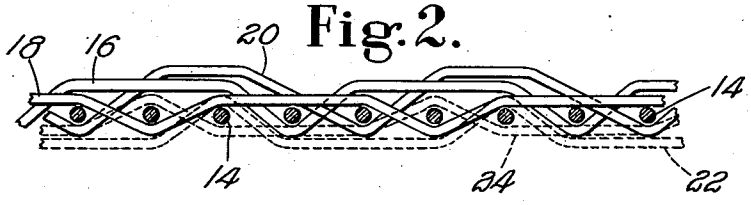
March 7, 1944. A. E. USHAKOFF 2,343,390

METHOD OF STIFFENING SHOES

Filed Nov. 26, 1941

Fig. 1.

Fig. 2.



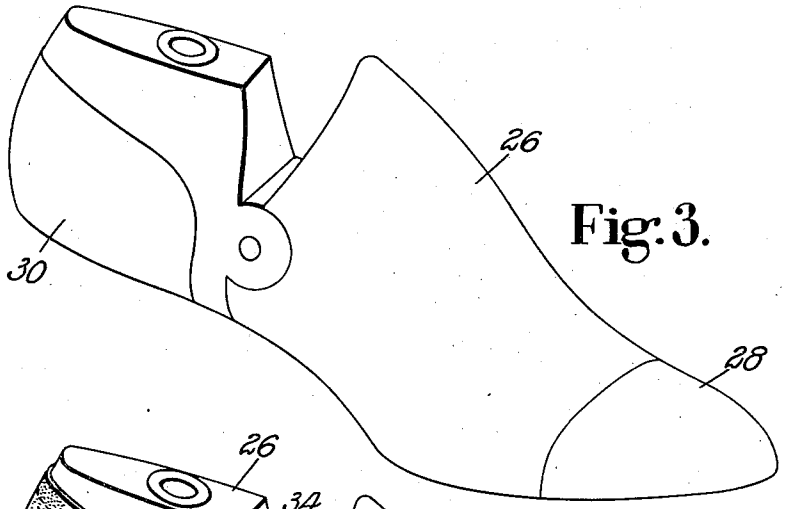


Fig. 3.

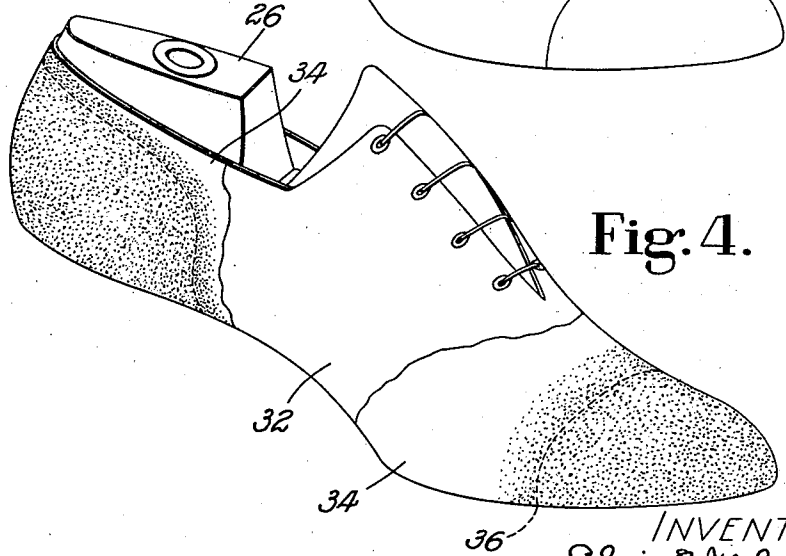


Fig. 4.

INVENTOR
Alexis E. Ushakoff
By his attorney
Clement Tolley

Patented Mar. 7, 1944

2,343,390

UNITED STATES PATENT OFFICE

2,343,390

METHOD OF STIFFENING SHOES

Alexis E. Ushakoff, Beverly, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application November 26, 1941, Serial No. 420,557

6 Claims. (Cl. 12—142)

This invention relates to methods of shoemaking and more particularly to methods of stiffening selected portions of shoes.

