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SHANK STIFFENER AND METHOD OF MAKING THE SAME

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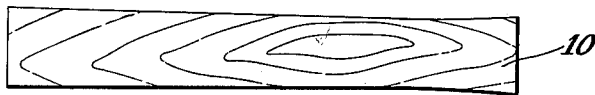


Fig. 1

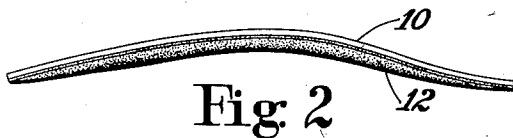


Fig. 2



Fig. 3

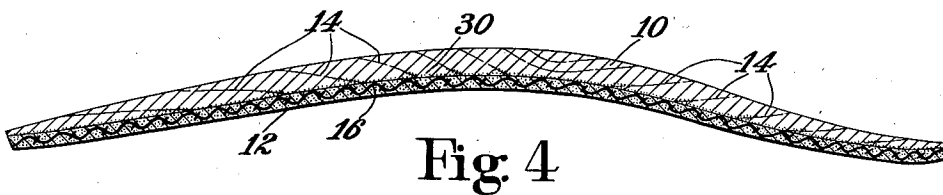


Fig. 4

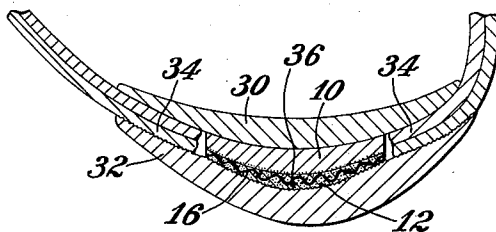


Fig. 5

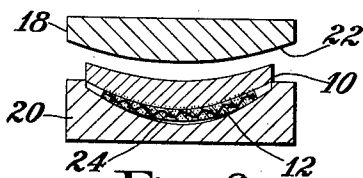


Fig. 6

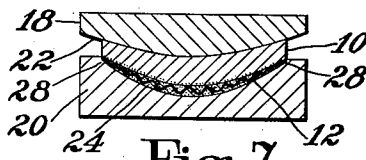


Fig. 7

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SHANK STIFFENER AND METHOD OF
MAKING THE SAME

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13 Claims. (Cl. 36-76)

This invention relates to improvements in shank stiffeners and methods of making the same and it is more particularly concerned with the manufacture of reinforced wooden shank stiffeners.

Shank stiffeners made entirely of wood are light in weight, resilient, and inexpensive to manufacture and such stiffeners, commonly known as "wood shanks" are extensively used in many types of shoes in preference to metallic shank stiffeners. When made in accordance with the usual commercial practice, however, wood shanks are subject to inherent weaknesses which greatly limit their field of use. In accordance with this usual practice a strip of veneer is cut from a log by a knife having its cutting edge curved to impart a transverse curvature to the veneer strip and thereafter the veneer strip is cut crosswise into narrow strips which constitute the shank stiffeners. Thus the longitudinal curvature of the shank stiffeners corresponds to the transverse curvature of the veneer strip. The grain of the wood in each shank stiffener runs lengthwise of the stiffener but the lines of the grain are more or less inclined with respect to the curved faces of the stiffener and consequently there is some tendency for the stiffener to split or break along these lines. In a shank stiffener having a substantial amount of longitudinal curvature the lines of the grain would slope at substantial angles to the curved faces of the stiffener and the tendency of such a stiffener to break or split when in use would be very substantial. For this reason it has heretofore been considered impracticable to cut wooden shank stiffeners with more than a moderate amount of longitudinal curvature and the field of use of wooden stiffeners has been limited to shoes having fairly low arches.

Another undesirable feature in connection with the use of a conventional wooden shank stiffener is that it is impracticable to secure it firmly in place in the shoe by means of tacks or similar fastenings because of the tendency of the wood to split where the fastenings are driven through it.

One object of the present invention is to counteract the above-mentioned tendencies of wooden shank stiffeners to break or split.

Another object is to enlarge the field of usefulness of wooden shank stiffeners by rendering their employment practicable and advantageous in shoes having high arches such, for example, as women's high heel shoes.

It is a further object to better adapt wooden shank stiffeners for use in shoes having cement-

attached outsoles where it is desirable to increase the security of the cement bond in the shank portion of the shoe bottom.

