normally limp, stretchable stiffener blank adapted to be incorporated in an end portion of the upper of a shoe and to be conformed to a last, said blank comprising a thin, flexible sheet having an outline shaped to encompass said end portion of a shoe and comprising an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., 5 to 20 parts by weight of a plasticizer for the resin, 15 to 50 parts of titanium dioxide, 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 to 0.4% to 2.3% by weight of benzoyl peroxide by weight of the said dimethacrylate ester.

6. The method of stiffening an end portion of the upper of a shoe which comprises incorporating in the end portion a normally limp, stretchable, thin plastic end stiffener blank having an outline shaped to encompass said end portion of the shoe and comprising an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and 0.4% to 2.3% by weight of benzoyl peroxide based on the weight of the said dimethacrylate ester, conforming the upper and stiffener blank to a last and while they are so conformed heating said end portion to polymerize the polyethylene glycol 200 dimethacrylate and convert the blank to a stiff, resilient condition in which its stiffens said end portion of the shoe upper.

7. The method of stiffening an end portion of the upper of a shoe which comprises incorporating in the end portion a normally limp, stretchable, thin plastic end stiffener blank having an outline shaped to encompass said end portion of the shoe and consisting of an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., a plasticizer for the resin, a filler, from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and 0.4% to 2.3% by weight of benzoyl peroxide based on the weight of the said dimethacrylate ester, conforming the upper and stiffener blank to a last and

9

while they are so conformed heating said end portion to polymerize the polyethylene glycol 200 dimethacrylate and convert the blank to a stiff, resilient condition in which it stiffens said end portion of the shoe upper.

8. The method of stiffening an end portion of the upper of a shoe which comprises incorporating in the end portion a normally limp, stretchable, thin plastic end stiffener blank having an outline shaped to encompass said end portion of the shoe and consisting of an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., from 5 to 20 parts by weight of a plasticizer for the resin, from 15 to 50 parts of titanium dioxide, from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and 0.4% to 2.3% by weight of benzoyl peroxide based on the weight of the said dimethacrylate ester, conforming the upper and stiffener blank to a last and while they are so conformed heating said end portion to polymerize the polyethylene glycol 200 dimethacrylate and convert the blank to a stiff, resilient condition in which it stiffens said end portion of the shoe upper.

9. The method of stiffening an end portion of the upper of a shoe which comprises incorporating in the end portion a normally limp, stretchable, thin plastic end stiffener blank having an outline shaped to encompass said end portion of the shoe and consisting of an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., from 5 to 20 parts by weight of a plasticizer for the resin, from 15 to 50 parts of titanium dioxide, from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about

10

200 and 0.4% to 2.3% by weight of benzoyl peroxide based on the weight of the said dimethacrylate ester, conforming the upper and stiffener blank to a last and while they are so conformed subjecting said end portion for a short period to the heating effect of a high-frequency electric field to polymerize the polyethylene glycol 200 dimethacrylate and convert the blank to a stiff resilient condition in which it stiffens said end portion of the shoe upper.

10. The method of stiffening an end portion of the upper of a shoe which comprises incorporating in the end portion a normally limp, stretchable, thin plastic end stiffener blank having an outline shaped to encompass said end portion of the shoe and consisting of an intimate mixture of 100 parts of a vinyl chloride-vinyl acetate copolymer resin comprising 88% to 95% by weight of vinyl chloride and softening in the range of 150° F. to 210° F., from 5 to 20 parts by weight of a plasticizer for the resin, from 15 to 50 parts of titanium dioxide, from 5 to 75 parts by weight of dimethacrylate ester of polyethylene glycol having a molecular weight of about 200 and 0.4% to 2.3% by weight of benzoyl peroxide based on the weight of the said dimethacrylate ester, conforming the upper and stiffener blank to a last and while they are so conformed subjecting said end portion for a period of about 10 seconds to the heating effect of a high-frequency electric field having a frequency in the range of from 75 to 250 megacycles to polymerize the polyethylene glycol 200 dimethacrylate and convert the blank to a stiff, resilient condition in which it stiffens said end portion of the shoe upper.

JOHN J. BROPHY.
CHARLES G. NEWTON, JR.

No references cited.