In the manufacture of shoes as hitherto practiced, it has been customary to provide stiffening members for certain portions thereof, for example toe-stiffeners and counter stiffeners which must be accurately located in the assembled upper before the upper is conformed to the last, and in the case of many toe-stiffeners which are rendered limp before being located in the assembled upper, such stiffeners are not fastened to the upper. In all shoe factories it has been necessary to provide a large number of stiffeners of different sizes and shapes because of the variations in the styles and sizes of shoes which are made. If a stiffener of proper size and shape is not employed, or if a proper stiffener is not accurately located in the upper, or becomes displaced in the conforming operation, an unsightly and uncomfortable shoe may result.

Another disadvantageous result which often confronts shoe manufacturers is the production of sharply defined boundaries between the stiffened and the unstiffened portions of the upper of a shoe, for example along the top edges of counter stiffeners and along the rear edges of toe-stiffeners. It is customary, in order to alleviate this objectionable result, to skive the top edges of counters and the rear edges of toe-stiffeners to a thin edge, but it is difficult or impossible by such means to produce a satisfactory uniformly graduated degree of stiffening.

According to the present invention, a fabric lining member is provided which contains flexible threads capable of being caused to coalesce and become cementitious by suitable treatment. The lining member is incorporated in the assembled upper of a shoe, whereupon the shoe is lasted. Thereafter the threads in selected localities of said lining member are caused first to coalesce and then to harden and thus stiffen said localities. This method does away with the use of separate stiffening members and consequently with the necessity of accurately locating them in the assembled upper, and may readily be carried out in such manner that no sharply defined boundaries between stiffened and unstiffened portions of the upper will result.

Referring now to the accompanying drawing,

Fig. 1 is a schematic view in section showing a fabric suitable for use as a doubler;

Fig. 2 is a similar view showing a fabric suitable for use as a lining in a shoe;

Fig. 3 is a perspective view of a last having heating plates which may be used in stiffening the toe and the counter portions of the upper of a lasted shoe; and

Fig. 4 is a perspective view of a lasted shoe, the forepart and the rear part of the upper being broken away to show the stiffened toe end and counter portions of a doubler.

In stiffening portions of the uppers of shoes according to the present invention, a full lining member of specially prepared material is assembled in the upper prior to lasting. While many shoes contain two layers of lining material the inner of which is commonly called a "doubler," some shoes contain only a single lining. It will be understood therefore that it is within the scope of this invention to make either the doubler, the lining or both of double-lined shoes or the lining of single-lined shoes of specially prepared material. Accordingly, the term "lining member" as used heretofore and in the claims is intended to include either the doubler, or the lining or both. The material is one in which certain or all localities consist of or contain threads or fibers which may be caused to soften, coalesce and harden after the shoe is lasted by some suitable treatment, such as the use of heat or a solvent. A suitable material, for example, is one of woven fabric in which the woof threads are made of a substance capable of being coalesced and the warp threads are made of a substance not possessing this capability, the fabric being normally flexible so that it may readily be conformed to a last. Such a fabric is flexible before the stiffening treatment due to the fact that the stiffening substance is then in the form of separate threads. After treatment, the fabric holds its shape due to the coalescence of the threads.

Assuming that the coalescing agent employed is heat, the temperature at which coalescence takes place must be such that the stiffening substance will not soften and thus lose its stiffening characteristics while the shoe of which it forms a part is being worn. Also, the substance must have a well-defined melting point below a temperature which is injurious to the other materials of the shoe. In addition, the substance should be flowable when heated; it should solidify above room temperature, and it should act as a cement to bind together the component parts of the assembled upper. A fabric meeting these requirements contains thermoplastic threads which preferably are made of a suitably plasticized resinous substance. In general, however, resinous substances do not themselves possess sharp melting points so that the plasticizer employed must be

chosen to produce this characteristic. Liquid plasticizers may produce a sharp melting point but the plasticized resinous material is not hard enough at room temperature to permit it to be spun into threads. It has been found, however, that a suitable material for the spinning of thermoplastic threads for use in the weaving of lining members of the type discussed above comprises a resinous substance plasticized by a plasticizer such as a wax which is solid at room temperature. Several examples of suitable stiffening substances follow, but it is to be understood that other substances meeting the requirements set forth above may be used.

Example I

	Grams
Ethyl cellulose[1] 90 c. p. viscosity	360
12-hydroxystearin	300
Di(orthoxenyl) monophenyl phosphate	100

Example II

	Grams
Ethyl cellulose[1] 90 c. p. viscosity	400
12-hydroxystearin	250
Castor oil	150

Example III

	Grams
Ethyl cellulose[1] 90 c. p. viscosity	400
Stearic acid	400

[1] The ethyl cellulose in these examples is of the 46.8–48.5% ethoxyl content type.

