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UNITED STATES PATENT OFFICE

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TREATMENT OF FIBROUS VEGETABLE MATERIALS

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The subject of this invention is a method of obtaining from fibrous plants such as flax, hemp or ramie, fibres having a high gloss and adapted to be spun into yarn by machinery of the type generally used in cotton mills as well as by machinery of the type generally used in flax mills, valuable by-products as hereinafter described being also obtained from the said plants by the said method.

It is known that each of the external fibres of flax which may be, say, 60 centimetres long, is made up of a number of short lengths, say 4 centimetres long, which are joined together by bonds or nodes, and may be termed the ultimate fibres. The nodes in adjacent long fibres not being in alignment, that is, the ultimate short fibres in one long fibre overlapping those in an adjacent long fibre, when a bunch of long fibres is cut across or torn across at any point in order to produce fibres of such a short length that they can be dealt with by cotton spinning machinery, many of the ultimate fibres are broken at some part between the nodes, and the cut or broken ends will not bind satisfactorily with the other portions when spun into yarn, but project outside the yarn, which is therefore both roughened and weakened.

According to this invention the bonds or nodes are destroyed or weakened by chemical action so that practically all the ultimate fibres will remain unbroken after passing through a carding or other suitable process to separate the ultimate fibres from each other. A strong and glossy yarn can be made from the fibres thus produced.

The plant straw may or may not have been dried before this treatment, but in the case of flax is prefeably unretted, the results obtained with retted flax straw not being so good as those obtained with unretted straw. In the case of its having been dried, it may then be scutched in the usual way to separate the shive from the textile fibre, the fibre alone being treated to weaken or destroy the bonds or nodes, but by the use of this invention it is possible to eliminate the operation of scutching.

The straw without previous scutching is first digested in an autoclave for about an hour in plain water at a temperature of 182° C. and corresponding pressure, furfural being then distilled off, then the material is boiled for from 4 to 6 hours in a 3% to 5% caustic soda solution in quantity 5 to 8 times the weight of the material at a temperature of from 150° to 170° C. and corresponding pressure. A suitable plasticizer may be added to the soda solution in the autoclave; this plasticizer may consist of 1½% of Turkey red oil and ½% of linseed oil on the weight of the straw. On completion of the treatment in the autoclave the pulp is washed with water, preferably soft water, then immersed in an acid bath, preferably hydrochloric acid at a strength of ½% to 2% in cold water, and again washed.

In the case of flax straw being treated, the pulp then contains flax fibres in which the bonds or nodes have been destroyed or weakened, and a considerably larger proportion of shive or fibre of very short length, and can be dried and sorted by carding or similar machinery into flax fibres of a length suitable for spinning, and very short fibres consisting of cellulose, which latter if pure can be dissolved for making artificial silk, or if containing sub-normal cellulose (beta and gamma cellulose) can be used for making paper, cardboard or electrical insulating materials.

The aforesaid treatment with caustic soda if continued for six hours, removes a considerable proportion of the sub-normal cellulose, but if a less pure residue is required, for example for paper making, 4 hours treatment with caustic soda will suffice, and is advantageous in producing a stronger flax fibre for spinning.

Instead of being dried, the mixed fibres can be sorted into their respective lengths by a wet method, employing screening as used in paper mills, the short fibres going directly from the separator to the paper making machine, while the longer fibres are retained and dried for spinning.

It will be observed that when the invention is used in a paper mill, a single operation separates the products required for paper making from those suitable for spinning.

In the application of the invention to the treatment of fibre which has been scutched the fibre is treated in an autoclave in a caustic soda solution at a temperature of 130° to 170° C. and corresponding pressure. A suitable plasticizer is added to the solution originally placed in the autoclave; the said plasticizer may consist of 1½% of Turkey red oil and ½% linseed oil on the weight of the fibre treated. The concentration of the caustic soda solution may vary between 1% and 5% and the time of treatment in the autoclave from 20 minutes to 4 hours according to the degree of lustre and ultimate strength of fibre and degree of disintegration required. The shorter the time and the weaker the concentration of the solution, the less lustre and greater strength the fibres will possess, but although the maximum lustre is always reached after half an hour's treatment with a concentration of 1% and upwards at 130° C. the lustre is not much diminished during treatment for the next 2 hours and the length of time which the treatment is continued beyond this first half-hour depends on the degree of disintegration of the nodes of the fibre that may be desired, that is, the longer the treatment lasts, the higher the temperature, and the stronger the solution employed, which must not however exceed 5%, the more readily will the long fibres be subdivided by subsequent treatment into fine fibres of the lengths existing between the nodes of the long fibres.

Generally for cotton spinning machinery where shorter fibre is required, the time and/or concentration will be greater than for flax spinning machinery. On removal from the autoclave, the fibre is washed in water, preferably soft water, then immersed in an acid bath, which may comprise ½% to 2% of hydrochloric acid in cold water. The acid neutralizes any soda left in the fibre and dehydrolyzes any hydrocellulose formed, as well as destroying any soda cellulose. The fibre is then again washed and dried for spinning.

A treatment similar to that herein described in detail with reference to flax is also applicable to other fibrous materials such as hemp, ramie and the like.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A process of obtaining from flax and other similar fibrous vegetable materials a fibre suitable for spinning, said process comprising the steps of treating the said material at a temperature of 130° to 170° C. and corresponding pressure with a caustic soda solution of a strength between 1% and 5% containing a plasticizer for a length of time varying from twenty minutes to four hours sufficient to weaken the bonds or nodes between the ultimate short fibres composing each long fibre, the said time and the concentration of the solution being controlled according to the extent to which weaking of the said bonds is desired, after which the material is washed in water, immersed in a cold acid bath, and again washed.

2. A process as in claim 1 applicable to the treatment of flax straw without previous scutching, the said process comprising the steps of digesting the straw for about an hour in water at a temperature of 182° C. to produce furfural, distilling off the furfural, then treating the pulped straw in a caustic soda solution of a strength between 1% and 5% with a plasticizer for four to six hours, after which the straw is washed, immersed in a cold acid bath, again washed, the flax fibre being then separated from the cellulose fibre.

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