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TREATMENT OF FIBROUS MATERIAL

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The present invention relates to sizing fibrous material for the manufacture of paper, cardboard, wallboard, hollow articles and the like.

In manufacturing paper, cardboard, wallboard, formed fibre products and so on, it is often desirable to add suitable substances to the pulp to impart to the final product a better capability of resisting water and moisture or to give the same a greater strength and elasticity and also, if desired, other specially desirable qualities than those which products made from unsized raw material possess. Such additional substances or agents may consist of resins, waxes, paraffin, raw vaseline and similar substances. Such substances are insoluble in water or difficult to be dissolved in water, for instance in the form of emulsions, which is the most common method when sizing wood pulp, or in melted form, which method is often adapted when impregnating wood pulp for wallboard, in which case the whole pulp mixture (including the water) must be heated to a temperature which lies at or above the melting point of the sizing agent, for instance, in the case of paraffin, between 45 and 55° centigrade.

In these cases, the sizing agent is added to the pulp after the latter has been defibrated, and it is worked into the wood pulp by stirring in a rag engine or in a mixing vessel. The pulp is sometimes subjected to further beating, before it is transported to the paper making machine.

In connection with these sizing methods, certain costs arise in addition to the costs for the sizing agent itself, for instance in the former case the costs for preparing the emulsions, the working of the emulsions into the pulp and the precipitation of the same on the fibres of the pulp, and in the latter case the costs for heating the pulp mixture (including the water) to the melting temperature of the sizing agent, very often amount to about one half of the whole sizing costs, besides which the transporting of the heated pulp mixture to the paper making machine causes great inconveniences on account of its evaporation and condensation in the room.

In the preferred manner of carrying out the present invention, the sizing agent is added to the raw material, for instance wood chips, straw, bamboo, reed or other material containing ligneous cellulose, before or while the material is defibrated, and carrying out the defibration at temperatures which lie at or above the melting point of the sizing agent, the same being distributed throughout the fibrous material due to the vigorous working of the material which takes place in the defibration.

The present invention can readily be applied to or carried out with the method disclosed in my co-pending application U. S. Serial No. 611,700, filed May 16, 1932, in which the raw material, such as wood, straw, bamboo or the like, is introduced into a closed vessel and is heated at temperatures above 100° centigrade, for instance at 110°–140° centigrade, and in certain cases at temperatures as high as 150°–200° centigrade. This heating preferably is carried out by means of steam under pressure which is higher than atmospheric pressure, whereafter the material is defibrated while maintaining these temperatures or approximately said temperatures, and in any case a temperature above 100° centigrade, at the same time utilizing a defibrating device arranged in the vessel or in association thereto. Preferably this treatment is carried out by mechanically defibrating the material in the presence of limited quantities of moisture and if desired without the presence of free water. Thus, quantities of moisture varying between 1 and 3 kg. for each kg. material, under which conditions the material may be considered to be in dry state, have been utilized with advantage. Moisture quantities above 7 kg. for each kg. dry material ought not to be utilized. The sizing agent may be added to the raw material before the latter is introduced into the heating space, or may be introduced into the closed system, for instance by means of a pump, so that it meets the raw material before the defibrating of the latter is completed. The sizing substance is distributed during the defibration stage throughout the raw material very effectively.

According to an embodiment of the method according to the present invention, which has been carried out in practice, wood chips have been used as raw material, and the sizing agent which consisted of paraffin having a melting point of about 50° centigrade, has been added directly to the raw material in quantities corresponding to about 2% of dry weight of the raw material. The material has been defibrated, at a temperature of 140°–150° centigrade, by means of kneading in a defibrator having defibrating members rotating at high speed.

The mixture obtained has been diluted with water to the desired consistency at a temperature of 10°–20° centigrade, whereafter a sheet has been formed thereof and has been dried under

moderate pressure. When this finished sheet was submerged in water, it was found that, after about 24 hours, the sheet had absorbed a water quantity corresponding to about 14% only of the weight of the dry sheet. A sheet made under identical conditions but without the addition of sizing agent absorbed 105% during the same period of time.

These experiments have been repeated with different raw materials, such as straw, bamboo and the like, and in each case it has been found that the final sized product had a considerably higher capability of resisting moisture than the unsized material.

As one could expect, it has been found that the resistance against the influence of moisture varied in proportion to the quantity of sizing agent which had been added per unit of raw material. Small quantities under 0.1–0.3% had scarcely any noticeable effect. Greater quantities, for instance between 0.5 and 1%, had a very marked effect and ought to be sufficient for many purposes, although for instance for wallboard and other similar products made of vegetable material, a quantity of between 1.5 and 4% has been added in order to obtain the very best effect possible.

It has been found that the addition of the paraffin neither facilitated nor adversely affected the defibrating process in any marked degree.

Sizing agents, such as resin, wax, latex and the like, may also be utilized with advantage, and in these cases they should be added in about the same proportions as mentioned in the above example, that is to say in general up to 1 or 3% of the weight of the material to be sized, and in special cases up to 3 or even up to 5%.

The method according to the present invention may naturally be varied in many different ways without departing from the principles which form the basis for the same.

Very good results may, thus, also be obtained, if the addition of the sizing agent takes place after the defibrating stage, for instance at a succeeding grinding or other treatment, under the condition that the material not only has been heated or is heated up to a temperature which is equal to or higher than the melting point of the sizing agent, but also has a suitable degree of dryness, that is to say preferably 1–3 kg. or at the most, 7 kg. moisture per kg. dry material, as stated in the first-named examples, or that the material is entirely devoid of free water.

What I claim is:—

1. The method which includes adding a sizing substance to wood chips, heating the wood chips in a gaseous environment at a temperature above 212° F., and mechanically defibrating the wood chips with the sizing substance added while in such environment, said environment being essentially devoid of free water.

2. The method of treating fibrous material which includes directly adding to the entire quantity of fibrous material to be treated, and before pulping, a final desired proportion of sizing substance, heating the fibrous material with added sizing substance in a gaseous environment above atmospheric temperature and above the melting point of the sizing substance, and abrading the fibrous material to pulp it with added sizing substance while in said environment, said environment being essentially devoid of free water.

3. The improvement in the art of sizing pulp made of ligno-cellulose raw materials, such as wood chips, straw, bamboo or reed, which consists in adding the sizing agent to the fibrous raw material before it is mechanically converted into pulp and utilizing the abrading action employed in defibrating the fibrous raw material to form it into pulp to distribute the sizing agent and work it into the fibres, while heating the mass to above the melting point of the sizing agent.

4. The method which includes adding a sizing substance to fibrous ligno-cellulose raw materials, heating the fibrous raw material and sizing substance to above the melting point of the sizing substance and thereafter mechanically defibrating the fibrous raw material with the sizing substance added, while at such temperature.

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