In a double-lined shoe, the doubler may conveniently be made of specially prepared material and may be relied upon not only to stiffen the shoe but also to cement together the upper and the lining. To this end, the doubler should have thermoplastic threads exposed on both its upper and lining-contacting surfaces. Fabric having this property is illustrated in Fig. 1. This material is produced by means of a suitable weaving process in which the threads composing the warp **10** are made of cotton thread and those composing the woof **12** are spun from thermoplastic materials such as those disclosed in the above examples. In some cases, it may be convenient or necessary to make both the warp and woof of thermoplastic material although it will be understood that this procedure is undesirable if any strength is to be required of the lining member itself.

In a single-lined shoe, it is desirable to provide a lining in which the thermoplastic threads are exposed on the upper contacting surface only. Should the material illustrated in Fig. 1 be used for such a lining, it would tend to stick to the last. In Fig. 2, there is illustrated a fabric woven in such manner that the thermoplastic threads are exposed on one surface only. Since the lining of a shoe is called upon to bear some strain, the threads composing the warp **14** are made of cotton in order to add strength to the finished material. Thermoplastic threads **16**, **18** and **20** composing part of the woof are woven through the warp **14** as illustrated in the drawing. Subsequently, cotton threads **22** and **24**, illustrated in Fig. 2 by broken lines, are woven into the material in such manner as to cover all portions of the thermoplastic threads **16**, **18** and **20** appearing on one surface of the material. The net result of this process of weaving is the production of a fabric upon one surface of which none but thermoplastic threads are exposed and on the other surface none but cotton threads. When this fabric is used as a lining, the cotton thread surface is placed next to the last to prevent the stiffened shoe from sticking thereto.

Irrespective of which type of lining member is used, the procedure of stiffening a shoe remains the same. The lining member is assembled in an upper which is pulled over a last **26**. After the lasting operations have been completed, selected portions of the lining member such as those underlying the toe and counter portions of the upper are heated, preferably from within the shoe, by any suitable means thereby causing the thermoplastic threads to coalesce. Such heating may conveniently be carried out through the use of a shoe heating device similar to that disclosed in Letters Patent of the United States No. 1,390,998, granted September 20, 1921, upon an application filed in the name of Thomas Lund. Metallic plates **28** and **30** are located on the last **26** and secured thereto by any suitable means. The plates **28** and **30** are shown in Fig. 3 as being arranged to underlie the toe and counter portions of the last. It will be understood, however, that such plates may be attached to any portion of the last as, for example, along the shank portion in such position as to underlie the lasting margin of the upper. These plates form short-circuited conductors which when placed in a varying magnetic field, as disclosed in the above-mentioned patent, become the secondaries of a transformer in which a current is induced, such induced current operating to heat the plates. It should be noted that the heat is applied to the interior of the shoe and that the stiffening material is between the heated plate and the upper. In such case, the amount of heat applied may be much greater than as if the heat were applied directly to the upper. If the upper is of leather, the leather should be dry when the heating is carried out since dry leather, by which is meant ordinary upper leather the moisture content of which is due only to the humidity of the atmosphere and varies somewhat at different seasons of the year, will stand without injury a greater amount of heat than wet leather. In the use of the last **26** shown in Fig. 3, an upper **32** with which has been assembled a lining member **34** composed of fabric, such as that illustrated in Fig. 1 or Fig. 2, is lasted in the usual manner. The last is then placed in a varying magnetic field produced by an apparatus similar to that disclosed in the patent above referred to thereby to heat the plates **28** and **30**. When sufficient heat has been applied by this method, the thermoplastic threads **12** (or **16**, **18** and **20**) coalesce and become freely flowable. Thus, the thermoplastic material of the portions of the lining member **34** thus treated will flow to a slight extent and form roughly homogeneous films which conform exactly to the shape of the last. When these films are allowed to cool to room temperature, the thermoplastic material solidifies and stiffens those portions of the shoe.

