

UNITED STATES PATENT OFFICE

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METHOD OF PREPARING IMPREGNATED PAPER PRODUCTS

No Drawing.

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This invention relates to a new method of preparing paper, sheets, boards or laminated products made of fibres such as wood pulp or rag stock, asbestos, mineral wool, spun glass, leather fibres, etc. and having incorporated therein a derivative of cellulose.

An object of our invention is to prepare a material containing the ordinary paper making fibres, or other vegetable, animal or mineral fibres, which material is strong, water resistant and thermoplastic.

Another object of our invention is to prepare paper, sheets, boards or comparatively thick laminated products by incorporating in a paper pulp, derivatives of cellulose in such manner that the same is thoroughly disseminated throughout the mass so that very large amounts of cellulose derivatives may be added thereto while still obtaining a uniform product. Other objects of our invention will appear from the following detailed description.

In accordance with our invention we add a derivative of cellulose to the paper stock while it is in the beater. The paper stock may comprise wood pulp, rag fibres or any other vegetable fibres or animal fibres such as leather fibres made from leather scrap, or mineral fibres such as asbestos, mineral wool or spun glass suitable for paper making. The stock may contain one or a mixture of two or more of the above named materials. Moreover, any suitable or desired fillers, sizing materials, pigments or dyes may be incorporated therein.

In order to have the derivative of cellulose uniformly and tenaciously held in admixture with the pulp or rag fibres, we use one or preferably both of the following expedients. As one expedient we have found that if the derivative of cellulose is added in the form of fibres rather than in the form of powder, the cellulose derivative fibres intertwine with the fibres of the paper stock so that an extremely large proportion of cellulose derivative may be added to the pulp without separating out. As another expedient, we have further found that if a high boiling solvent, softener or plasticizer is added with the cellulose derivative, a uniform product may be

obtained without the addition of large amounts of cellulose derivative, because of the action of the high boiling point solvent, softeners or plasticizers in preparing the cellulose derivative in such physical form so that it can be thoroughly distributed throughout the aqueous mass containing the paper stock. After the admixture of the cellulose derivative in the beater with the paper stock, the same is processed in the usual manner, being eventually passed to the Fourdrinier machine from which the paper is drawn to be subjected to the finishing operations.

The paper may be placed between heated rollers under high pressure, whereupon the particles of cellulose derivative coalesce to form a continuous mass embedding the wood, rag or other vegetable, animal or mineral fibres. When plasticizers or softeners are used, these aid materially in causing the cellulose derivative to coalesce. Or else, a solvent for the cellulose derivative may be applied to the paper by brushing, spraying, dipping or otherwise coating, and then, with or without rolling, upon evaporation of the solvent, the cellulose derivative is formed as a continuous film. When it is desired to form a laminated product, the paper, after it leaves the Fourdrinier machine, is built up in layers to the desired thickness and hot pressed to cause the cellulose derivative to coalesce and form a solid mass. Or else, a solvent for the cellulose derivative may be applied to the paper prior to the building up of the same layers and then the mass is pressed to cause consolidation of the layers in one mass.

In another form of our invention, especially for making leather boards, a pulp containing leather fibres and the cellulose derivative with or without a softener, plasticizer, or high boiling solvent, is placed in a "wet" machine provided with a revolving perforated cylinder. As the cylinder revolves in the machine, suction is applied to the interior thereof and thus a film of fibres is collected on its surface. When a layer of sufficient thickness is built up on the cylinder, the cylindrical layer of fibres is slit with a knife, the sheet

then removed and then dried in any suitable manner.

The amount of cellulose derivative that is added may be varied within wide limits depending upon the requirements of the finished product. Thus for a writing paper, a relatively small amount of cellulose derivative, say from 5% to 10% based on the weight of the paper, is sufficient.

