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G. FERGUSON ET AL

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SHOE

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Fig. 1.

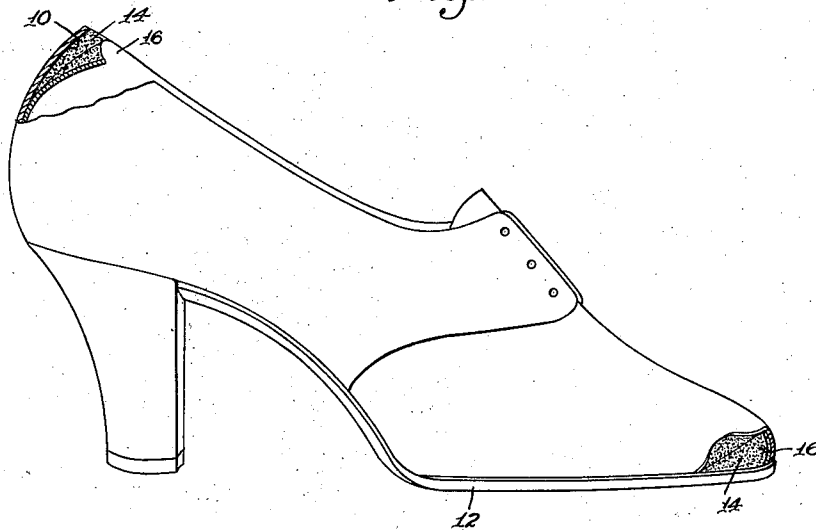
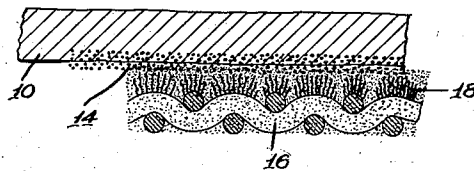


Fig. 2.

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UNITED STATES PATENT OFFICE

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SHOE

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2 Claims. (Cl. 36-77)

This invention relates to improvements in shoes. More especially it relates to those parts of the shoe upper which are desired to be stiff, such as the toe and quarter; and it provides an improved means for producing there the required stiffness.

Hitherto it has been customary to obtain the needed stiffness of toe by inserting, between the lining and the leather of the toe portion of the upper, a thick, flat plate of thermo-plastic or solvent-plastic material, which is naturally stiff at ordinary atmospheric temperatures, but which when duly softened by heat or by a solvent can be re-shaped in the lasting operation and become a toe box. And it has been customary to obtain the stiffness of quarter by making a pocket in the canvas lining, and by inserting there a plate of leather, fibre board or other stiff material which is duly molded into the heel shape. In both toe and quarter the inserted plate has to be preliminarily cut into proper shape and must be made of proper size, and then be skived, and then secured in the upper.

Moreover, it is well known that if the visible external material of a shoe upper be thin, as is common for some styles of women's shoes, especially when made of kid, there is danger that some ingredient of the thermo-plastic plate will strike through the leather from the flesh side so as to disfigure the exterior face.

The present invention eliminates the need for introducing sheet or plate elements, thus saving in the cost of material; and also saving time and labor cost for properly preparing, inserting and securing these stiffening sheets among the other sheets of the upper.

Instead of such, the *modus operandi* of the invention is merely to combine a suitable liquid with the upper. This liquid easily impregnates the lining; and the doubler, if any; and penetrates or adheres to the inner face of that sheet, whether it be leather, canvas, or other material, whose outer face constitutes the ordinarily visible part of the upper. The liquid then hardens in its penetrative location, by cooling, or by evaporation of a volatile component. Thus it stiffens these materials; yet its solid body can be temporarily softened by known methods, as by heat or a volatile solvent, in order to be re-shaped during the lasting operation.

And the invention provides a double safeguard against the upper becoming exteriorly disfigured by the stiffener; first, by the stiffener itself being of colorless character, when solidifying from liquid form; and, second, by preliminarily introducing into the upper leather (notwithstanding its thin-

ness) a sort of septum or dam which physically obstructs the complete permeation of the upper by the stiffening liquid. This device of a dam is useful also with stiffener plates of the old style above mentioned. It can be executed successfully with rubber latex. The rubber, applied on the flesh side of the kid, in the form of undiluted latex penetrates the leather a little and closes its pores, without itself going completely through.

The stiffening liquid which we describe below, applied to the upper leather after the latex or applied directly without any latex, in which case the adhesion is usually stronger and better, will stiffen the composite sheet of leather, doubler and lining; also binding together the doubler, lining and leather. When it is hard, these make a resiliently stiff solid body with the effect that the toe or the counter is pleasingly stiff in proper form, and yet yields to external pressure, and returns resiliently when released.