To the accomplishment of these and other objects my improved shank stiffener comprises a longitudinally curved strip of wood having substantially the strength and resiliency of a conventional wood shank of a corresponding size and shape, and a resilient strip or layer of hardened plastic material which is secured to and entirely covers the lower or longitudinally concave side of the wooden strip so that the latter is effectively reinforced against any tendency to break or split under the ordinary strains to which it is subjected in use, or as the result of the attachment of the stiffener to the shoe by means of tacks or other metallic fastenings. In practice it is preferred to employ, as the body portion of my improved shank stiffener, a wooden shank piece made by conventional methods of manufacture, the shank piece being longitudinally arched or curved and having the natural grain of the wood running generally lengthwise of the strip but along lines more or less inclined relatively to the curved faces of the strip, and to apply a reinforcing element to the lower or longitudinally concave side of the strip in a soft and plastic condition, pressing the plastic material against the shank piece and holding it under pressure until it hardens or sets thereby causing some of the plastic material to penetrate into the texture or grain of the wood and harden therein and thus to bond together the fibers of the wood for an appreciable distance inwardly from the lower surface thereof, the more effectively to reinforce or strengthen the wood. I prefer to employ as the reinforcing means a strip of woven fabric initially prepared by having in and through the interstices thereof, and carried within the same as a filling therefor, a colloidal substance such as cellulose nitrate or pyroxylin in finely comminuted or powdered form, and to dip the prepared strip in acetone, or other solvent for colloidal material, thereby to resolve the latter into a soft plastic condition and render the fabric flaccid. Thereafter I apply the reinforcing strip to the lower or longitudinally concave side of the wooden shank piece and allow the solvent to evaporate so that the colloidal material hardens and becomes secured by its inherent adhesive properties to the shank piece.

The invention will now be described in detail with reference to the accompanying drawing, in which

Fig. 1 is a plan view of my improved reinforced shank stiffener;

Fig. 2 is a side elevational view of the shank stiffener;

Fig. 3 is a bottom view thereof;

Fig. 4 is a longitudinal sectional view of the stiffener on an enlarged scale;

Fig. 5 is a transverse sectional view of the stiffener on an enlarged scale, showing it incorporated in a shoe having a cement-attached outsole;

Fig. 6 is a transverse sectional view of the shank stiffener in process of manufacture showing cooperating molding members which may be employed to mold the plastic reinforcing element and secure it to the wooden element, the molding members being inactively positioned; and

Fig. 7 is a view similar to Fig. 6 but showing the molding members in the relative positions they occupy after the molding pressure has been applied.

As shown in the drawing, my improved shank stiffener comprises a shank piece 10 having a reinforcing strip or layer 12 of hardened plastic material secured thereto. The shank piece 10 consists of a narrow strip of wood and it is longitudinally curved or arched to conform to the longitudinal curvature of the arched portion of the bottom of the last for the shoe in which the shank stiffener is to be used. A conventional wood shank of the type commonly employed in shoe manufacture may advantageously be employed as the shank piece 10, the piece being cut so that the grain of the wood extends in the general direction of the length of the shank piece but along lines inclined more or less to the curved faces thereof, as indicated at 14 in Fig. 4. The reinforcing strip 12 is located at the lower or longitudinally concave side of the shank piece, since the strains to which the shank piece is subjected in use tend to flatten it and consequently to place under longitudinal tension the portion immediately adjacent to its lower side and since the reinforcing strip is intended to function primarily to counteract the tendency of the shank piece to split or break as a result of longitudinal tension such as that referred to.

Any suitable plastic substance may be employed in making the reinforcing strip 12 but I have found that cellulose nitrate is particularly well adapted for this purpose since, in its hardened state, it is resilient to a degree comparable to that of the wood from which the shank piece is cut and thus insures that the reinforcing strip will be adapted to serve effectively to strengthen the shank piece without making it rigid or unduly stiffening it. The cellulose nitrate is applied to the shank piece in a soft or plastic condition and it is allowed to harden thereon so that it will become firmly secured to the shank piece by its inherent adhesive properties.

I prefer to employ in connection with the plastic reinforcing strip 12 a strengthening strip or layer of fabric, such as the woven fabric indicated at 16 in Figs. 4 and 5, and find it desirable, as indicated in those figures, to have the fabric strip embedded within the plastic strip so that it will not interfere with the formation of a smooth surface upon the exposed side of the latter. In providing for such a construction of the reinforcing strip or layer 12, the fabric is initially prepared by having a colloidal substance such as pyroxylin, in a finely comminuted or powdered form, deposited thereon so that it fills the interstices of the fabric. The fabric, thus prepared, is cut to a size such that it will cover or approxi-

mately cover the lower side of the shank piece and it is dipped in acetone, or other suitable solvent for the pyroxylin, and thereby the latter is resolved into a plastic state and the fabric itself is rendered flaccid. The reinforcing strip, in its soft plastic condition, is then laid upon the lower or concave side of the shank piece so as to cover or substantially cover the latter and it is allowed to dry and to become securely attached to the shank piece by the adhesive properties of the pyroxylin.

