Nov. 6, 1934. R. B. FRAZIER 1,979,461

SHOE STRUCTURE

Filed March 16, 1932

Fig. 1.

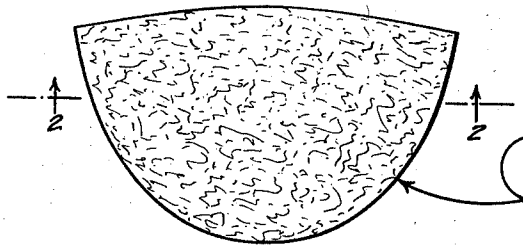


Fig. 2.

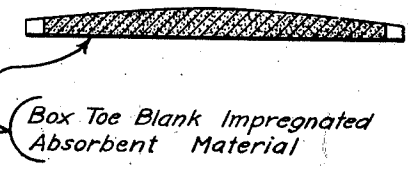


Fig. 3.

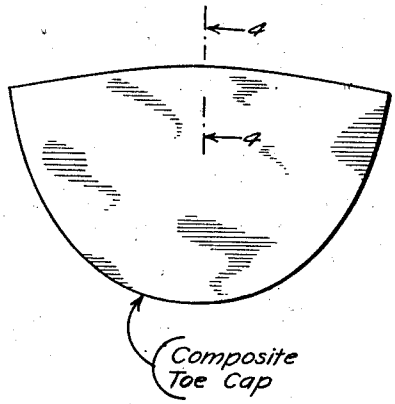


Fig. 4.

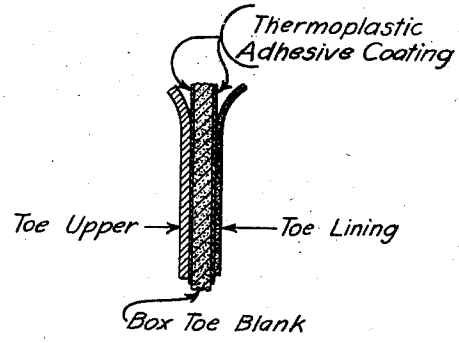
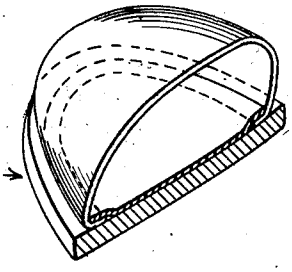


Fig. 5.



INVENTOR:
Ralph B. Frazier,
BY Byrne, Townsend & Cotter,
ATTORNEYS.

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SHOE STRUCTURE

Ralph B. Frazier, Norristown, Pa., assignor to Carbide & Carbon Chemicals Corporation, a corporation of New York

Application March 16, 1932, Serial No. 599,318

10 Claims. (Cl. 36—77)

This invention relates to shoe structures, and specifically to an improved box-toe or blank therefor which comprises cellular, fibrous, or other absorbent material impregnated or coated with vinyl resins, that is, artificial resinous bodies resulting from the polymerization of certain vinyl compounds.

Shoe structures, particularly box-toes, frequently require stiffening means to impart the desired shape to the finished article. It has been proposed to use various materials in conjunction with cellular or fibrous material to provide blanks having the requisite stiffness for box-toes. It is necessary for the stiffening material to possess certain properties, and the most essential property is an ability to be shaped into the proper form of toe during the manufacturing operations. Shellac, rosin, pitch, asphalt, tar, cellulose esters, and various other resinous or gum-like materials have been used as stiffening agents for box-toe blanks. In practically every case the use of the previously suggested materials has been accompanied by one or more disadvantages. For example box-toes formed from certain of the above materials are almost entirely devoid of resiliency, and are too stiff or tend to break when pressure is applied thereto. Other materials are too soft at temperatures ordinarily encountered, or are softened by the heat of the foot. Other materials lack resistance to water, or are readily attacked by liquids with which the shoe may be contacted while in use, e. g. gasoline. Some of the materials used lack sufficient thermoplasticity and consequently must be shaped by softening the material with solvent. This is an expensive procedure both by reason of the solvent lost by evaporation and because of the time required to dry the shaped blank. Still other materials are readily combustible and constitute a distinct hazard in use and in the shoe manufacturing processes. All of these and various other disadvantages are encountered in the use of previously proposed stiffening materials for box-toes.

The principal object of my invention is to provide a shoe structure which includes a stiffening material substantially free from the disadvantages enumerated above. Another object is to provide an improved box-toe blank comprising cellular or fibrous absorbent material and vinyl resins.