The great advantage of our invention, however, is due to the fact that by our process large amounts as high as 100% of cellulose derivative based on the weight of the other ingredients of the paper may be incorporated therein. With the larger percentages of cellulose derivative, hard, stiff and thermoplastic products may be produced. The addition of the high boiling point solvent, plasticizer or softener is of particular advantage when large proportions of cellulose derivatives are used, since the product thus formed is not brittle but is pliant and adaptable for many uses, and can be worked under less heat and pressure than when they are not used, and yet the use of volatile solvents is avoided. The cellulose derivative used in this invention may be cellulose nitrate or organic substitution derivatives of cellulose. Since the organic substitution derivatives of cellulose are not inflammable, they are preferred over the inflammable cellulose nitrate. The organic substitution derivatives of cellulose include cellulose esters such as cellulose formate, cellulose acetate, cellulose propionate, cellulose butyrate and cellulose ethers such as methyl cellulose, ethyl cellulose and benzyl cellulose. However, at the present time cellulose acetate is preferred because of economy and ease of working. The cellulose acetate best used in this process is a hydrated cellulose acetate preferably formed by ripening the cellulose acetate after acetylation in the presence of water and then precipitating the same with water under such conditions that the cellulose acetate assumes a fibrous form. The cellulose acetate that is added to the pulp in the beater should preferably be either freshly prepared or else kept moist so that it does not harden and become friable. The plasticizer, softener or high boiling solvent used may be of any suitable nature such as diethyl phthalate, tricresyl phosphate, triphenyl phosphate, triacetin, diacetin, etc. The volatile solvent that may be used may be any known solvent such as acetone, alcohol, ether, benzene, ethylene dichloride, etc.

The product formed in accordance with our invention may be used for any of the processes for which it is adapted because of its waterproof, electrical insulating and thermoplastic properties. It may be used for making articles of mechanical utility such as wheels, gears, etc. because of its great strength, and also for making ornamental objects because of its beauty.

It is to be understood that the foregoing details are given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we claim and desire to secure by Letters Patent is:

1. Process of preparing an impregnated paper product comprising adding a cellulose derivative in a fibrous form to a paper stock, forming the same into sheets and fixing the said cellulose derivative therein.

2. Process of preparing an impregnated paper product comprising adding an organic substitution derivative of cellulose in a fibrous form to a paper stock, forming the same into sheets and fixing the said organic substitution derivative of cellulose therein.

3. Process of preparing an impregnated paper product comprising adding an organic ester of cellulose in a fibrous form to a paper stock, forming the same into sheets and fixing the said organic ester of cellulose therein.

4. Process of preparing an impregnated paper product comprising adding cellulose acetate in a fibrous form to a paper stock, forming the same into sheets and fixing the said cellulose acetate therein.

5. Process of preparing an impregnated paper product comprising mixing cellulose acetate in a fibrous form with a paper stock in a pulp beater, forming the resulting product into sheets, removing the excess moisture and then causing the cellulose acetate to coalesce.

6. Process of preparing an impregnated paper product comprising mixing hydrated cellulose acetate in a fibrous form with a paper stock in a pulp beater forming the resulting product into sheets, removing excess moisture and then causing the cellulose acetate to coalesce.

7. Process of preparing an impregnated paper product comprising mixing hydrated cellulose acetate in a fibrous form with a paper stock in a pulp beater, forming the resulting product into sheets, removing excess moisture and then passing the sheets between heated rollers to cause the cellulose acetate to coalesce.

8. Process of preparing an impregnated paper product comprising mixing hydrated cellulose acetate in a fibrous form with a paper stock in a pulp beater, forming the resulting product into sheets, removing excess moisture, forming layers of the sheets and then causing the cellulose acetate to coalesce to form a laminated product.

9. Process of preparing an impregnated paper product comprising mixing hydrated cellulose acetate in a fibrous form with a paper stock in a pulp beater, forming the resulting product into sheets, removing excess moisture, forming layers of the sheets and

then passing the sheets between heated rollers under pressure to cause the cellulose acetate to coalesce to form a laminated product.

5 10. Process of preparing impregnated paper product comprising mixing a cellulose derivative in unplasticized state and a plasticizer with the paper stock, forming the same into sheets and fixing the said cellulose derivative therein.

10 11. Process of preparing an impregnated paper product comprising mixing an organic substitution derivative of cellulose in unplasticized state and a plasticizer with the paper stock, forming the same into sheets and fixing the said organic substitution derivative of cellulose therein.

15 12. Process of preparing an impregnated paper product comprising mixing cellulose acetate in unplasticized state and a plasticizer with the paper stock, forming the same into sheets and fixing the said cellulose acetate therein.

20 13. Process of preparing an impregnated paper product comprising mixing cellulose acetate in unplasticized state and a plasticizer with the paper stock, forming the same into sheets and fixing the said cellulose acetate therein by passing the same between heated rollers to cause the cellulose acetate to coalesce.

25 In testimony whereof, we have hereunto subscribed our names.

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