In applying the reinforcing strip 12 to the shank piece 10 it may sometimes happen that the strip 12 will extend somewhat beyond one lateral edge or the other of the shank piece, a condition which may be remedied by subsequently trimming off the projecting portion of the reinforcing strip. To prevent this condition from occurring, however, and still further to improve the construction of the shank stiffener, I may cut the reinforcing strip somewhat narrower than the wooden shank piece and apply the reinforcing strip so that its lateral edges will be spaced inwardly from the respective edges of the shank piece (as indicated in Fig. 6), and thereafter, and while the reinforcing strip remains in a plastic condition, I may apply molding pressure to the reinforcing strip in such a manner as to widen the strip until it extends to both edges of the shank piece. This may be done by placing the shank piece, with the reinforcing strip applied thereto, between molds such as the upper and lower molds 18 and 20, respectively (Figs. 6 and 7), and pressing the molds toward each other by means of a suitable press. As shown, the upper mold 18 has a lower face 22 shaped to conform to that of the upper face of the shank piece while the lower mold has a molding face 24 shaped to impart a desired surface contour to the lower side of the reinforcing strip. The reinforcing strip, instead of being applied initially to the shank piece, may be laid in a transversely central position upon the surface of the lower mold 20. The shape of the molding face of the lower mold 20 may be such as to form feather edges at the opposite lateral margins of the reinforcing strip, as indicated at 28 in Fig. 7, and to shape the strip so that it will be of maximum thickness in its center portion and will decrease gradually in thickness toward its feather edges. The reinforcing piece is shown in Fig. 6 in the condition in which it appears before the molding pressure has been applied, while in Fig. 7 the molds are shown as being under pressure and the reinforcing piece as having been molded to the full width of the shank piece and shaped as above described. The action of such pressure molding results also in causing some of the soft plastic material constituting the reinforcing piece to penetrate to a limited extent into the texture of the wood of the shank piece, as indicated conventionally by stippling at 30 in Fig. 4, this penetration being particularly effective along the lines or joints 14 between the component layers of the wood.

In a shank stiffener produced as above described, the wooden element or body portion is reinforced by the hardened layer of pyroxylin upon its lower side so that it will be best adapted to resist any breaking strains to which the stiffener will ordinarily be subjected in use. The stiffener, however, will be highly resilient due to the resilience of both the wooden and pyroxylin elements of which it is composed. The reinforcing layer 12 being applied to the lower

side of the wooden strip will most effectively resist breaking strains resulting from the application of weight to the bottom of the shoe in which the stiffener is incorporated, inasmuch as such strains subject the lower side of the wooden strip to longitudinal tension and tend to develop fractures in the wood starting at the lower side of the shank piece and extending upwardly along the lines 14. Because of the novel manner in which the wooden shank piece 10 is reinforced by the plastic layer 12 it becomes practicable to produce wooden shank pieces in accordance with the usual commercial methods of manufacture with substantial amounts of longitudinal curvature and to use them in high arch shoes without risk of the shank pieces breaking during the wearing of the shoes. Any tendency of the reinforcing layer itself to become broken as a result of the tension to which it is subjected when the shank stiffener is in use is offset by the fabric reinforcement 16 which is embedded therein. The reinforcing layer or strip 12 also effectively prevents the wooden piece 10 from being split by means of tacks used for securing the shank piece to the bottom of the shoe, or, in case a split should be developed, to reinforce the stiffener so that it will still be capable of performing its foot supporting function.

As shown in Fig. 5, my improved shank stiffener is made of such shape as to fill the bottom cavity in the shank portion of a shoe between the insole 30 and the outsole 32, inwardly of the overlaid margins 34 of the shoe upper, the stiffener being, for this purpose, made of substantial thickness along its central median zone and tapering transversely therefrom toward its opposite lateral edges which are relatively thin. This characteristic of the shank stiffener imparts to the outsole the transversely rounded shape desired in the shank portions of many styles of high arch shoes. In cases where the outsole is to be attached to the shoe by means of cement, as shown in Fig. 5, the reinforcing layer 12 of hardened cellulose nitrate or pyroxylin insures the obtaining of a secure cement bond, as indicated at 36, between the outsole and the shank stiffener, the latter having been firmly attached by means of tacks (not shown) or otherwise to the shoe bottom. The obtaining of such a bond may be facilitated by the application of solvent to the hardened plastic reinforcing strip or layer 12 just before the outsole is applied to the shoe.