I have found by experimentation that the use of vinyl resins as stiffening agents enables me to accomplish the objects of my invention and to secure novel and beneficial results in the formation of shoe structures which include box-toes. The invention is illustrated by the accompanying drawing, in which

Fig. 1 shows the invention embodied in an improved box-toe blank;

Fig. 2 is a section along the line 2—2 of Fig. 1;

Fig. 3 shows a composite toe cap including the improved box-toe blank;

Fig. 4 is a fragmentary section along the line 4—4 of Fig. 3, in which the elements of the composite toe cap are partly separated to show the assembly, and

Fig. 5 is a fragmentary view of an assembled shoe structure.

Various types of vinyl resins and various methods of producing these resins are known. The vinyl resins which are especially adapted for use in my invention are those resulting from the polymerization of vinyl halides, vinyl esters of aliphatic acids, or mixtures of a plurality of polymerizable substances including vinyl compounds. Resins formed from vinyl esters of aliphatic acids, such as vinyl acetate, have relatively low melting points, are comparatively soluble, and possess excellent adhesive qualities. The polymerization products of vinyl halides, such as vinyl chloride, are higher melting, more insoluble, and somewhat deficient in adhesive properties. Resins made by polymerizing vinyl benzene (styrene) resemble the vinyl halide resins in their general properties.

The resins preferred by me for use in this invention are those resulting from the conjoint polymerization (by which is meant polymerization of a plurality of compounds while in mutual contact) of two or more polymerizable substances at least one of which is a vinyl compound of the previously mentioned groups. An example of this latter type of resin, and one which has desirable properties for use in the new box-toe blanks, may be made by the conjoint polymerization of about 80 parts of vinyl chloride and about 20 parts of vinyl acetate. The polymerization may be conducted in the presence of a solvent or non-solvent liquid by the aid of a catalyst, such as benzoyl peroxide or lead tetraethyl, and at a temperature below about 65° C. Vinyl resins so prepared are tough and resilient, chemically and electrically inert, substantially non-flammable (i. e. they will not support combustion), and they are almost permanently thermoplastic. The vinyl resins and processes of making them are not a part of my invention.

The invention may be practiced by impregnating a sheet of absorbent material, such as felt, paper, cloth, etc. with a solution of the vinyl

resin in a convenient solvent or solvent mixture. When the solvent is removed the sheet becomes stiff, but due to the resiliency of the vinyl resin, cannot be permanently distorted by pressure. The dried impregnated sheet may be then coated with another thermoplastic composition to impart additional adhesiveness to the surface of the box-toe blanks formed therefrom, and to produce the proper softening temperature or to vary the softening temperature of the composition. Such an additional coating also lengthens the hardening time of the blank somewhat, thus insuring adequate plasticity of the box-toe during the period that the shoe is being completed on the last. For such additional coating I have found that a mixture of rosin and rosin-pitch, a coumarone resin or mixture of a coumarone resin with rosin, ester gum, of the like, or any adhesive thermoplastic gum-like or resinous material softening at about 100° F. or higher may be used. The coating may be applied by dipping the impregnated sheet into a bath of the molten coating material, and the thickness of the coating may be controlled by varying the viscosity of the molten bath or by the use of a "doctor" blade or similar device. Thus, the thickness of the coating will vary directly with the viscosity of the coating bath, or if the bath is such as to produce a thicker coating than is desired, "doctor" blades may be arranged so that the sheet leaving the bath presents its coated surface or surfaces to the blades whereby excess coating material is removed and a coating on the sheet of the proper thickness is obtained.

The impregnated sheet coated as described may be then cut into box-toe blanks, as shown in Figs. 1 and 2 of the drawing. The box-toe blank may be stitched to the upper of the shoe, or it may be softened by the application of heat, for example over a steam jet, and inserted between the upper and lining of the shoe. This latter procedure is commonly practiced in the manufacture of shoes. The blank, when placed in position with respect to the other elements of the shoe is then softened by heat as described, and while soft is formed to the desired shape on a last and secured in this position. My improved box-toe cools readily in the time required to complete the fabrication of the shoe, allowing the last to be removed as the operation is complete.

The invention may be modified by forming a composite laminated toe cap, as shown in Figs. 3 and 4 of the drawing, which comprises a toe cap upper and lining with an interposed portion of sheet material impregnated with a vinyl resin. The laminated toe cap may be formed from a box-toe blank formed from a sheet of absorbent material impregnated with a vinyl resin and coated with a low melting resin, such as coumarone resin, rosin, or ester gum, which will become fluid at the temperature used in softening the toe. This coated blank is placed between the toe cap upper and lining and heated until the coating becomes fluid. The resultant structure when again cooled forms the laminated composite toe-cap.

