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ARTHUR E. BARNARD AND ROBERT G. CASWELL, OF NEWTON, MASSACHUSETTS, ASSIGNORS TO W. B. PRATT, INC., OF NEWTONVILLE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

PROCESS OF MANUFACTURING PAPER.

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The object of this invention is to produce a paper from any of the usual cellulosic paper-making materials, e. g. chemical wood pulp, but having a strength exceeding that of paper made from such materials by the ordinary or usual processes.

We have discovered that, if the pulp be beaten or milled in the presence of certain alkalies prior to the formation of the pulp into a web, a sheet may be formed which when dried has a bursting strength greatly exceeding that of paper which has been beaten or milled in the usual manner to effect the hydration thereof. More specifically we have discovered that, if the water, which is added to the mill or beater in the usual quantities for admixture with the pulp, be rendered alkaline by the addition of ammonia in certain proportions, optimum results are secured.

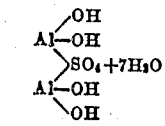
Apparently the increase in the bursting strength is progressive with the increase in the proportion of ammonia contained in the water, or with the concentration of ammonia, the time of beating being constant in each case. For example, an increase of 1% in the bursting strength of paper produced from sulphate pulp has been noted when the water contains 0.005% of ammonia; and, where the water contains 0.05% of ammonia, equivalent to 0.1% of NH_3, based on the amount of pulp beaten, we have noted an increase in bursting strength of about 7%. The figures which are herein given are only average figures resulting from a number of tests. In actual commercial operation, depending upon the results desired to be secured, the water may contain from about 0.05% to more than 0.2% ammonia, based on weight, (or about 0.1% to 4% of NH_3 based on weight of dry pulp) and in the case of the water containing 0.2% ammonia, the average of a number of tests has shown an increase in strength of about 23% over paper produced from sulphate pulp under the same conditions but lacking ammonia in the beating water.

In preparing the water for the beating operation, there is added thereto sufficient aqua ammonia having a predetermined NH_3 content so as to give to the beating water the desired alkalinity. Although the bursting strength of the paper is increased as herein set forth, there is no increase in the shrinkage in area of paper thus formed over paper made under identical conditions but lacking the presence of ammonia in the water. Instead of using NH_3 in the form of aqua ammonia, we may employ an ammonium salt, such as ammonium carbonate, with comparable results. For example, by employment of ammonium carbonate,

$$(NH_4)_2CO_3 \cdot H_2O$$

in an amount which is the equivalent of 0.2% NH_3, we have secured an increase in the bursting strength averaging 19.48%.

We have made the further discovery that if to the diluted pulp, after being beaten with the ammoniated water, there be added certain soluble metallic salts, the bursting strength of the paper is further surprisingly increased. For this purpose we have successfully used the sulphates of aluminum, copper and zinc, with a further average increase in bursting strength of over 25%. In carrying out this step of our process, the dilution of the pulp is effected by the addition of ammoniated water of sufficient concentration so that the water in the pulp has a concentration of about 0.1% NH_3. To the diluted pulp is now added sufficient soluble salt, such as sulphate of aluminum, copper or zinc, to react with the ammonia. For example, when aluminum sulphate is used for the purpose, it is added in excess of that amount which would be required for the formation of "aluminite", or basic aluminum sulphate



When sulphate of copper is employed for the purpose, a sufficient quantity is added to form with the ammonia, cupric hydroxide. On the other hand, where zinc sulphate is added to the diluted pulp, a sufficient quantity is employed to form the hydroxide of zinc. In these operations, it is desirable (and in fact necessary) to increase the quantity or amount of the ammonia in the beater contents at the end of the beating operation, as the proportion of ammonia would otherwise be insufficient for reaction with the added soluble salts to produce a sufficient amount of the above-mentioned salts to

secure the desired increase in bursting strength. We do not regard the use of the sulphates of copper and zinc as desirable as the use of aluminum sulphate, for the reason that there is a marked increase in the area shrinkage of the paper, even though its bursting strength is increased. Moreover, it is to be noted that, due to the increase in the weight of the resulting paper, the bursting strength in relation to the weight is not as great when sulphates of copper and zinc are employed as where aluminum sulphate is employed.

What we claim is:—

1. The herein described process of producing paper having an increased bursting strength, which comprises beating or milling cellulose pulp to effect the hydration thereof in the presence of ammonia, in conditioning the pulp for the web formation.

2. The herein described process of treating cellulosic pulp for the manufacture of paper having an increased strength, which comprises beating or milling such pulp to effect the hydration thereof in ammoniated water having a concentration of approximately 0.001% to and above 0.2% ammonia.

3. The herein described process of treating cellulosic pulp in the formation of paper, which comprises beating the cellulosic pulp to effect the hydration thereof in the presence of ammonia, and then adding a soluble metallic salt.

4. The herein described process of treating cellulosic pulp in the formation of paper, which comprises beating the cellulosic pulp to effect the hydration thereof in the presence of ammonia, and then adding aluminum sulphate.

5. The herein described process of treating cellulosic pulp in the formation of paper, which comprises beating the cellulosic pulp to effect the hydration thereof in the presence of ammonia, increasing the ammonia content of the pulp after beating, and then adding a soluble metallic salt.

In testimony whereof we have affixed our signatures.

ARTHUR E. BARNARD.
ROBERT G. CASWELL.