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

1. A reinforced shank stiffener consisting of a longitudinally arched wooden strip in which the grain of the wood extends lengthwise of the strip along lines inclined with respect to the curved lower face thereof, and a resilient layer of hardened plastic material secured to and covering said curved lower face and reinforcing said strip against splitting along the lines of the grain without unduly stiffening said strip.

2. A shank stiffener consisting of a longitudinally arched wooden strip of substantial thickness reinforced by hardened plastic material, said material constituting a relatively thin covering for the longitudinally concave side of said wooden strip and extending into the texture of the wood at said side of the strip.

3. A shank stiffener consisting of a strip of wood having a natural grain extending lengthwise thereof, and means for reinforcing said strip against splitting along the lines of the grain, said

means comprising a hardened plastic material coextensive with said strip and covering one side thereof and forming an outer surface of said stiffener, said material extending into the interstices in the grain of the wood and binding the fibers of the wood together to prevent splitting.

4. A shank stiffener consisting of a strip of wood having a substantial amount of longitudinal curvature and having a natural grain extending lengthwise of the strip along lines angularly disposed to the curved surfaces thereof, and means for reinforcing said strip against splitting along the lines of the grain, said means comprising a layer of hardened plastic material coextensive with said wooden strip and covering the longitudinally concave side of the latter, said material extending into the interstices between the layers of the grain and binding said fibers together to prevent splitting of the wood.

5. A shank stiffener consisting of a longitudinally arched wooden strip of substantial thickness in its longitudinal median zone and having its lateral margins tapered to relatively thin edges at its longitudinally concave side, a relatively thin layer of hardened plastic material secured to and covering the tapered side of said wooden strip, and means embedded in said layer for reinforcing the same.

6. As an article of manufacture, a longitudinally arched wooden shank stiffener of substantial thickness having upon its longitudinally concave side a relatively thin reinforcement consisting solely of hardened nitrocellulose having a layer of fabric embedded therein.

7. A longitudinally arched wooden shank stiffener reinforced at its longitudinally concave side with fibrous material impregnated with pyroxylin in colloidal form and secured by means of the pyroxylin to the stiffener.

8. A longitudinally arched wooden shank stiffener having a relatively thin layer of hardened nitrocellulose secured to and entirely covering its longitudinally concave side, said layer having a strip of woven fabric embedded therein and extending throughout the full width and length of said layer.

9. That improvement in methods of making reinforced shank stiffeners which consists in applying a reinforcing layer of plastic material in a softened condition to one side of a wooden shank piece, pressing the soft plastic material against the shank piece thereby causing some of the material to penetrate into the texture of the wood of the shank piece, and allowing said material to harden while under pressure.

10. That improvement in methods of making reinforced shank stiffeners which consists in providing a reinforcing strip containing colloidal material in comminuted or powdered form, applying to said strip a solvent for said colloidal material thereby resolving the latter into a soft plastic state, pressing said strip against one side of a wooden shank piece and allowing said colloidal material to harden or set while under pressure thereby causing some of said material to penetrate the texture of the wood of said shank piece, and securing said strip to said shank piece.

11. That improvement in methods of making reinforced shank stiffeners which consists in providing a strip of fabric having its interstices filled with powdered colloidal material, applying to said strip a volatile solvent for said colloidal material thereby resolving the latter into a plastic condition and rendering the fabric flaccid, lay-

ing said strip upon the concave side of a longitudinally curved wooden shank stiffener, applying molding pressure to said strip thereby causing a portion of said plastic material to penetrate into the texture of the wood, and allowing said plastic material to harden or set to reinforce said stiffener and provide upon its concave side a surface adapted to facilitate the formation of a cement bond between the shank stiffener and an outsole.

12. That improvement in methods of making reinforced shank stiffeners which consists in positioning in a transversely central location upon one side of a wooden shank piece a strip of soft plastic material which has inherent adhesive properties and is narrower than the shank piece,

and molding said reinforcing strip while it is soft thereby widening said strip to conform to the width of the shank piece and causing it to become secured to the latter by means of its adhesive properties.

13. That improvement in methods of making reinforced shank stiffeners which consists in positioning in a transversely central location upon one side of a wooden shank piece a strip of soft plastic material which has inherent adhesive properties and is narrower than the shank piece, and thereafter by molding pressure widening said strip to conform to the width of the shank piece and reducing the thickness of said strip along its opposite lateral margins.

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