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MANUFACTURE OF PAPER AND THE LIKE

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In my copending application, Serial No. 443,633, filed April 11, 1930, I have described and claimed textile material treated with an esterifying derivative of a higher fatty acid under conditions as herein described to produce mild esterification, and the method of producing such material.

The water absorbing property, which is peculiar to paper pulp, is characteristic even of the finished fabrics made from same, as paper, millboard, and the like, especially wall board, if it is not suppressed by certain definite means. The impregnation of paper is a means of that kind. It is old to incorporate resin and alumina into the paper pulp to waterproof the same. In that way the water absorbing propensity of the cellulose mass is reduced to such a point that ink, for instance, is but slowly absorbed during the process of writing. It is impossible, however, to obtain complete impermeability to water in that way. To effect complete impermeability in certain cases, it has been usual to soak paper in solutions of stearic acid, wax, rosin and the like, to allow the solvent to evaporate and thereby to incorporate the solute in the paper. By such a treatment, one succeeds to make paper and the like completely impermeable to water, but it is necessary to incorporate a considerable quantity of the substances mentioned into the pulp, which materially and in different ways impairs the original properties of the paper. The paper turns hard and brittle and can be used only to a limited extent as a packing material, which should be its chief use.

The object of this invention is a new process, which serves to make paper and the like impermeable to water without any change of its remaining physical and technical qualities. The process was developed from the fact found by me, that a trifling amount of a water repellent radical is sufficient to obtain the desired effect, provided that it be embodied into the paper mass by treating with esterifying derivatives of higher fatty acids. By the term higher fatty acids I mean those fatty acids which contain ten or more C-atoms in each molecule, for instance capric acid, stearic acid, palmitic acid, oleic acid, montanic acid, and the like. According to this principle the paper is treated, neither with a free acid, like stearic or abietic acid, nor with an ester, similar to those contained in wax, as has been done previously, but it is treated with an esterifier, such as a chlorid, or an anhydride of one or more of the higher fatty acids. Very surprisingly, it has been found that paper and the like, when treated with reagents of the said kind, becomes completely impermeable to water and remains so even when the reagent has been extracted again by a suitable solvent.

The products treated thus offer no visible difference from the material non-treated, and no appreciable increase of weight is detected by weighing before and after the treatment; nevertheless, the faculty of absorbing water is completely lost. Even the thinnest sheet is repellent to water. Organic liquids, as alcohol, are absorbed as before.

It is really surprising how mild a treatment may succeed in producing the desired effect. To give an example, a few hours treatment with a warm 2–5 per cent solution of stearic anhydride is sufficient with any paper. With a more reactive paper, good grade filter paper for instance, it is sufficient to soak the material in a very dilute, say 0.1 to 2 percent solution of stearic or palmitic anhydride and to dry it. After staying a few hours at ordinary temperature the paper has become water repellent. Even if soaked in benzin for a number of days, a paper treated in that way remains to be impermeable to water, by contrast to a paper imbued in the old way by a solution of stearic acid.

In the manner described the process can be applied at any stage of the manufacture or finishing process of paper, at which the fibre is in a dry condition. As an example, dry boards of cellulose, which may or may not be ground for the purpose are steeped in an esterifying solution, the excess of the esterifying agent is washed away, the wash liquor is removed, whereupon the material is worked in the usual manner.

Alternatively, the finished renning band of paper, millboard and the like, sufficiently dried, is treated as disclosed heretofore; or paper and the like, which has been subjected to the action of sulphuric acid, or of zinc chloride, or to coloring, or to any other similar finishing process, is treated in the same way.

There is, however, still another way of carrying out this invention, which consists of adding the esterifying reagent to the fibrous mass not as a solution, but as an emulsion. The anhydrides of acids are especially adapted to be worked into emulsions, using the methods familiar from the manufacture of fatty emulsions. By this modification, the invention can be applied at any stage of the paper and millboard manufacturing process, because, in that case, it is not required that the fiber be dry.