In a specific example, a piece of felt was impregnated with an acetone solution of vinyl resin containing about 20% by weight of the vinyl resin. This resin was formed by the conjoint polymerization of 80% of vinyl chloride with 20% of vinyl acetate in the presence of about 1% of benzoyl peroxide at a temperature of about 40° to 50° C. Since various types of materials are used for the manufacture of box-toes, I have found that it is advisable to add 10% to 20% of plasticizer for the resin where a dense material is used and where a resilient box-toe is desired. For this type of product plasticizers such as dibutyl phthalate, tricresyl phosphate, ethylene glycol monobutyl ether phthalate and various other materials may be used to obtain the desired softening effect. The impregnated material when dried was coated with a 10% solution of a coumarone resin with a softening point of approximately 100° F. I have also found that other resins, such as rosin, which are more or less sticky may be used for this purpose. As a solvent for these resins I prefer to use a low boiling solvent, such as acetone, ethylene dichloride, benzene or ethyl acetate, although other solvents may be used. The cooled coated sheet was then cut into box-toe blanks, and these blanks were softened by means of a steam jet and inserted between the lining and upper of the toe portion of the shoes and formed on a last while the remainder of the shoe was being completed. The completed shoes included the box-toes which were resilient and not subject to impairment of heat in a degree ordinarily encountered in use, or by water, gasoline, alcohol or other common solvents. Also, the new box-toes are practically non-flammable.

It is possible to modify the vinyl resins used in forming the new box-toes by the incorporation therewith of plasticizers, other resins, or gums. For example, rosin, rosin-glycerol esters, coumarone and other natural and artificial resins, or plasticizers, such as dibutyl phthalate, castor oil, linseed oil and various glycol and glycerol esters, and combinations of the foregoing may be added to the vinyl resin to vary its properties of resiliency, fusibility, and plasticity. For example, instead of coating a vinyl resin impregnated material with an additional thermoplastic substance, the second material may be incorporated with the vinyl resin in the absorbent material. Thus, a piece of felt may be impregnated with a mechanical mixture, suspension, or partial solution of both vinyl resin and rosin in a solvent for either or both or a non-solvent in such a manner as to form a material impregnated with about 70% of vinyl resin and 30% of rosin.

I claim:—

1. A shoe having a resilient box-toe comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin selected from the group consisting of polymerization products of vinyl halides, vinyl benzene and mixtures of a plurality of polymerizable substances at least one of which is from the group consisting of vinyl halides, vinyl esters of aliphatic acids, and vinyl benzene.

2. A shoe having a resilient box-toe comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin substantially identical with a resin formed by the conjoint polymerization of a plurality of polymerizable substances including a vinyl halide and a vinyl ester of an aliphatic acid.

3. A shoe having a resilient box-toe comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin substantially identical with a resin resulting from the conjoint polymerization of about 80% by weight of vinyl chloride and about 20% by weight of vinyl acetate.

4. A box-toe blank comprising an absorbent

sheet material impregnated with a composition which contains a substantial proportion of vinyl resin, said blank being adapted to be rendered plastic by heat and capable of hardening when cooled and said blank being substantially unaffected by water, alcohol and gasoline and incapable of supporting combustion.

5. A box-toe blank comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin of the group consisting of polymerization products of vinyl halides, vinyl benzene and mixtures of a plurality of polymerizable substances at least one of which is from the group consisting of vinyl halides, vinyl esters of aliphatic acids, and vinyl benzene.

6. A box-toe blank comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin substantially identical with a vinyl resin resulting from the polymerization of about 80% by weight of vinyl chloride and about 20% by weight of vinyl acetate.

7. A box-toe blank comprising an absorbent sheet material impregnated with a composition which contains a substantial proportion of a vinyl resin of the group consisting of polymerization products of vinyl halides, vinyl esters of aliphatic acids, vinyl benzene and mixtures of a plurality of polymerizable substances including at least one vinyl compound of the foregoing group, said blank being coated with a thermoplastic resinous composition softening at about 100° F.

8. A composite laminated toe cap comprising a toe upper and toe lining and an interposed box-toe blank of absorbent material impregnated with a vinyl resin and coated with a resinous composition capable of becoming fluid at about the softening temperature of said impregnated blank, the whole being bonded into a unitary structure by the action of heat and pressure.

9. A composite laminated toe cap comprising a toe upper and toe lining and an interposed box-toe blank of absorbent material impregnated with a vinyl resin of the group consisting of polymerization products of vinyl halides, vinyl benzene, and mixtures of a plurality of polymerizable substances at least one of which is from the group consisting of vinyl halides, vinyl esters of aliphatic acids, and vinyl benzene, said blank being cemented to said upper and said lining.

10. A composite laminated toe cap comprising a toe upper and toe lining and an interposed box-toe blank of absorbent sheet material impregnated with a vinyl resin substantially identical with a resin resulting from the conjoint polymerization of about 80% by weight of vinyl chloride and about 20% by weight of vinyl acetate and coated with a resinous composition comprising a coumarone resin capable of becoming fluid at about 100° F., the whole being bonded into a unitary structure by the action of heat and pressure.

RALPH B. FRAZIER.