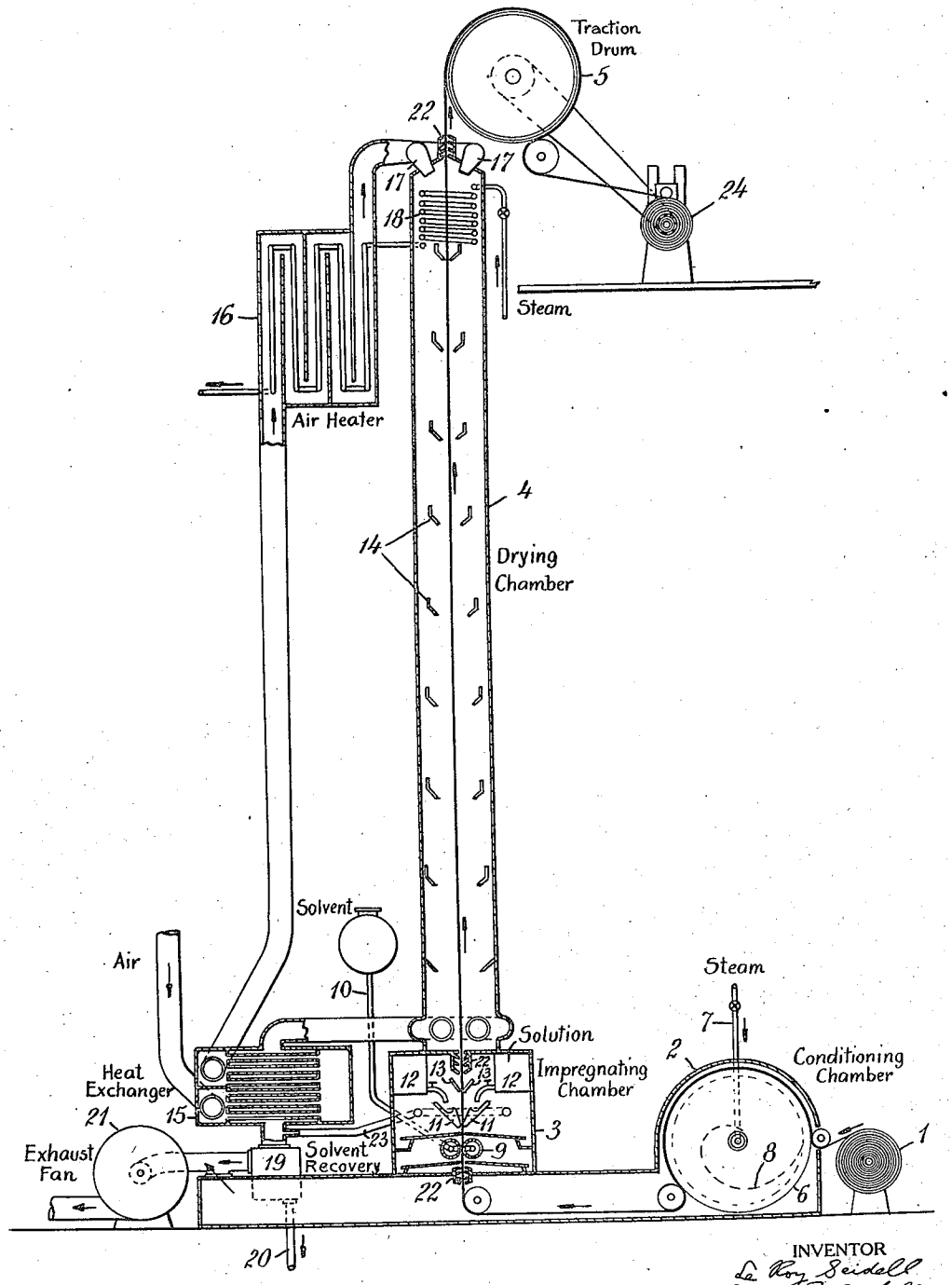
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WATERPROOF FABRIC

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WATERPROOF FABRIC.

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This invention relates to water proof fabrics and involves the provision of improved water proof fabrics having several important advantages and characteristics. The invention includes the new water proof fabric products and the process of making them. One of the objects of the invention is to provide water proof fabrics retaining the identity and the desirable characteristics of the fabric base and having additional desirable properties.

According to the present invention, fabrics are water proofed by impregnation with a thin solution of low viscosity containing an ether-soluble cellulose ester, a latent solvent therefor and a non-drying or semi-drying vegetable oil. The improved water proof fabric of the invention comprises a fabric having the individual fibres thereof impregnated throughout and coated with a thin flexible film of an ether-soluble cellulose ester together with a latent solvent or a non-drying or semi-drying vegetable oil.

