April 12, 1938. J. T. CALLAHAN 2,113,718

COMPOSITE FABRIC

Filed Feb. 29, 1936

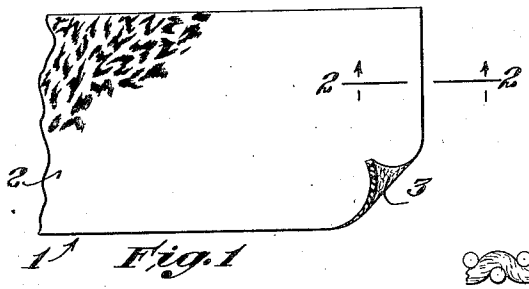



Fig. 1

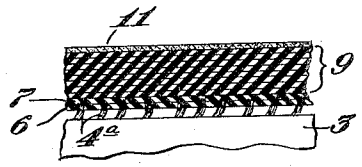



Fig. 2




Fig. 3

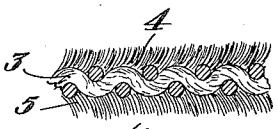



Fig. 4




Fig. 5




Fig. 6

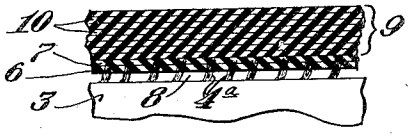



Fig. 7

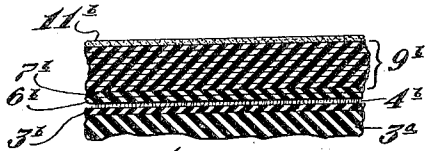



Fig. 8




Fig. 9

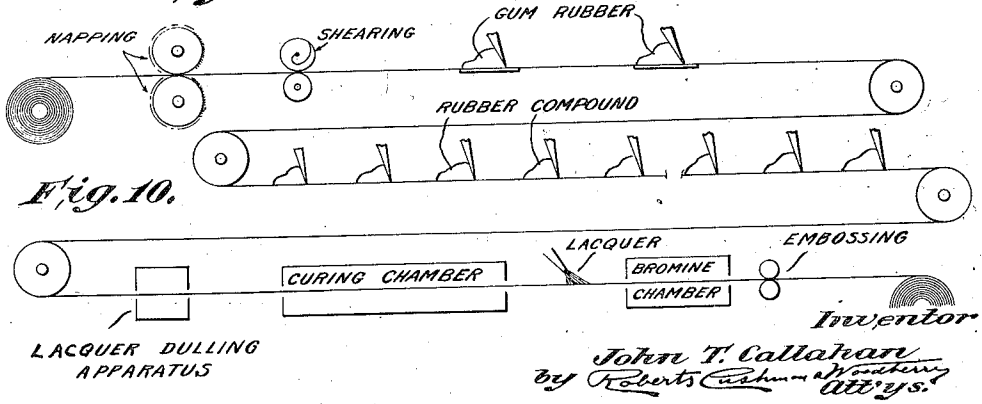



Fig. 10.

Inventor

John T. Callahan

by Roberts Cushman & Woodbury Atty's.

Patented Apr. 12, 1938 2,113,718

# UNITED STATES PATENT OFFICE

2,113,718

## COMPOSITE FABRIC

John T. Callahan, Waban, Mass., assignor to Archer Rubber Company, Milford, Mass., a corporation of Massachusetts

Application February 29, 1936, Serial No. 66,383

6 Claims. (Cl. 91—68)

This invention pertains to composite fabrics and to a method of making the same and relates more particularly to a fabric designed to simulate leather and useful, for example, in the manufacture of garments, and which is light in weight and substantially wind and waterproof.

While soft dressed natural leather has from time immemorial been used in the manufacture of garments and in many respects is ideal for the purpose, its cost and weight, as compared with modern textile materials of similar thickness, often more than offsets its characteristically good qualities such, for example, as its impermeability to wind, its softness to the touch, its pleasing appearance, etc. so that except for a relatively few special uses it is not commonly employed for garment manufacture.

On the other hand, ordinary textile fabrics of sufficient flexibility for acceptable use in garments are seldom, if ever, really windproof, nor, except in relatively expensive and special weaves or finishes, are they greatly resistant to penetration by water, while ordinary rubber or rubberized fabrics are objectionable for many purposes by reason of their stiffness, rattle, coldness to the touch and unesthetic appearance.

The principal object of the present invention is to provide a fabric having the desirable qualities of soft dressed leather, to wit, its impermeability to wind, its characteristic drape, its pleasing and artistic appearance, its softness, smoothness and warmth to the touch, and, together therewith, lightness of weight, great flexibility, durability and low cost of production.

