Patented July 1, 1930 1,768,820

UNITED STATES PATENT OFFICE

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METHOD OF BLEACHING PULP

No Drawing. Application filed March 16, 1922. Serial No. 544,322.

This invention relates to an improved method of bleaching chemical pulp produced from wood and similar fibrous materials, including, jute, bamboo, cotton linters and the like.

The bleaching of chemical wood pulp is commonly effected with a solution of bleaching powder or calcium hypochlorite, but this method of bleaching, as commonly practised, not only requires a considerable amount of the bleaching agent, but may also require an elevated temperature to bring about effective bleaching. In order to bleach the pulp satisfactorily in this way, the action of the bleaching agents upon the fibre may be sufficiently severe to injure the fibres, with production of oxidation products, e. g., oxy-cellulose, or with more or less profound modification of part of the cellulose of the fibres, e. g., with resulting increase in beta and gamma cellulose, etc.

The improved bleaching process of the present invention is a two-stage process in which the pulp is subjected first to the action of chlorine or hypochlorous acid in the presence of sufficient mineral acid to give the pulp an acid reaction, and in which the bleaching operation is completed by a subsequent treatment with another bleaching solution, e. g., a solution of bleaching powder or calcium hypochlorite, or of sodium hypochlorite, or of sodium peroxide.

This process is particularly advantageous for treating and more specifically for bleaching those resistant cellulosic fibrous materials which bear a non-fibrous organic content of a nature such that treatment thereof with free chlorine renders only a part thereof readily soluble in water and leaves a relatively insoluble part thereof with the fibres, which may, however, be readily bleached by a suitable subsequent treatment, such as an alkaline hypochlorite bleaching treatment.

The improved process of the present invention is of more or less general application but is particularly advantageous for bleaching pulp that is difficult to bleach with ordinary bleaching powder or calcium hypochlorite without objectionable injury to the fibres. The invention is also of special value as applied to pulp made by the cooking of wood with alkaline cooking liquors, such as pulp made by the so-called soda process or the so-called sulphate process. It is also of special value for the bleaching of pulp produced according to our improved process, set forth in certain prior companion applications Serial Nos. 481,146 and 481,147, filed June 28, 1921, in which the wood is cooked with a cooking liquor made up essentially of normal sodium sulphite, or of a mixture of caustic soda and sodium sulphite in varying proportions, with the caustic soda present in regulated amount such that the fibres are not injured to any considerable degree during the cooking operation. When wood is cooked with such an alkaline cooking liquor, and particularly in the case of certain woods, the reaction of the cooking liquor upon the wood, with resulting conversion of a very considerable proportion of the wood into soluble compounds, sometimes leaves the fibres in such a condition that a considerable amount of bleaching powder is necessary to bleach them effectively, while an elevated temperature may also be necessary. The use of an alkaline bleach solution at an elevated temperature may injure the fibres to an objectionable degree.

According to the present invention, however, the use of an alkaline bleaching solution is preceded by an acid chlorine or hypochlorite bleaching treatment so that the pulp is subjected to an acid bleaching treatment followed by a different bleaching treatment.

In the claims the term "an active chlorine reagent" is particularly intended to include material which is capable of furnishing chlorine in gaseous or nascent state. Such a material may readily be formed in place when a mixture of resistant cellulosic fibrous material, water and alkaline hypochlorite is treated with a suitable acid so as to decompose the alkaline hypochlorite.

Chemical pulps derived from, for instance, jack pine or loblolly pine, are impaired in strength or yield, usually both, if the cooking operation is so conducted with cooking liquor carrying a large amount of caustic

soda as to produce pulps readily bleached to a high white in a single-stage bleaching operation with the usual bleaching powder liquors. The process of the present invention enables us to produce from such woods finished pulps of high white with less impairment.

The invention will be further illustrated by the following more detailed description of certain applications thereof, but it will be understood that the invention is not limited thereto.