The objects of the invention are accomplished by combining the leather or other principal material of the shoe upper, and its ordinary cotton drill lining, with any of the firm resin like products of the polymerization of unsymmetrically substituted ethylenes, choosing one that will soften sufficiently, either with moderate heat or by use of a solvent,—some ordinary solvent or a mixture of several such being preferred. If the solvent which it is desired to use be inflammable, a serious objection in a shoe factory, we can render it non-inflammable, without destroying its softening property, by mixing with it a sufficient proportion of carbon tetrachloride.

The general class of stiffeners thus indicated includes polymerized styrol (phenyl ethylene) and polymerized vinyl derivatives and esters (ethylene monochloride or vinyl chloride, vinyl bromide, vinyl acetate, vinyl chloracetate, and the like). Other and similar compounds containing the vinyl group, $\text{CH}_2\text{:CH}$ are found to be usable, when polymerized to such a degree that they are hard at ordinary temperatures. Some of the above are not soluble, so far as we know, and for this reason we mention that the product selected for this use must be one that is soluble, in some one or other acceptable solvent, or else must be reducible by heat to a state of fluidity or of high plasticity so that it can penetrate the materials of the shoe. When it has thus penetrated the shoe leather and lining in a state of liquidity, and become solidified in situ, the polymerized substance combines its own properties with the flexible qualities of the leather and lining, making the whole, at toe or quarter, to be firm to a de-

sired degree, and resilient if its firmness be overcome by pressure; strong and tough, not cracking with objectionable fracture; and very resistant to penetration of or weakening by moisture.

Polymerized resins suitable for the purpose are obtainable in the market under various trade names. One such vinyl resin is available either in solution form or solid, and, if solid, either in sheet or powder form.

A commercial form of styrol resin, resulting from the polymerization of styrol (styrolene or styrene) is available in colorless, transparent hard and firm sheet form, having the aspect of glass. Substances referred to as ordinary solvents include toluene, benzene, ethylacetate or acetone, and other general lacquer solvents. This resin is soluble in benzene. Therefore the fact that it is not soluble in acetone is inconsequential. The same might be said if some other of the described polymerized resins were soluble in acetone, or some other ordinary lacquer solvent, but not in benzene. When the polymerized resin is sufficiently liquid it can be applied to the proper part of the shoe lining by dipping the lining into it, or may be applied with a cementing machine. On the leather or other material which has external exposure in the shoe, it can be applied to the inner face thereof with a brush, or, preferably, be printed thereon with a pad or die, to place it with the exact limits desired.

The method of use is to fill the lining and inner surface of the leather with the material which has been softened or liquefied for the purpose; let it dry, the whole of a batch of uppers thus filled being let stand as is usually more convenient in the management of a shoe factory, until this batch is taken for the next operation; then to apply heat or solvent, to soften each upper as wanted for the lasting operation, and to last the upper while thus softened; and then after the lasting to let the whole harden by cooling or drying.

The liquid to be applied is preferably a mixture of the styrol resin with the vinyl ester and it has been found that while either of the two varieties above described may be employed safely, yet if they are used in combination a result is attained, which is more satisfactory in the quality of resilient stiffness which it produces. In such a combination the styrol contributes hardness or firmness, and the vinyl contributes flexibility and resilience. They may be used in equal parts, with better results than either solely, but the proportion of two parts of the styrol polymerized resin to one part of the polymerized vinyl ester gives a particularly pleasing result of combined stiffness and resilience. These proportions refer to mixtures of weights of the respective solids when liquefied by heat.

The softening for the lasting operation we find most conveniently done by heat, as adequate heat can be readily applied by steam, in a manner already well known for the softening of thermoplastic materials. But there is the difference that, in the case of the materials now being described, steam softens the toe box so that it can be crumpled in the hand, and feels like a rag, without making the toe box or the materials in it plastic, nor making it sticky, hence it is not necessary to chalk the last. The use of heat, as compared with the method by solvent, is found ordinarily both quicker in softening, quicker in hardening, and less expensive in incidental costs. On the other hand, an advantage can be seen for

the use of the volatile solvent method in some circumstances. For example, when the leather is so thin that it is advisable to apply latex to prevent the stiffener from striking through, the water of the latex strikes through, and later dries out, and the rubber deposit is found mostly at the surface of the flesh side of the leather. The vinyl ester does not adhere to this so well as it does to clear leather; but if the ester be dissolved in acetone, this fact that acetone also dissolves rubber leads to a better mingling of the adjacent ester and rubber, and lets the acetone go through the rubber to the leather and carry some of the ester in,—all contributing to a better adhesion when the acetone has departed.