These and other objects and advantages of the invention will be pointed out at greater length in the following detailed description wherein reference is made to the accompanying drawing, in which

Fig. 1 is a plan view partly in perspective illustrating a piece of the improved fabric made in accordance with the present invention;

Fig. 2 is a fragmentary section to very greatly enlarged scale substantially on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary section illustrating textile fabric of a kind which may be employed in the preparation of the improved material of the present invention;

Fig. 4 is a view similar to Fig. 3 illustrating the results of the early steps of the process;

Fig. 5 is a view similar to Fig. 4 but diagrammatically illustrating the result of the next step of the process;

Fig. 6 is a fragmentary section to greatly enlarged scale, showing the material after the first two coats of rubber have been applied;

Fig. 7 is a view similar to Fig. 6, but showing the result of the following step of the process;

Fig. 8 is a view similar to Fig. 2, but illustrating a fabric of modified construction;

Fig. 9 is a section similar to Fig. 3, but illustrating a true pile fabric useful in the practice of the invention in accordance with one embodiment thereof; and

Fig. 10 is a diagrammatic elevation illustrating the improved method.

Referring to the drawing, the numeral 1 designates the improved fabric, such fabric having the outer face 2 which is preferably finished to resemble leather and the inner face 3 which in a preferred construction has a soft napped surface. The outer surface 2, when the fabric is made in accordance with the preferred process, is not perfectly smooth or glossy but has a dull or flat finish and is more or less undulatory in character, having irregular elevations and depressions which differentially reflect the light, resembling to some extent the leather finish known as "pigskin", or perhaps more closely simulating the finish known as "rhinoceros", but is very flexible and light in weight, in these respects resembling the finer leathers such as kid.

In preparing this material it is desirable to use a textile fabric as the body or foundation fabric, such fabric being made in accordance with any of the usual textile processes but preferably, for convenience, being a woven fabric such, for example, as sheeting. For the best practice of the process, particularly where it is desired that the inner surface of the completed fabric have a soft nap finish, it is essential that the fabric be of a firm close texture capable of being napped on both sides, and desirably woven from a good quality of yarn, the weight known as "2 yard sheeting" being desirable for the purpose, although it is to be understood that other materials than sheeting may be employed. This body fabric may be of any desired color, but if the material is to simulate leather, it is preferred to have the material dyed to a shade approximating that of the finished leather substitute.

Having selected the proper material, it is then napped upon both sides by means of any suitable napping means, as indicated at 4 and 5 respectively (Fig. 4), so as to provide a thick, soft and substantially uniform nap of substantial length. It is to be understood, however, that if the inside of the material is to have a finish of a different

character, the inside need not be napped at this stage of the process.

Having completed the napping operation, that surface of the fabric which is to be finished to resemble leather is sheared so as to cut off the nap at that side, leaving short projecting fibers 4a (Fig. 5) preferably of the order of one millimeter in length. However, the permissive length of the fibers may vary in accordance with their size and the character of the material, the desirable characteristic of such short fibers being that they are rather stiffly resilient, so as to resist matting and collectively to provide a cushion-like layer. While "shearing" is herein referred to as the process by which the nap is thus reduced in length, it is to be understood that any equivalent method may be employed and is to be regarded as within the scope of the invention. After the nap has thus been sheared so that the remaining portions of the nap fibers are short, as above suggested, and if the napping operation has been properly carried out so as to provide a thick nap, a large percentage, at least, of the resultant short fibers are found to stand more or less perpendicular to or at least make a substantial angle with the plane of the body material, thus giving the effect of a pile or velvet surface. Hereinafter for convenience this sheared surface may be referred to as a "pile surface", for although the projecting fibers are not technically "pile" fibers, they nevertheless have somewhat the general characteristics of a true pile surface. In this connection it is to be understood that if desired this pile-like surface upon one side of the fabric may be obtained by the employment of a true pile fabric in place of the napped fabric, although the napped fabric is usually preferable by reason of its lesser cost and greater flexibility of the body material.

Having thus prepared the body fabric with its pile surface, a thin film 6, preferably of pure gum rubber or material of equivalent physical properties, is then spread upon the pile surface by means of a suitable spreader device or equivalent appliance. In thus spreading the rubber film, care should be exercised that it is not subjected to sufficient pressure to impregnate the entire pile layer or in particular to cause the film to adhere directly to the surface of the body material. On the other hand, when the spreading is properly conducted, the film 6 embeds the outer end portions of the fibers 4a but leaves their intermediate or lower portions uncoated so that they may flex readily. Thus, in a sense, the rubber film floats upon the pile fibers, being free from actual union with the body fabric except through the intervention of the pile fibers. Theoretically at least there will be a space 8 between the inner surface of the film 6 and the outer surface of the body material 3, although this space may be of irregular thickness and at some points quite minute.