A pulp prepared from jack-pine or lobolly-pine, or pines of a similar character by cooking the pinewood chips with a cooking liquor containing a preponderating amount of caustic soda and a lesser amount of sodium sulphite, for example 15 parts by weight of caustic soda and 5 parts by weight of sodium sulphite per 100 parts by weight of wood, (figured on an air dried basis) at a saturated steam pressure of 110 lbs. and a corresponding temperature for a period of 6 hours was freed from the residual liquor and washed in the usual way. It was then diluted with sufficient water to enable it to be readily handled (e. g., containing 1 to 5 of fibres) and was then treated with chlorine by using a hypochlorite solution (bleaching powder) and liberating the cholrine or hypochlorous acid with a mineral acid, such as sulfuric acid. Instead of producing the chlorine or hypochorous acid in this way, chlorine gas can be directly introduced and absorbed by the pulp. Only a moderate amount of chlorine is necessary, for example, 10 lbs. of bleaching powder per 100 lbs. of pulp (air dried basis) together with sufficient mineral acid to give an acid reaction. This chlorine treatment can be carried out at ordinary atmospheric temperature and requires but a few minutes for its completion, ordinary care being taken to uniformly treat the pulp and utilize the chlorine in an economical manner.

After this preliminary acid bleaching treatment, the excess liquor is removed, for example, by means of a suitable thickening device, and the pulp is preferably washed to remove a considerable part of the dissolved organic matter that may be contained therein. The pulp is then subjected to a further bleaching operation with an alkaline hypochlorite bleach, e. g., chloride of lime or bleaching powder, although the amount of such bleaching agent can be materially decreased from that commonly used, when a single bleaching treatment with this reagent is relied upon. The amount of hypochlorite solution may, for example, be the equivalent of 10 lbs. of bleaching powder per 100 lbs. of pulp (air dried basis), and the bleaching can be promoted by heating the pulp to a moderate degree. When the bleaching operation is thus completed, the pulp is washed to free it from the residual solution, and is then ready for further use as a bleached pulp.

The bleaching of such pine pulp in the manner above described has been found to give a good strong white pulp which holds its color satisfactorily even upon prolonged exposure to air. When the pulp is made with a cooking liquor, such as a cooking liquor containing a preponderating amount of normal sodium sulphite with a moderate amount of caustic soda, which is without seriously objectionable action upon the fibres, the resulting pulp will contain fibres of a substantially uninjured condition such that the pulp will contain strong fibres as well as fibres which may be thus bleached to a satisfactory white color, without undue injury.

The improved process of the present invention makes it possible to economize in the amount of steam required for the bleaching operation and also enables a substantial saving to be effected in the amount of bleaching reagent required, and permits the production of superior bleached products, which are so different as to justify considering them new commercial products.

The preliminary treatment of the pulp with chlorine can be effected by introducing free chlorine or chlorinated water or an acid hypochlorite solution into the pulp or producing such compound therein on its way to the thickening device preferably of acid-proof construction. The chlorine acts very rapidly even at ordinary temperatures so that its required work will be finished by the time the pulp has been thickened in the thickener. The thickening may, for example, be done in a Belmar bleacher so-called equipped with a suitable drumwasher, or in other suitable thickening device. By subjecting the pulp to a preliminary chlorine or acid hypochlorite treatment in this way, a special bleaching operation is avoided, in so far as the thickening and the removal of the residual acid bleach liquor takes place at the same time. The preliminary acid bleaching operation appears to remove certain objectionable organic matter or otherwise dissolve or change certain of the constituents present so that the subsequent bleaching, for example, with chloride of lime, can be carried out at a reduced temperature and with saving in time and in steam for heating, while giving an improved bleached pulp which is not subjected to the injurious action of a stronger alkaline bleach liquor at high temperatures. The bleached pulp accordingly will have an improved color as well as improved properties in other respects, and the bleached pulp obtained from pines will be very different from such pulps bleached by the usual method.