An advantageous way of carrying out this invention consists of first treating the fibrous mass

with a suitable derivative of an acid, for instance with the anhydride of a higher fatty acid, to be applied either as a solution or as an emulsion, then drying and finally exposing the dry product to a temperature exceeding 35° C., preferably to a temperature between 80 and 110° C. The time required to secure a satisfactory effect is different for different materials. While for a cellulose product two to three hours are sufficient, other matter, for instance such containing wood pulp, is preferably treated, to obtain the maximum effect, for six or more hours at the said temperature. This modification of my process is especially to be recommended in case that an emulsion of stearic or palmitic anhydride is added to the wet fibrous mass, as explained heretofore, whereupon the said mass is worked, in the usual way, into paper or millboard and the product is dried and treated at an elevated temperature as said.

As an example, water repellent cable paper is made by soaking ordinary cable paper in a one percent benzene solution of palmitic anhydride, evaporating the benzene and exposing the paper during four hours to a temperature of 80° C. The paper thus treated has entirely lost the faculty of absorbing water in its capillaries.

Another way of carrying out the invention, used for instance to make water repellent wallboard, consists of stirring a four percent aqueous suspension of suitable material, as for instance wood pulp together with a three percent emulsion of stearic anhydride in ammonia water, to which a little starch paste has been added, using the emulsions in the proportion of one part, by weight, of stearic anhydride to one hundred parts of ground wood. The mass is worked into millboard on a boarding machine and the dry millboard is treated at about 90° C. during six hours. A product is obtained, which does not absorb water and which is excellently suited as a packing and as a building material.

Instead of palmitic or stearic anhydrides one can use for instance lauric, palmitic, oleic, montanic anhydrides or the like, or mixtures of different anhydrides.

A very important application of this invention consists of manufacturing paper and millboard, which are water repellent and fireproof at the same time. Fireproof paper and the like has of course, been made before, by soaking the material with strong solutions of different salts, for instance of ammonium chloride. Such products are, however, a great deal more liable to absorb water, than even ordinary paper and millboard are. In many cases, especially for building purposes, they can hardly be used. On the other hand, paper and millboard made water repelling by known methods, cannot be made, by a combined process, fireproof at the same time. They either do not absorb the salt solutions, or, if the solution is forced into them by heat, the water repelling effect is destroyed.

The products made waterproof according to the method here disclosed, have the peculiarity, though they repel cold water, to admit warm water to a degree which rises with temperature. After drying, they repulse cold water again as before. By virtue of that peculiarity, paper, millboard and the like can be made waterproof and fireproof at the same time. This is done by first making the product waterproof in any manner as explained heretofore, then steeping it, at an elevated temperature, preferably above 40° C., into a salt solution of the same kind as usually employed for the purpose.

As an example, waterproof wallboard is made by adding, to wood pulp suspended in a board mill cylinder, a three percent aqueous suspension of stearyl anhydride, using one part by weight of the anhydride to one hundred parts of dry paper pulp. The board obtained is dried, for six hours, at a temperature of 90° C., and is finally soaked in a solution, which contains 100 grams of ammonium chloride and 50 grams of sodium tungstate in 1000 cc. After having been dried, the millboard thus made is water repellent and fire retarding at the same time.

As used in the claims, the term "paper material" includes only paper pulp and finished paper.

I claim:

1. A process for waterproofing paper which comprises treating the said paper with an esterifying derivative of a higher fatty acid, and drying the product at a temperature above 35° C.

2. A process for water- and fireproofing paper which comprises treating the said paper with an esterifying derivative of a higher fatty acid, then steeping the said paper in a solution containing a fire-retarding salt.

3. As a new article of manufacture a waterproof paper material being the product obtained by treating the said paper material with an esterifying derivative of a higher fatty acid, and drying the product at a temperature above 35° C.

4. As a new article of manufacture a fire- and waterproof paper material being the product obtained by treating the said paper material with an esterifying derivative of a higher fatty acid, then steeping in a solution containing a fire-retarding salt and drying the product at a temperature above 35° C.

5. A process for waterproofing paper pulp which comprises treating the said pulp with an esterifying derivative of a higher fatty acid, and subjecting the material after drying to a temperature of more than 35° C. for at least one hour.

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