Aug. 22, 1933. R. C. SIMMONS 1,923,168

METHOD OF MAKING WOVEN FABRICS

Filed Feb. 5, 1931

Fig.1.

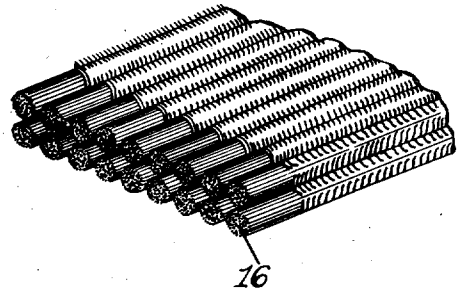
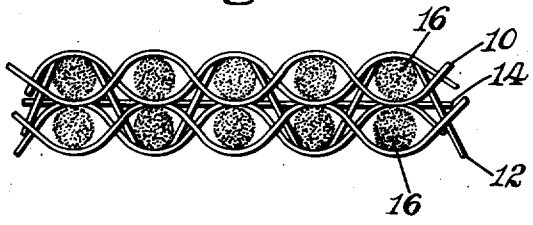


Fig.2.



INVENTOR
Ralph C. Simmons
By his attorney
Victor Cobb

Patented Aug. 22, 1933 1,923,168

UNITED STATES PATENT OFFICE

1,923,168

METHOD OF MAKING WOVEN FABRICS

Ralph C. Simmons, Beverly, Mass., assignor to United Shoe Machinery Corporation, Paterson, N. J., a Corporation of New Jersey

Application February 5, 1931. Serial No. 513,628

8 Claims. (Cl. 28—1)

This invention relates to methods of making woven fabrics.

For certain purposes a woven fabric which is limp and flexible in one direction and relatively stiff and inflexible at right angles to that direction is desirable. Objects of this invention are to provide methods of making a woven fabric having these characteristics. A woven fabric having the above-mentioned characteristics is adapted for various purposes and is particularly advantageous for incorporation into soles and insoles for boots and shoes for the purpose of providing in the shoes longitudinal flexibility and lateral rigidity.

The illustrated woven fabric has strands extending in one direction which are impregnated with a stiffening material such as hard rubber and strands extending at right angles to the first strands which are untreated with the stiffening material and hence are relatively flexible. It is to be understood, of course, that the strands of treated yarn may constitute either the warp or the filling of the fabric.

The method of the present invention by which the above-mentioned woven fabric may be produced consists in treating yarn which is to constitute the warp or filling of the fabric by subjecting it to the action of an impregnating bath containing a stiffening agent and then weaving the fabric, employing for the filling or warp, respectively, untreated yarn. Preferably the stiffening agent employed is capable of being rendered active, that is hard and insoluble after the fabric is woven by suitable treatment, for example by subjecting it to a moderately high temperature.

It has been found that a closed and better fabric is produced when the treated yarn is employed as the filling. It is desirable, therefore, to select as the stiffening agent material which, when the yarn is impregnated therewith and dried, will be inactive, that is will not impart thereto such stiffness as to interfere with the manipulation of the yarn in weaving so that the yarn can be readily handled in the bobbin of a shuttle, the fabric, after it is woven, being subjected to a treatment such as heat treatment to activate the stiffening material, that is to harden the material with which the filling is impregnated, thereby producing a fabric which is stiff in one drection and limp in the other. It is also desirable that the material with which the filling is impregnated be water resistant or be rendered so by treatment of the fabric after weaving. Various fibers may be employed for the yarn of the fabric, satisfactory results having been obtained by the use of cotton yarn as the warp and jute yarn as the filling.