According to another application of the

invention, the preliminary bleaching operation can be carried out by adding chloride of lime solution or sodium hypochlorite solution, together with a limited and regulated amount of acid sufficient to give the pulp an acid reaction and to liberate chlorine or hypochlorous acid, and, after the first bleaching treatment, a predetermined amount of alkali can be added sufficient to give the pulp an alkaline reaction together with enough additional alkaline hypochlorite (e. g., bleaching powder or sodium hypochlorite solution) to finish the bleaching operation, the pulp being moderately heated during the second alkaline bleaching treatment.

We consider it more advantageous, however, to subject the pulp to a washing operation after the preliminary acid bleaching treatment and before the subsequent alkaline bleaching treatment, in order to wash out certain objectionable organic matters from the pulp and free it from the excess of acid, and of compounds dissolved by the acid bleaching liquor, before adding the alkaline hypochlorite for the second bleaching treatment.

Pulp which is difficult to bleach with an alkaline hypochlorite solution alone (e. g., a solution of bleaching powder) can nevertheless be readily bleached by the improved two-stage treatment of the present invention. For example, we have found that kraft paper, produced from spruce by the sulphate process so-called and which was difficult to bleach with bleaching powder alone, could be readily bleached to a strong white pulp by the present process. We have also found that pulp from Canada jack-pine, Minnesota jack-pine, Virginia loblolly-pine, yellow pine, etc. (produced by means of a cooking liquor made up essentially of a limited amount of caustic soda and a lesser amount of sodium sulphite) could be readily bleached by our new method to a beautiful strong bleached pulp with a moderate amount of bleaching agent.

The second stage of the two-stage bleaching process can be carried out at ordinary temperature if a somewhat increased time is permitted for the bleaching operation, especially with pulp such as poplar pulp made by the soda process and spruce pulp made by the so-called (acid) sulphite process, although it is better to warm the liquor to a moderate degree. Bleached pulps of excellent white color can be thus obtained, with relatively decreased injury to the pulp in that the process avoids the severe treatment with alkaline hypochlorites at an excess temperature such as tends to oxidize the pulp with resulting production of oxycellulose or to modify the pulp with a resulting production of high amounts of beta and gamma cellulose, etc. The second stage of the bleaching process can be carried out by the addition of sodium perborate, sodium peroxide or by permanganates, for example, by sodium or potassium permanganate, using either an alkaline solution or one which is made acid by the addition of a suitable acid in sufficient amount. When an alkaline permanganate solution is employed the pulp preferably should be warmed somewhat to facilitate or expedite the bleaching operation. When an acid solution is used, the bleaching takes place readily at ordinary temperatures although a moderate heating may be employed. The manganese compound deposited on the fibres can be readily removed with a solution containing sodium sulphite, or bisulphite, and sulphuric acid, or by a solution of sulphurous acid, and the pulp can then be freed from dissolved reagents by washing.

The following example shows another application of the invention:

Short leaf pine was cooked with a cooking liquor containing caustic soda and sodium sulphite for a period of about four hours, the amount of caustic soda being about 15 parts by weight and the amount of the sodium sulphite 25 parts by weight in 450 parts of liquor used for treating 90 parts by weight of bone dry wood. The pulp obtained was of excellent quality, with long and strong fibres, but it did not bleach readily to a white pulp with a calcium hypochlorite solution. It was readily bleached, however, when treated with chlorine in the presence of water at ordinary room temperature for about 15 minutes, then washed and treated with calcium hypochlorite (bleaching powder) solution and moderately warmed. The resulting pulp was a good strong white pulp.

Cotton linters, black gum, red gum, tupelo gum, chestnut, white oak, black oak, red oak, hickory, birch, beech, maple, bamboo, jute and other pulps have been bleached by our new process and in each instance beautiful white and strong pulps were obtained in an economical and practical manner.