After the film 6 has thus been applied, one or more similar films 7 may be spread and caused to adhere to the outer surface of the film 6, the film 7 embedding any projecting ends of the fibers 4a which are not wholly embedded in the film 6.

Having prepared this multi-ply layer of pure gum rubber, another multi-ply layer 9, preferably of high gravity rubber compound containing a vulcanizing agent, is then caused to adhere to the outer surface of the gum rubber layer. This layer 9 may comprise from one to ten, for example, successively applied films of rubber compound (preferably comprising an accelerator to hasten vulcanization) such films being applied by means of a spreader or equivalent device in the same way as the pure gum films 6 and 7. The total number of films of rubber or rubber compound thus applied to the pile surface may, for example, be such that in the completed fabric there will be approximately three ounces of rubber per square yard of fabric. However, while this thickness of coating is desirable, it is contemplated that the coating may be thicker or thinner in accordance with the purposes to which the fabric is to be put.

Having deposited the several films of rubber or rubber compound as above described, the fabric may then be subjected to a curing operation in accordance with any usual and desirable method whereby the rubber compound is vulcanized. It is to be noted that the gum rubber layers 6 and 7 need not contain any vulcanizing agent when applied to the pile surface. These gum rubber layers are apparently an important factor in the production of the improved fabric, and in some way, not fully understood, appear to contribute to its peculiar characteristics. When the fabric is fully cured it would seem from careful examination that these inner films have, to some extent, been affected by the vulcanizing agents in the rubber compound layers, since they do not exhibit all of the usual characteristics of uncured gum rubber after the curing operation. If desired, a very small amount of sulphur may be added to the gum rubber layers.

Preferably after curing (although before curing, if desired) a coat 11 of lacquer is applied to the outer surface of the rubber compound layer. This lacquer may be shellac cut with alcohol and preferably including a suitable drier or any of the special lacquers designed for use with rubber, it being understood that in using the term "lacquer" herein such term is intended to be inclusive of shellac or any other material natural or synthetic having the same general characteristics and which are commonly known to the trade as "lacquers". Having applied this coat of lacquer to the surface of the rubber, the surface of the lacquer coat is preferably first dulled, by chemical or mechanical means, and then, after curing, the lacquer coat is subjected to the action of bromine or some other halogenizing agent which renders the lacquer film tough and durable. Preferably, as a final step, the material may be subjected to a crumpling process, or its equivalent, for example by passing between embossing rolls, press plates, or the like, designed to enhance the natural uneven character of the surface, or to impart a definite grain as is the common practice in leather finishing.

In Fig. 10, the several steps are shown as embodied in a continuous process, but obviously, the several essential steps may be carried out with any desired intervening intervals, or supplementary operations between them.

By following the method above set forth it is found that the exposed outer surface of the coating material is soft and has a leather-like feel, being slightly uneven or undular and minutely pitted as is the grain surface of natural leather. While it is not understood with any degree of certainty why this surface appearance results from the above method, it is surmised that it may in part at least be due to the fact that the coating layers, first of gum rubber and then of rubber compound, are spread upon a cushion-like surface formed by the short, resilient upstanding pile fibers 4a, and that in thus spreading the

material upon this yieldable surface the latter crushes irregularly and in a manner which can not be predetermined, thus causing the superposed coating layers to follow an irregular contour.

In Fig. 8 a modification is illustrated wherein, instead of using a textile fabric as the base or body material, a sheet $3^a$ of rubber is employed. Upon one surface of this sheet of rubber there is deposited a thin layer $3^b$ of an adhesive, for example, latex rubber, which serves to anchor a layer $4^b$ of flock to the body fabric $3^a$. This flock material may consist of very short cut textile fibers, for example, cotton, silk, wool or the like, having one end of each fiber embedded in the layer $3^b$ and the rest of the fiber projecting outwardly to the surface of the layer $3^b$. These fibers may be of the order of one millimeter in length and to their projecting free ends, which collectively form a pile-like surface, the layers $6^b$ and $7^b$ of gum rubber are anchored, being spread upon the pile layer in the same way as described in the above referred to construction. Thereafter the multi-ply layer $9^b$ of rubber compound is applied to the gum rubber layer $7^b$, and then a coating $11^b$ of lacquer is applied to the outer surface, the material being cured and subjected to bromine treatment the same as previously described. This mode of procedure provides a fabric devoid of any textile inclusion (except the flock layer) and may be useful where a very thin and light fabric characteristically rubber in its nature is desired, but having an outer surface very closely resembling leather in its appearance, texture and feel.