The water proof fabric of this invention retains the desirable characteristics of the untreated fabric and has, in addition, several further advantages. The water proof fabric of the invention retains the identity and substantially all of the flexibility of the untreated fabric, and is free from adhering layers separate from the fabric itself which tend to crack or break on flexure. The treated fabric is usually stronger than the same fabric untreated and the protective action of the water proofing material distributed throughout the fabric prolongs the life and preserves the strength of the fabric. The treated fabric will also preserve and protect material deleteriously affected by the air or external moisture and is also adapted to retain, without undesirable effect, materials which act upon or are acted upon by the untreated fabric. The water proof fabric of the invention is comparatively light in weight although water proof and substantially impervious, and is sanitary and can be washed in the ordinary way without detriment.

Cellulose nitrate or cellulose acetate may be employed, either separately or in admixture, in the water proofing composition of the invention in conjunction with a latent solvent therefor such as camphor. Such compositions are flexible without brittleness. Non-drying or semi-drying vegetable oils such as castor oil, rapeseed oil or cocoanut oil may be used raw or blown, that is, partly oxidized. The use of blown oil sometimes causes discoloration and it should be used with care where color is important. Castor oil dissolves readily in solvents such as ethyl alcohol with the production of thin solutions of low viscosity and is particularly advantageous in the prepartion of the water proof fabric of the present invention. Its use also enables the production of a product of excellent and permanent qualities. Methyl, ethyl, amyl or butyl acetates, or acetone, or ether, or various mixtures thereof, for example, may be employed as solvents for the cellulose esters and the latent solvent employed in the practice of the present invention. These solvents may be employed in admixture with alcohols such as methyl ethyl, amyl or butyl alcohol. Solvent naphtha, or benzol, toluol, or xylol may be used as diluents of the cellulose ester solutions.

The water proofing composition of the present invention may comprise, for example, 12 ozs. of cellulose nitrate or cellulose acetate, 8 ozs. of camphor, and about 35 ozs. of raw or blown castor oil, in solution in one gallon of ethyl acetate diluted with approximately an equal volume of ethyl alcohol, or benzol, or a mixture of alcohol and benzol in about equal proportions. A composition of these proportions is particularly adapted for the treatment of canvas and heavy fabrics.

The viscosity of the impregnating solution is regulated in accordance with the character of the fabric, the temperature of impregnation and the volatility of the solvent employed. If the solution is too viscous, a surface coating forms on the fabric which stiffens it and destroys the original properties and the identity of the fabric. If the solution is too thin, the water proofing may be imperfect or discontinuous, although solutions too thin to secure a satisfactory result in a single application may be satisfactory where the impregnation is repeated one or more times. The viscosity of the solution can be decreased by increasing the amount of solvent or diluent employed and vice versa, but the proportion of solvent employed must at all times be sufficient to maintain the water proofing composition in solution.

The fabrics which may be treated in accordance with the present invention include textiles such as canvas, linen, satin, silk and burlap, and rope, cord and twine, and unwoven fabrics such as felt. The term fabric is used herein to include woven, felted or knitted material. As noted above, different fabrics require the use of impregnating solutions of different viscosity for best results. More viscous solutions are used with open mesh fabrics than for close mesh fabrics and very thin solutions are used for the treatment of paper and the like. The increase in weight per unit of area differs with different materials and different thicknesses of the same material but advantageously roughly approximates 20% of the weight of the fabric, or less.

A treatment of a fabric in accordance with the method of the present invention is diagrammatically represented in the accompanying drawing. The fabric from the roll 1 is drawn successively through the conditioning chamber 2, the impregnating chamber 3 and the drying chamber 4 by the traction drum 5. In the conditioning chamber 2 the fabric passes over a hollow drum 6 which is heated by steam supplied through pipe 7, condensed water being removed from the drum by means of the spiral vane 8. Steam under a pressure of from 20 to 30 lbs. per square inch may be employed to maintain the drum at the proper temperature. In the impregnating chamber 3, the fabric first passes between a pair of felt rollers 9, internally supplied with a solvent through connection 10, preferably that used in the impregnating solution, where it is thoroughly impregnated with the solvent. The fabric then passes through a trough formed by the members 11 which are held against the fabric. The impregnating solution is supplied to depressions in the upper surfaces of the members 11 from the tanks 12, and overflows from the puddles formed in these depressions into the lower part of the trough where it thoroughly impregnates the fabric. The "doctors" 13, which may be of glass are adjusted to remove excess solution from the fabric. The temperature of the impregnating bath is preferably maintained at about 80° to 100° F. Leaving the impregnating chamber 3, the impregnated fabric passes through the drying chamber 4 where it is brought in contact with a stream of heated air flowing counter current to the motion of the fabric. A series of vanes 14 serve to redirect fresh portions of the heated air against the fabric. The temperature of the heated air may be maintained at about 175° F., at which temperature blistering of the treated fabric is avoided. The air passed through the drying chamber 4 is first passed through the heat exchanger 15 where it is partly heated by the air exhausted from the drying chamber and then passes over the steam coils in the air heater 16 being directed into the upper part of the drying chamber through connections 17. The heating action of the steam coils in the heater 16 may be supplemented by first passing the steam therefor through a coil 18 arranged in the upper part of the drying chamber 4. The solvent and diluents removed by the stream of heated air are collected in the recovery apparatus 19 after the air from the drying chamber 4 has been partially cooled in the heat exchanger 15, the recovered solvent and diluent being drawn off through connection 20. The circulation of heated air through the drying chamber 4 is maintained by the exhaust fan 21, which may also serve to remove moist air from the conditioning chamber 2. A series of baffles 22 are provided about the fabric between the conditioning chamber, the impregnating chamber and the drying chamber, and at the top of the drying chamber, to inhibit as much as possible the escape of the vapors and gases from any of these chambers. A connection 23 serves to remove vapors formed in the impregnating chamber and to pass them to the solvent recovery apparatus where any solvents and diluents vaporized in the impregnating chamber are collected together with those recovered from the drying air. By arranging the traction drum 5 at the upper end of the drying chamber 4, any contact with the surfaces of the treated fabric is avoided until the fabric is thoroughly dry. The finished fabric is rewound on the roll 24.