The above-described stiffening process produces a graduated stiffening effect, as is shown schematically in Fig. 4, in which the forepart and rear part of the upper **32** have been broken away to expose the lining member **34**. The portion of the lining member **34** overlying the toe plate **28** and bounded at the rear by the dotted line **36** is caused to coalesce completely by the application of heat from the plate. However, it will be understood that there can be no sharp temperature gradient at the line **36** and therefore that the threads of the lining member to the rear of that line will be caused to coalesce

to some extent, the extent to which they coalesce being proportional to their distance from the heated toe plate 28 and the amount of heat used. An entirely similar result is produced at the rear part of the shoe, as indicated in Fig. 4. In view of the above, it is obviously impossible to produce a sharply defined boundary between the stiffened and unstiffened portions of the shoe. The above-described graduated stiffening effect which may be varied by varying the temperature of the plates is produced in the same manner at all boundaries between the treated and untreated portions of the lining member 34. Thus, when a shoe, which has been stiffened according to the method of the invention, is flexed in wearing, there is no sharp boundary or edge to discomfort the foot of the wearer. It will also be clear that, since the plates 28 and 30 are fitted to the particular last and are permanently affixed thereto, the stiffened areas are always properly positioned in relation to the other elements of the shoe whereas, in the case of individual toe and counter stiffeners which are inserted in the shoe, improper positioning may well result.

Although the invention has been described above by way of example as one in which the stiffening substance is thermoplastic and the coalescing agent is heat, stiffening substances which are not thermoplastic or not sufficiently so at temperatures which are not injurious to the other materials of the shoe have been used and caused to coalesce by the use of a volatile solvent. In such case, a lining member is provided containing threads which may be caused to coalesce and become cementitious. Threads of cellulose acetate, such as are used in the fabric known as "Celanese" have been successfully employed. This material is then caused to coalesce and become cementitious through the use of a suitable solvent, such, for example, as acetone. Preferably, such lining member is incorporated in the assembled upper of a shoe after which the shoe is lasted. Thereafter, the solvent is applied to selected portions of the lining member to cause them to coalesce and become cementitious. In cases in which the material of the upper is such that a suitable solvent will not stain it, such solvent may, for example, be applied by a brush to the outer surface of the upper, whereupon it will penetrate the upper and coalesce the threads of the lining member, the stiffening effect then following upon evaporation of the solvent. In other cases, it may be advisable to apply the solvent just prior to the lasting operation.

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

1. The method of shoemaking which includes providing a lining member containing throughout its whole extent flexible threads which may be caused to coalesce and become cementitious, incorporating said lining member in the assembled upper of a shoe, lasting the shoe, and thereafter causing the threads in selected localities of said lining member first to coalesce and then to harden and thus stiffen said localities.

2. The method of shoemaking which includes providing a lining member of fabric containing fusible threads throughout its whole extent, incorporating said lining member in the assembled upper of a shoe, lasting the shoe, and thereafter heating selected portions of said lining member to fuse said threads into a film which, upon cooling, stiffens the selected portions, the heat being applied in such manner as to produce graduated stiffness in margins of the stiffened portions.

3. The method of shoemaking which includes providing a one-ply lining member having on its upper-contacting surface only flexible threads which may be caused to coalesce, incorporating said lining member in the assembled upper of a shoe, lasting the shoe, and thereafter causing the threads in selected localities of said lining member first to coalesce and then to harden and thus stiffen the localities.

4. The method of shoemaking which includes providing a lining member containing flexible threads of a resinous material plasticized with a solid plasticizer, incorporating said lining member in the assembled upper of a shoe, lasting the shoe, and thereafter causing the threads of said lining member to coalesce in selected localities and then to harden and thus stiffen said localities.

5. The method of shoemaking which includes providing a lining member containing throughout its whole extent flexible threads which may be caused to coalesce and become cementitious, incorporating said lining member in the assembled upper of a shoe, lasting the shoe, applying heat to the inside of the shoe in selected localities to fuse said threads, and thereafter allowing said threads to cool and stiffen said localities.

6. The method of shoemaking which includes providing a lining member of fabric containing fusible threads throughout its whole extent, incorporating said lining member in the upper of a shoe, lasting the shoe upon a last having a metallic plate an edge of which extends across an upper portion of the last, heating the plate to fuse the fusible threads, and then allowing the heated portion of the lining member to cool, whereby the selected portion of the lining member which overlaid the plate is uniformly stiffened and another portion of the lining member which was adjacent to the edge of but did not overlie the plate has a graduated stiffness.

ALEXIS E. USHAKOFF.