UNITED STATES PATENT OFFICE.

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MATERIAL USED IN THE MANUFACTURE OF ARTICLES OF CLOTHING.

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To all whom it may concern:

Be it known that we, RAYMOND B. PRICE and THEODORE WHITTELSEY, both citizens of the United States, and residents, respectively, of the city of New York, county and State of New York, and Upper Montclair, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Materials Used in the Manufacture of Articles of Clothing, of which the following is a full, clear, and exact description.

This invention relates to articles of clothing and more particularly to materials to be used in the manufacture thereof. The object of the invention is to provide a material which will be transpiratory or vapor conducting, impervious to dust, water-repellent, and of sufficient body and pliability to be easily shaped and to withstand flexing without deleterious effects. Materials having these properties are well adapted for many articles of wearing apparel, as for instance rain coats, leggings, caps, foot-wear, and the like.

It is manifestly important that such articles as are illustrated by the above examples be impervious to dust, water-repellent, and of sufficient body and pliability to serve their intended purposes. Materials are known and have been used for such articles having these characteristics, but such materials have always possessed other characteristics which have made their use objectionable in one or more respects. Never before this invention, as far as we are aware, has a material been discovered having these desirable properties together with the all-important property of being transpiratory or vapor conducting or transmitting the perspiration of the body from the intervening garments through the material to the exterior thereof, thereby preventing any excessive quantity accumulating.

Whenever a material has had this transpiring property it has been at a sacrifice of some other desired properties which the material that is the subject of this invention possesses. For instance the generally known fabrics have the desired property of conducting vapor or being transpiratory to a very large degree, but they have not the property of being impervious to dust, or water-repellent; rubber has all the desired properties above considered with the exception of being vapor conducting and so with other substances each lacks one or more of the desired attributes necessary to properly adapt it for such purposes of wearing apparel as illustrated by the above examples.

We have discovered that the discomforture which one experiences when wearing garments made of certain materials, such for instance as rubber rain coats, boots, etc., is not that they are productive of heat but rather that they do not permit evaporation of the perspiration from the surface of the body, or from the wearing apparel adjacent thereto, and that there is therefore not the cooling effect that would otherwise take place.

It is the object of this invention to provide a material that will have sufficient transpiratory properties in conjunction with the other properties desirable to suitably adapt it for use in the manufacture of wearing apparel.

We have accomplished the desired results by providing a material which has all the required properties with the exception that it is insufficiently strain-resisting for use for any of the desired purposes, and to provide for this deficiency we have combined therewith a suitable strain-resisting material, having no properties which will unfit it for such combination, that is to say no undesirable properties which will offset the desired properties possessed by the material. The strength giving material is preferably a fabric and may if desired be the fabric constituting the article of wearing apparel or it may be used in conjunction therewith when desired.

The material we use is elastic so that it will not detract from the pliability of the supporting material. It moreover gives to the supporting material the required body, and is non-porous, or homogeneous in its structure, whereby it is rendered dust and water-resisting. It possesses the property of absorbing moisture from the interior of the garment and transmitting it to the opposite side due to the difference in vapor pressure between the interior and exterior of the garment when it is worn upon the body. It

will, however, oppose the ingress of any moisture from the exterior to the interior of the garment.

We have found that certain materials of a gelatinous nature, commonly known as colloids, when properly treated and combined with fabric or other suitable strain-resisting material as for instance certain grades of leather will produce the desired results. These substances are permeable by water vapor by imbibition or absorption. The materials we make use of are made for the greater part of soluble colloids or blends thereof with or without suitable inert filling material which are suitably applied to the fabric or other strengthening layer and later set or rendered insoluble in water by suitable chemical action. Among the materials we have used are animal colloids such as fish or other animal glues, and gelatin, and vegetable colloids, or gums such as gum arabic, gum tragacanth, Irish or Iceland moss, agar-agar, and the like, to which is added a suitable swelling material such as glycerin, glucose, molasses, and the like, and water when desired.

In carrying out our invention the material is usually applied directly on the fabric. This may be accomplished in any desired manner for instance a solution of the colloid and glycerin may be spread on the surface or impregnated in the fabric. In some cases an insoluble colloidal material may be used which may be applied to the fabric by heat and pressure. After the material has been applied it is allowed to cool or dry as the case may be which firmly fixes it to the fabric. The sheets thus formed may then be plied up as desired and the plastic material finally brought to the stage of setting or rendering it insoluble in water to give it the desirable qualities of moisture transpiration and insolubility.