Various materials may be employed for imparting stiffness to the filling yarn such as certain colloids, proteids, gums and resins. For example, a solution of hard rubber in the form of a varnish has given satisfactory results. Synthetic gums or resins are also suitable since they can be readily obtained in soluble form suitable for use in impregnating the yarn and can be rendered hard and insoluble by heat treatment at a temperature which will not be injurious to the fiber of the fabric. The synthetic gum or resin known as "Bakelite" has been found satisfactory. Thus jute yarn may be impregnated with a varnish or solution of the character referred to, allowed to dry and utilized as the filling of the fabric woven. Yarn so treated is quite flexible enough for use in the shuttle, and by treating the fabric so woven with heat the varnish may be hardened and rendered insoluble.

The fabric so produced has, of course, a flexible warp and a relatively inflexible filling and is hence limp and flexible in one direction and relatively stiff and inflexible in a direction at right angles to that direction. In using this material in the manufacture of soles, it is desirable to cut the soles or parts thereof with the stiffened yarn or filling strands extending laterally, that is from side to side, of the sole, so that the sole will be flexible in the direction in which it is bent in use and relatively inflexible as to flexure about an axle extending lengthwise of the sole.

While a textile fabric having a single ply is preferable for some uses, it is preferable under other conditions to employ a textile fabric of two or more plies. Accordingly, as illustrated, a fabric having two plies is shown.

In the drawing,

Fig. 1 represents a woven fabric made in accordance with the present invention, and

Fig. 2 is an enlarged sectional view of the fabric shown in Fig. 1.

The woven fabric provided by the present invention, which is stiff in one direction and limp in the other, consists, as shown in Fig. 1 of the drawing, of limp warp threads 10, 12 and 14 which are preferably of soft, short fiber, cotton yarn and transverse or filling threads 16 which are preferably of coarse, relatively stiff, long fiber material such as jute and are treated by

impregnation with a stiffening material to increase their rigidity.

The method of manufacture, as herein exemplified, consists in treating the yarn which is to extend transversely of the fabric, that is the filling, with a stiffening material, allowing it to dry, and then weaving the fabric, employing the treated yarn as the filling and using a warp of untreated yarn. As shown, the fabric is two-ply; that is, the filling threads 16 are in two layers one superposed upon the other and the filling threads of each layer are bound together by the interlacing of the warp threads around them. Some of the warp threads, such as 12 (Fig. 1), are interlaced with the filling threads 16 of both layers to bind them together and others of the warp threads, such as 14, lie between the layers to maintain a distinction between the two layers or plies of the fabric.

After the weaving the fabric is treated to activate the stiffening material by rendering the material with which the filling threads have been impregnated hard and insoluble. Various materials have been employed for treating the yarn. A colloid such as glue has been employed satisfactorily under certain conditions. When the glue dries upon the yarn fiber it stiffens it immediately and hence, if glue is used for stiffening the filling, the fabric is best woven by hand or in a hair-cloth loom. However, the fabric may readily be woven in an ordinary loom by using the glue-stiffened strands as the warp. Furthermore, if a water-soluble colloid such as glue is employed, it is desirable to render the glue insoluble by treatment with a bichromate or with formaldehyde, which may be done either before or after the fabric is woven.

Many synthetic gums or resins have been produced which are initially soluble, are flexible when dried on the yarn, and which, in the dried condition, can be rendered hard and insoluble by heat treatment for a short time at a temperature not injurious to the fabric.

