

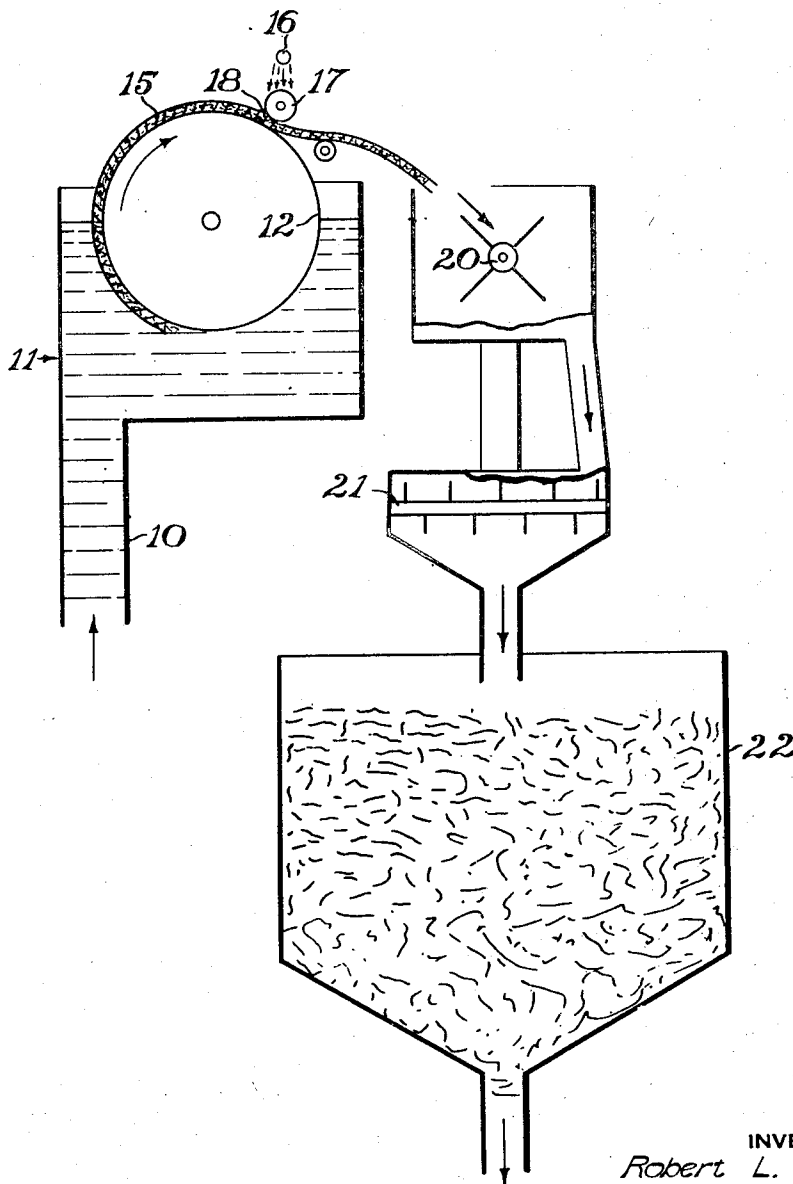
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METHOD OF BLEACHING HIGH-DENSITY PULP

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METHOD OF BLEACHING HIGH-DENSITY PULP

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The present invention relates to a method of bleaching wood pulp at high densities with the attainment of an even and uniform color increment based upon a given consumption of oxidizing agent per unit weight of oven dried pulp.

It has been suggested heretofore to bleach wood pulps by adding the bleaching agent directly to a slurry of the pulp, that is to say, at pulp densities of about 3 to 6%. It has also been suggested to bleach pulps by adding hydrogen peroxide bleaching solution to a wet pulp sheet or lap in order to obtain a flash bleach, and subsequently to finish the sheet with the peroxide bleachant still remaining therein. The latter type of bleach was generally performed upon sheets or laps formed of previously bleached pulp. All of these procedures possess disadvantages that have limited their commercial use.