In carrying out our invention, the colloidal sheet is preferably prepared from a soft blend such as gelatin swollen with glycerin in the proportions of approximately 100 parts by weight of gelatin and 200 parts of glycerin. This is proofed, calendered or otherwise applied to a sheet of fibrous or fabric material such as duck or other suitable material to form a continuous coat thereon, and if desired a second sheet of the strain-resisting material may be employed. The applied coat is then permanently set to firmly fix it with one or both plies of the fabric as the case may be, the setting being preferably accomplished by coating or otherwise applying a solution of formaldehyde or other hardening agent between the plastic and fibrous layers of material or to one of the plies of fibrous material, the strength of the solution determining the hardness and consequently the pliability of the plastic material. The setting may be attained by any other suitable means and in some cases by the action of heat alone.

In connection with the use of a low grade colloidal material a disagreeable odor may arise from the compound but this may be obviated or disguised by treating the compound with a suitable deodorizer, such as methyl benzoate or the like. To prevent putrefaction under severe conditions of service, the compound may be treated with an antiseptic, such as formin or the like. This will kill any bacteria which might exist in the compound. Calcium chlorid or other suitable agents may be added when desirable to insure the hydroscopic properties of the material.

It is essential however, in order to insure the degree of transpiration necessary, that the gelatin and glycerin or other substances used in place of these be blended in suitable proportions. To therefore further characterize the material we use it may be described as a material comprising a fabric or other strain-resisting base associated with a homogeneous non-porous sheet of transpiring material the whole having a transpiring number of over 400. This number denotes the minimum degree of transpiration which the material should possess to make it practical for use as compared to that of leather which is about 1400, that is to say the transpiration properties of the material we use should be at least two-sevenths that of leather. This latter number 1400, has been determined by taking a jar weighing about 250 gms. in which was coiled a fabric wick weighing about 25 gms. and filling it with 175 gms. of water. At the top of the jar was an opening of 17.3 sq. cm. area.

The leather to be tested for its transpiratory properties was placed over this opening and hermetically sealed thereto about its margin. The jar was then weighed and allowed to stand for 24 hours in a temperature of about 20° C. Under these conditions the jar was found to lose about 1400 to 1500 mg. of water, or about 80 mg. per sq. cm. of leather exposed. This loss was caused by the water vapor within the jar passing through the leather to the exterior. To obtain the degree of transpiration for our material the minimum of which is represented by the number 400 when thus calculated, we have found it necessary to use the ingredients forming the material in reasonably definite proportions, for instance when gelatin and glycerin are used they should be in substantially the proportions of one part gelatin to two parts glycerin.

When it is desired to spread the plastic material upon the strain-resisting material it may be advantageous to add sufficient water to reduce the consistency of the plastic material, so that it may be easily spread or

similarly applied. In many cases however, we prefer to combine the ingredients forming the plastic mass without the use of water, thereby forming a blend that may be milled upon milling rolls or otherwise mixed preparatory to its being applied to the strain-resisting material.

In some instances we desire to mill with the plastic material before referred to, a quantity of rubber, rubber compounds and similar materials, and to finally subject the plastic thus formed after it has been applied to the strength giving material to the vulcanizing process. When rubber or similar materials are thus combined with the transpiring plastic it is found that the resulting material has not lost the transpiring property and the addition of the rubber gives to the final product certain advantages which makes its incorporation in some instances desirable. Where vulcanizable plastic is used with the transpiring material it imparts thereto a certain degree of resistance against abrasion so that instead of protecting the plastic material between the plies of strain-resisting material it may be applied directly to the outer surface thereof, thereby forming an outer or wear surface for rain coats, boots and shoes, and the like.

Having thus described our invention, what we claim and desire to have protected by Letters Patent is:

1. An article of clothing comprising two plies of strain-resisting material, and a layer of inherently transpiring material between them.

2. An article of clothing comprising two plies of strain-resisting material, and an inherently transpiring material comprising a colloid and a swelling material between them.

3. An article of clothing comprising two plies of strain-resisting material, and a transpiring material including gelatin, glycerin, and a hardening agent between them.

4. An article of clothing comprising two plies of strain-resisting material, and a transpiring material including a vegetable colloid, glycerin, and a hardening agent between them.

Signed at New York, N. Y., January 14th, 1915.

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