The synthetic resin known as "Glyptal", which is a condensation product of glycerine and phthalic anhydride, may also be used. It, however, requires a longer heat treatment than the products known as "Durite" and "Bakelite", which are phenol condensation products, "Durite" being a condensation product of phenol and furfural (an aldehyde), and "Bakelite" being a condensation production of phenol and formaldehyde. The synthetic resins known as "Condensite" and "Redmanol" are similar to "Bakelite", each being a condensation product of phenol with a higher aldehyde. "Bakelite", which is readily obtainable in soluble form as "Bakelite" varnish, has been found satisfactory. Another highly satisfactory varnish for this purpose is a hard rubber solution made in accordance with United States Letters Patent No. 1,745,533, granted February 3, 1930, on application of Gibbons and Binmose. Preferably, therefore, the jute yarn which is to constitute the transverse strands of the insole material is treated in any suitable manner with a varnish of one of the kinds mentioned to impregnate the yarn. The yarn so impregnated with inactive stiffening material is still quite flexible when dry and can be handled in the shuttle of a loom of usual construction, for example a ribbon loom by which strips of the required width are produced. In this weaving of the fabric, limp untreated yarn will, of course, be employed for the warp, soft cotton yarn being preferred. After the fabric is woven it is subjected to heat treatment to activate the stiffening material at a temperature preferably above the boiling point of water, but not high enough to injure the fiber of the fabric, that is preferably under 300° F., for a sufficient length of time to cause the varnish to become hard and insoluble. The time required will vary with the temperature and other conditions; for example, if a small piece of the fabric is treated at a temperature of 250° F. for one half hour, the desired result will be obtained, and if the fabric is in a roll of substantial size, several hours may be required for the heat to penetrate the roll and affect all parts thereof.

The fabric produced by the method described and illustrated may be used for any purpose where stiffness in one direction and flexibility in the other direction are desirable, and is of special utility when employed for an insole or part of an insole or outsole where lateral stiffness and longitudinal flexibility are desirable.

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

1. That improvement in methods of making woven fabric for shoe soles which consists in treating a warp or filling yarn with a solution of synthetic resin which will dry on the yarn without substantially stiffening it, said resin serving as an inactive artificial stiffening agent, providing a filling or warp of yarn untreated with said stiffening agent, weaving the warp and filling to form a woven fabric and heating the fabric to activate the stiffening agent and render the treated yarn hard and stiff.

2. That improvement in methods of making woven fabrics for shoe soles which consists in treating a warp or filling yarn with a phenolic condensation product as an inactive initially flexible stiffening agent, providing a filling or warp of cotton yarn in its natural condition, weaving said warp and filling together to form a fabric and heating the fabric to activate the stiffening agent and render the treated yarn hard and stiff.

3. That improvement in methods of making woven fabrics which consists in treating filling yarn with stiffening material which is initially flexible, providing a warp of yarn untreated with said stiffening material, weaving the filling material and the warp, and then subjecting the fabric to treatment to render the stiffening material stiff.

4. That improvement in methods of making woven fabrics which consists in preparing filling material by treating it with a hard rubber solution which is initially soft and flexible, providing a warp of yarn untreated with said gum, weaving the fabric, and then subjecting the fabric to heat treatment to render the rubber hard and stiff.

5. That improvement in methods of making woven fabrics for shoe soles which consists in treating filling yarn with a phenolic condensation product which is initially soft and flexible, providing a warp of yarn untreated with said stiffening material, weaving the filling material and the warp, and then subjecting the fabric to heat treatment to render the stiffening material hard and stiff.

6. That improvement in methods of making woven fabric for shoe soles which consists in preparing filling material by impregnating it

with phenolic condensation product, providing a warp of yarn containing no phenolic condensation product, weaving the fabric, and then subjecting the fabric to heat treatment to render the phenolic condensation product hard and stiff.

7. That improvement in methods of making woven fabrics for shoe soles which consists in treating a warp or filling yarn with a solution of hard rubber, as an inactive stiffening agent, providing a filling or warp of cotton yarn in its natural condition, weaving the warp and filling together to form a fabric, and heating the fabric to activate the stiffening agent thus rendering the treated yarn hard and stiff without affecting the cotton yarn.

8. That improvement in methods of making woven fabrics for shoe soles which consists in impregnating a warp or filling with a phenolic condensation product as an inactive stiffening agent, providing a filling or warp of cotton yarn in its natural condition, weaving said warp and filling together to form a fabric, and heating the fabric to activate the stiffening agent thus rendering the fabric stiff as to bending in one direction and leaving it limp as to bending in another direction.

RALPH C. SIMMONS.