Where pulps at low density, that is to say, dispersions of the fiber in water as a continuous phase, are treated with peroxide bleaching solution, it is difficult to obtain the full bleaching power of the peroxide due to the fact that a portion of the peroxide is decomposed into water and oxygen without providing a compensating bleaching action upon the fibers. This decomposition may be due to a number of factors, an important one being the action of materials which may be termed catalysts of decomposition.

Where the peroxide has been added to a wet pulp sheet at high density heretofore, it has been employed generally for the purpose of obtaining a surface or flash bleaching effect upon a preformed paper sheet in order to obtain a slight increase in brightness. The procedure was effected within the normal operating conditions of a paper machine and was found to be disadvantageous by reason of non-uniformity of application of the peroxide, or the bleaching values in the peroxide bleaching solution was inefficiently employed by reason of rapid decomposition of the peroxide at the high temperatures of the finishing rolls of the paper machine.

It is an object of the present invention to bleach wood pulps at so-called high densities, that is to say, at percentages of water insufficient in amount to produce a slurry wherein the water is the continuous phase, but rather to bleach the pulp at pulp densities wherein the pulp may be considered to be merely moistened with water.

It is also an object of the invention to provide a method of adding a bleaching solution to a pulp sheet or wet web at high density in order to obtain uniform distribution of the bleaching

solution over the entire face or surfaces as well as throughout the sheet, a condition difficult to attain in a system which does not contain water as a continuous phase.

It is also an object of the invention to provide conditions of bleaching wherein the maximum bleaching efficiency of the hydrogen peroxide upon the pulp is obtained.

It is also an object of the invention to provide a means of feeding the peroxide bleaching solution to the pulp in extremely limited quantities and yet obtain uniform distribution of such solution throughout the sheet.

In accordance with the present invention, the wood pulp prepared in the conventional manner and which may be mechanical groundwood pulp is fed from a stock chest at usual pulp densities of 1.5 to 3.0% to a conventional forming machine, which is generally of the cylinder type, where the fibers are picked up upon the periphery of the cylinder, water being gradually eliminated by suction and by pressure, with the production of a sheet or wet web in which water is no longer the continuous phase as it was in the slurry from which the sheet was prepared. The sheet is conventionally about $\frac{1}{8}$ " to $\frac{1}{4}$ " thick, the width being dictated by the width of the machine and the freeness of the stock employed. The wet lap so formed contains more than about 15% of fibers. This percentage may vary from this figure but may be thought of as the point or range within which the water-pulp system changes from a pulp suspension in water to a unified fiber system merely moistened with water and in which water is probably not a continuous phase. The figure 15% given above will be found to be a fairly average figure for most types of pulps but will vary depending upon the history of the pulp, machine cylinder speed and the degree of fineness of the individual fiber or fiber bundles of the pulp.

After the sheet has been formed in the conventional way and dewatered so that it contains insufficient water to destroy the self-sustaining character of the sheet, the sheet is then treated with an amount of hydrogen peroxide bleaching solution sufficient to give the brightness increment desired. Although it has been indicated above that it is desired to produce a sheet having a consistency of not less than about 15% in the practical application of the procedure, best results will be obtained when operating upon pulp sheets of a consistency of about 18 to 35% or even higher.

In accordance with the procedures of the pres-

ent invention, an amount of peroxide bleaching solution is added which will give at least a 1% change in the consistency and this will be an amount of solution equivalent to not more than 42% based on the weight of oven dried fibers. In any event, the amount of solution added should be insufficient in amount to change the sheets system from fibers moistened with water to a system in which water is the continuous phase. It is preferred to add the bleaching solution in as small quantities as possible based on the dry fibers and yet to add the quantity of active peroxide bleaching agent required to give the desired brightness increment. Normally, the peroxide bleaching solution should contain at least 0.25-1.0% of actual hydrogen peroxide but may contain more than that amount. Furthermore, sufficient of the solution should be added to the web to give about 0.5-2% of 27.5% hydrogen peroxide based on the weight of oven dried pulp. In some instances, the amount of 27.5% hydrogen peroxide required will be slightly less than 1%, depending upon the type of fiber treated and upon the ultimate brightness desired.