In either case the portion of shoe upper thus produced, at toe or heel, is thereafter possessed permanently of a resiliently firm characteristic which resists change by any influence, such as any condition of moisture, temperature or pressure, which the shoe is likely to encounter while in the possession of the wearer. And this is true whether the main material of the upper be leather, as herein mentioned by way of example, or any other substance to which it can adhere, as canvas.

It has long been customary to add, to the lining of a shoe toe, a sheet of fabric, called sometimes a "doubler", to give greater body to the wall of this part of the shoe; and of late it has been the practice of some makers of women's shoes to combine the doubler and the lining in one single piece of heavy cotton drill having a nap on one of its faces, to which the customary introduced plate of felt and waxy material are added for making the box. By the present invention the toe box may be omitted; and the hardened polymerized styrol will be held in sufficient body by the lining and doubler, or by the single piece lining with nap. With the elimination of the inserted box plate the shoe maker avoids that step-off in thickness which has accompanied boxes heretofore, making for better appearance and comfort, yet holding the desired shape of toe. If the vamp material of the shoe be thick, the applied stiffening material will not penetrate to the exterior face; but if the vamp material be so thin that penetration to the exterior face would occur, such penetration can be avoided by first applying a rubber latex.

In the accompanying drawing:

Figure 1 represents a shoe, with toe and heel portions in section; and

Figure 2 is a schematic enlargement of a section through the materials at a stiffened portion.

Referring to the drawing the upper of the shoe is built and is secured to the sole 12 in the usual or any suitable way, and this may be by any of various known methods; but those parts of the upper which are desired to be stiff, as the toe portion and the rear part of the quarters, are devoid of the usual toe box and counter. Their stiffening results from the presence of the polymerized styrol 14, or whatever equivalent substance is employed, which is impregnated into the lining 16 and into the inner surface of the leather 10 of the shoe, as is indicated by the stippling in the drawing.

The lining, which is shown in the schematic drawing as illustrating one way of applying the invention, is of the composite kind consisting of cotton drill 16 with a nap 18 on one face; but the situation would be similar if the toe were constructed with the ordinary plain drill as a lining and an additional sheet as a doubler, the

doubler being impregnated with the polymerized styrol, and the lining also if desired.

While it is an advantage of the invention that it permits of requisite stiffness being attained without the introduction of a toe box, yet if for any reason such an element be desired, the stiffening material herein described may be used therein, impregnated into the felt thereof. It would take the place, in this case, of the thermoplastic and other stiffening material which in past years have been employed in box toe blanks. Similar remarks apply to the quarter. The invention contemplates that the counter hitherto customary will be omitted; and that the requisite stiffness will be attained by impregnating the described material into the lining and the inner face of the shoe leather, at the quarters, (or into the canvas or whatever the shoe be made of other than leather). If greater stiffness be desired it can be attained by making a thicker body of absorbent material and/or of absorbed material.

When desired the cost can be reduced by mixing with cheaper resins. Also the temperature of softening can be reduced by mixing with resins which soften at lower temperature, one example being cumar resin.

The stiffener of the invention may be modified in firmness, if desired, by mixing with plasticizers such as di-butyl phthalate, tricresyl phosphate and others commonly used for this purpose. And other diluents or modifiers suitable to the purpose may be used, in accordance with principles already known.

As the polymerized resins above mentioned do not all respond to the same solvent, the solvent

for any particular resin which it may be desired to use will be a matter of choice among those in which the particular resin is known to be soluble, or which can be ascertained or verified by simple trial. If a solvent be selected which is inflammable, the composite liquid, containing the polymerized resin, may be rendered unflammable by the introduction of a proper proportion of carbon tetrachloride.

It is intended that the patent shall cover by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention disclosed.

What is claimed is:

1. A shoe having a stiffened portion comprising, in impregnating combination with the inner face of the outside sheet material of the shoe upper, a solid, resiliently stiff, resin-like combination of polymerized vinyl ester and polymerized styrol; the polymerization of each having been carried to such an extent that the polymerized product is at ordinary temperatures a hard solid.

2. A shoe having a stiffened portion in its upper, in which that sheet of material of the shoe which is exposed externally contains a layer of rubber in the body portion of said externally-exposed sheet, next to the internal face thereof, and contains, on said internal face, a layer of penetrative stiffening material whose penetration through the sheet is obstructed by the said rubber and thereby is prevented from penetrating to the exposed face of the sheet.

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