Many fabrics are loaded or filled with substances such as clay or metallic oxides or starch. This invention is applicable directly to the treatment of such loaded or filled materials, but more advantageously the fabric is treated before the loading or filling is carried out, or such loading or filling substances are removed in any appropriate manner before treatment in accordance with the present invention. In the case of many fillers, this can be accomplished by prolonged washing.

The water content of various fabrics, particularly cotton textiles, is frequently high and usually variable. Before treatment with the impregnating solution of the present invention, it is advantageous to remove any water present, or reduce it to a low and constant amount, by a drying operation. This drying operation can be carried out by passing the untreated fabric through a chamber maintained at a temperature of about 225° to 250° F. immediately before impregnation.

Impregnation with the water proofing solution can be facilitated by previously impregnating the fabric with a solvent for the cellulose ester employed in the impregnating solution. Advantageously, the same sol-

vent or solvent mixture is employed in this preliminary impregnation as in treatment with the water proofing composition of the invention. After impregnation with the water proofing solution, the treated fabric can be dried by the removal of the excess solvent and diluent in any suitable manner. If necessary or desirable, impregnation with the water proofing composition followed by the drying operation can be repeated one or more times. In the treatment of very dense fabrics, it is sometimes useful to employ a thinner impregnating solution and to repeat the operation if necessary to secure a completely water proof fabric. Repeated preliminary impregnation with the solvent can also be employed where the impregnation with the water proofing composition is repeated.

The water proof fabric of the invention is adapted to resist the attack of wind and salt water and can be used advantageously for sails and hatch covers and the like. It is particularly useful as sail material in connection with light, fast craft requiring light, strong and flexible sails and where a wet sail renders the craft unmanageable. It is resistant to greases and is well adapted for use in protecting idle machinery. It is also useful as sacking for the protection of materials such as lime and cement which are objectionably affected by atmospheric moisture. The washability and sanitary qualities of the fabric of the invention renders it useful as hospital sheeting.

We claim:

1. A flexible water proof fabric, comprising a heavy fabric impregnated throughout with a mixture containing approximately 12 parts of an ether-soluble cellulose ester, 8 parts of comphor and 35 parts of castor oil, and retaining the identity and substantially the original flexibility of the untreated fabric.

2. A process of making a flexible water proof fabric, comprising impregnating the fabric with a solvent for cellulose esters and then while still impregnated with the solvent impregnating it with a dilute solution containing an ether-soluble cellulose ester, a latent solvent therefor and a non-drying or semi-drying vegetable oil, said solution being of sufficiently low viscosity to coat and impregnate the individual fibres of the fabric without the formation of a thick relatively inflexible surface layer on the fabric and so that the impregnated fabric is substantially homogeneous with respect to the impregnating composition.

3. A process of making a flexible water proof fabric, comprising impregnating the fabric with a solvent and then while still impregnated with the solvent impregnating it with a dilute solution in the same solvent containing an ether-soluble cellulose ester, a latent solvent therefor and a non-drying or semi-drying vegetable oil, said solution being of sufficiently low viscosity to coat and impregnate the individual fibres of the fabric without the formation of a thick relatively inflexible surface layer on the fabric and so that the impregnated fabric is substantially homogeneous with respect to the impregnating composition.

4. A process of making a flexible water proof fabric, comprising impregnating the fabric base with a solvent for cellulose esters and then while still impregnated with the solvent impregnating it with a dilute solution containing an ether-soluble cellulose ester, said solution being of sufficiently low viscosity to coat and impregnate the individual fibres of the fabric base without the formation of a thick relatively inflexible surface layer on the fabric base and so that the impregnated fabric is substantially homogeneous with respect to the impregnating composition.

In testimony whereof we affix our signatures.

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