The peroxide bleaching solution will generally contain a stabilizing agent and may contain an alkali. The stabilizing agent may be sodium silicate and the solution may contain additional alkali such as caustic soda, soda ash and the like.

The bleaching solution may be prepared from hydrogen peroxide or from alkali metal or alkaline earth metal peroxides, or from perborates or percarbonates in the usual way well known in the art. All of such metal peroxides are capable of producing hydrogen peroxide in solution and are classed herein as peroxygen compounds.

The bleaching solution may be added to the wet sheet in any conventional way although it is preferred to distribute the peroxide solution uniformly over the lap by means of a distributing roll described more fully hereinafter and illustrated in the drawing attached hereto.

After the sheet has been impregnated uniformly with the desired amount of bleaching solution, it is disintegrated or shredded and passed to a retention tower. The disintegrated and peroxide impregnated pulp passes through the retention tower as shredded material and in a condition where the pulp is only moistened and where the aqueous phase is felt to be non-continuous. The disintegrated or shredded pulp is passed slowly through the retention tower, the time of passage being controlled in order to obtain the maximum bleaching action of the peroxide on the fibers. Generally the action of the peroxide upon the fibers is effected at room temperature although the time for such action may be decreased by raising the temperature of the pulp. An average and practical time period for passage of the shredded pulp is from about 1 to about 3 hours more or less. The bleached and brightened pulp is discharged from the retention tower either into mixers or other suitable mechanism for producing diluted pulp stock from which paper can be made.

In the production of bleached pulp, in accordance with the present invention, a bleaching solution was prepared containing per 100 gallons of solution, 48.0 lbs. of 27.5% hydrogen peroxide and 190 lbs. of sodium silicate of 42° Bé. strength.

This solution was fed to the wet web or sheet discharging from a cylinder machine, and which contained 37% fibers, at the rate of 0.65 gallon

per minute, the machine producing pulp at the rate of 13.5 lbs. of pulp per minute on oven dried basis. That is to say, the amount of actual hydrogen peroxide calculated as 100% H_2O_2 was 0.83% upon the weight of oven dried fiber or actual fiber content of the lap. Standard handsheets prepared from the original fiber prior to treatment with the bleaching solution had a value of 55.5 brightness units as measured on a Hunter photoelectric colorimeter equipped with a blue filter. After treatment with the amount of peroxide solution given above, and after disintegration and storage in a retention tower for 2 hours and neutralization and dilution, handsheets prepared from the pulp showed a brightness of 64.7 units measured in the same fashion, or a total increment of 9.2 units of color was obtained. In contrast to the above action, a portion of the peroxide impregnated lap was dried at high temperature and no brightening obtained.

The drawing attached hereto illustrates diagrammatically a range of equipment that may be employed in the process.

Pulp stock from the deckers (not shown) and which consists of a suspension of mechanical wood pulp in water at a consistency of about 1.5-3.0% is fed through feed conduit 10 into the vat 11 of a conventional forming machine. A suction cylinder 12 is suspended in the pulp slurry and is rotated therein whereby fibers from the slurry are picked up upon the periphery of the cylinder machine to form a relatively unified fiber lap or sheet 15, as mentioned hereinbefore. Water is eliminated from the slurry until the lap contains more than about 15% fibers on an oven dried basis and preferably 18 to 35% fibers. Some fibers will require the use of press rolls contacting the sheet 15 and pressing the sheet against cylinder 12, in order to raise the consistency to this high solids content range. After the lap has been dewatered and consolidated to a fiber content of about 18 to 35%, a condition in which the individual fibers are merely now dampened with water and are not suspended in water as a continuous phase, the lap is moistened uniformly with the peroxide bleaching solution. This solution is advantageously applied to the lap by discharging the solution from feed pipe 16 over spreading roll 17 in such amount that there is always a small excess of liquid at 18 in the bite of roll 17 so that the upper surface of the lap in the bite is continuously wet with the bleaching solution which is pressed into the lap by the action of spreading roll 17. The bleaching solution may also be applied to both upper and lower surfaces by the use of a bottom saturating roll picking up the bleaching solution from a trough, and transferring the solution by pressure contact to the bottom of the sheet, in addition to the system described above.