Again, as above suggested, the base material may, if desired, be a true pile fabric produced in accordance with usual and known methods of weaving. Such a pile fabric is illustrated in Fig. 9, wherein the base fabric is indicated at $3^x$ and the special pile-forming yarns are indicated at $4^x$. It will be understood that when employing this material as the body fabric, the process will be carried out in the same way as described with respect to Figs. 6, 7 and 2 above referred to. Doubtless other modifications of the invention will occur to those skilled in the art and all such modifications falling within the purview of the appended claims are to be regarded as within the scope of the invention.

While as above suggested the layer of pure gum rubber which is first applied to the pile fibers appears to be of importance in attaining the desired results, it is contemplated that reasonably useful results may be secured by the use of an equivalent element, for example one of the tenaciously adhesive isomers of rubber such as results from the treatment of rubber with a sulphonic acid in the presence of heat, or that under some conditions the gum rubber layer or its equivalent may be dispensed with without sacrifice of all of the beneficial results of the invention.

I claim:

1. A composite flexible fabric including a close woven body material provided on one face at least with projecting fibers of the order of one millimeter in length collectively constituting a pile-like surface, a layer of pure gum rubber in which the free ends of the pile-forming fibers are embedded, said projecting fibers normally holding said layer of gum rubber in spaced relation to the body of said fabric, a layer of vulcanized rubber compound adhering to the gum rubber layer, and a coating of halogenized natural resinous material covering the exposed surface of the rubber compound layer.

2. That method of making composite fabric which comprises as steps providing a textile material having short projecting fibers on one face at least imparting thereto a pile-like surface, so applying to said surface a layer of pure gum rubber that the free end portions of the fibers are embedded in the rubber and the entire gum rubber layer is normally held in spaced relation to the body of said textile material, applying to the gum layer a layer of rubber compound including an accelerator, curing the rubber, applying a coat of lacquer consisting essentially of a natural resinous material to the outer surface of the rubber, and subjecting the lacquer to the fumes of bromine.

3. That method of making composite fabric which comprises as steps providing a woven textile material having short projecting fibers on one face at least imparting thereto a pile-like surface, so applying to said surface a thin coating of pure gum rubber that the free end portions only of the fibers are embedded in the rubber and the entire gum rubber layer is normally held in spaced relation to the body of said textile material, spreading one or more additional coats of pure gum upon the first, successively spreading a plurality of thin coats of rubber compound, including an accelerator, upon the last gum coat, curing the material, applying an outer coating of flat lacquer consisting essentially of a natural resinous material, and subjecting the lacquer to the action of bromine vapor.

4. That method of making composite fabric which comprises as steps providing a textile material having short projecting pile-like fibers on one face at least, applying a layer of pure gum rubber to the projecting fibers in such a way that the free ends of the fibers are embedded in the rubber and the entire gum rubber layer is normally held in spaced relation to the body of said textile material, applying to the outer face of the gum rubber layer a layer of high gravity rubber compound containing an accelerator, applying to the outer face of the rubber compound layer a coating of shellac, curing the rubber, and subjecting the shellac surface to bromine vapor.

5. That method of making lacquer-like, flexible, waterproof material of light weight suitable for garment manufacture which comprises as steps providing heavy sheeting having projecting fibers upon both sides, the projecting fibers upon one side of the sheet at least being of an average length of approximately one millimeter and collectively forming a pile-like surface, spreading one or more film-like layers of pure gum rubber upon said pile-like surface, thereafter spreading a film-like layer of rubber compound containing an accelerator upon the outermost gum layer, continuing to spread additional layers of rubber compound until a total of approximately three ounces of rubber per square yard have been applied to the pile surface, curing the rubber, applying an outer coating of lacquer thereto, and subjecting the lacquered surface to bromine fumes.

6. That method of making composite fabric suitable for use in the manufacture of garments which comprises as steps providing a close woven textile fabric having projecting fibers upon both sides, the projecting fibers upon one side at least being of the order of one millimeter in

length and collectively forming a pile-like surface, spreading a film-like layer of pure gum rubber upon the pile-like surface in such a way that the film embeds the outer end portions only of the nap fibers while remaining otherwise free from the body material, thereafter applying one or more successive film-like coatings of rubber compound to the gum rubber layer, applying a coating of lacquer to the outermost layer of rubber compound, curing the material and subjecting the lacquered surface to the action of bromine fumes.

JOHN T. CALLAHAN.