The amount of bleaching solution added is that amount which will give at least a 1% change in the consistency of the wet lap and add at least ½% of 27.5% hydrogen peroxide based on the weight of oven dried fibers.

The impregnated lap is then passed by means of feeder 20 into a disintegrator 21 which destroys the coherent nature of the lap or sheet and forms moistened, damp shreds of the fibers. The fibers thereafter pass from the disintegrator into retention tower 22 and are permitted slowly to pass through the retention tower. The action of the peroxide bleaching solution, which was started upon the addition of the peroxide

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to the lap, is completed in the retention tower during the passage of the fibers therethrough. In general, the fibers will remain in the retention tower for about two hours but may be maintained therein for a sufficient period of time to permit the complete bleaching action of the peroxide upon the mechanical pulp to be effective. The duration of the treatment may be as much as 3 hours or more, depending upon the temperature within the tower, it being understood that the higher the temperature of the pulp within the retention tower, the shorter the period of time required to obtain the full benefit of the action of the peroxide, and vice versa.

After discharge from the retention tower, the pulp is diluted, neutralized and used for heater furnishing in the normal manner. The finished sheet is of a sufficient degree of whiteness to be acceptable in the trade, and the whiteness is level and uniform.

What is claimed is:

1. The method of bleaching wood pulp containing ground wood fibers which comprises preparing a wet lap from the pulp, said lap containing more than 15% fibers, wetting the lap with sufficient alkaline peroxide bleaching solution to reduce the pulp consistency at least by 1%, disintegrating the lap substantially immediately thereafter, and permitting the fibers of the disintegrated lap to bleach in the damp condition, then lowering the consistency of the pulp for use in paper making.

2. The method of bleaching wood pulp containing ground wood fibers which comprises preparing a wet lap from the pulp, said lap containing more than 15% fibers, wetting the lap with an amount of hydrogen peroxide bleaching solution equivalent to not more than 42% of the weight of the fibers, based on oven dried weight, disintegrating the lap substantially immediately thereafter, and permitting the fibers of the disintegrated lap to bleach in the damp condition, then lowering the consistency of the pulp for use in paper making.

3. The method of bleaching wood pulp containing ground wood fibers which comprises preparing a wet lap from the pulp, said lap containing from 18% to 35% fibers, wetting the lap with an alkaline peroxide bleaching solution, disintegrating the lap substantially immediately thereafter, and permitting the fibers of the disintegrated lap to bleach in damp condition, then lowering the consistency of the pulp for use in paper making.

4. The method of bleaching wood pulp containing ground wood fibers which comprises pre-

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paring a wet lap from the pulp, said lap containing from 18% to 35% fibers, wetting the lap with sufficient alkaline peroxide bleaching solution to reduce the pulp consistency at least by 1%, disintegrating the lap substantially immediately thereafter, and permitting the fibers of the disintegrated lap to bleach in the damp condition, then lowering the consistency of the pulp for use in paper making.

5. The method of bleaching wood pulp containing ground wood fibers which comprises preparing a wet lap from the pulp, said lap containing from 18% to 35% fibers, wetting the lap with an amount of hydrogen peroxide bleaching solution equivalent to not more than 42% of the weight of the fibers, based on oven dried weight, disintegrating the lap substantially immediately thereafter, and permitting the fibers of the disintegrated lap to bleach in the damp condition, then lowering the consistency of the pulp for use in paper making.

6. The method of bleaching wood pulp containing ground wood fibers which comprises preparing a wet lap from the pulp, said lap containing more than 15% fibers, wetting the lap with an alkaline peroxide bleaching solution by pressing sufficient of the solution into the lap to reduce the consistency at least 1%, disintegrating the lap, and permitting the fibers of the disintegrated lap to bleach in the damp condition, then lowering the consistency of the pulp for use in paper making.

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