It will thus be seen that the present invention comprises a two-stage bleaching process in which the first stage is an acid bleaching operation with chlorine or hypochlorite bleaching liquor and in which the acid bleach liquor is preferably and advantageously removed, for the most part, from the pulp before the second stage of the process. The preliminary stage can be carried out with the use of chlorine gas added to the pulp or by the use of bleaching powder or sodium hypochlorite together with an acid such as sulphuric acid to give an acid reaction. The second bleaching operation can then be carried out at ordinary temperature for sufficient time or with moderate warming with a solution of calcium hypochlorite or bleaching powder or sodium hypochlorite. The second bleaching operation can also be car-

ried out with sodium perborate, sodium peroxide or with sodium or potassium permanganate and with or without sulphuric acid with subsequent treatment of the pulp with sodium bisulphite and sulphuric acid, or a solution of sulphurous acid, followed by a washing operation.

We have found that the following method of applying the process gives good results. After washing the pulp to remove substantially all residual liquor resulting from the cooking of the wood chips, bamboo, jute, cotton linters, etc., the pulp is treated with chlorine gas while being transferred to a washing or pulp thickening device. The pulp may be subjected to chlorine gas in any suitable manner, e. g. by adding enough water to the pulp so that it may be readily handled and then pumping the thinned pulp to the top of a baffled tower (preferably acid-proof) allowing the pulp to pass downward through the tower and come into contact with chlorine gas introduced preferably near the bottom of the tower. The major portion of the chlorine may thus be absorbed by the pulp. The chlorine which escapes from near the top of the tower may then be conducted to a tower in which milk of lime is circulated so as to absorb this portion of the chlorine which escaped the first tower. In this manner, by regulating the flow and amount of pulp and of chlorine, the desired amount of chlorine can be absorbed by the pulp in one tower and at the same time produce a suitable amount of alkaline hypochlorite bleaching liquor suitable for the second stage of the bleaching process. Sodium carbonate solution may be used in the second tower instead of milk of lime. The treated pulp may be further thinned with water if desired and then sent to a thickener where the excess liquor is removed, followed by the second stage treatment. Instead of passing the pulp through a tower, it may be treated with chlorine gas without thinning by agitating the pulp while the chlorine gas is being introduced, passing the escaping chlorine into milk of lime or a solution of sodium carbonate. The treated pulp should be washed before the second stage treatment.

We have used the term "alkaline hypochlorite" in this specification and the accompanying claims as including hypochlorites of alkali metals such as sodium hypochlorite and the hypochlorites of alkaline earth metals such as calcium hypochlorite or chloride of lime.

We claim:

1. The method of bleaching chemical wood pulp which comprises subjecting the pulp to a preliminary treatment with an acid chlorine-containing bleach liquor and subsequently, without intermediate high temperature cooking of the pulp, completing the bleaching operation with an oxidizing bleach liquor.

2. The method of bleaching pulp containing cellulosic fibres which comprises subjecting the pulp to a preliminary treatment with an acid chlorine-containing bleach liquor and subsequently completing the bleaching operation with an alkaline chlorine-containing bleach liquor.

3. The method of bleaching pulp containing cellulosic fibres which comprises subjecting the pulp to a preliminary treatment with an acid chlorine-containing bleach liquor and subsequently treating the pulp with an alkaline hypochlorite solution.

4. The method of bleaching pulp containing cellulosic fibres which comprises subjecting the pulp first to an acid hypochlorite bleach solution and subsequently to an alkaline hypochlorite bleach solution.

5. The method of bleaching pulp which comprises subjecting the pulp first to an acid hypochlorite bleach solution, freeing the pulp from a considerable part of the solution and subsequently treating the pulp with an alkaline hypochlorite solution.

6. The method of bleaching chemical wood pulp which comprises subjecting the pulp first to an acid bleach liquor and later, without intermediate cooking of the pulp, to an alkaline oxidizing bleach liquor.

7. The method of bleaching pulp resulting from the cooking of wood with a non-acid cooking liquor containing monosulfite, which comprises subjecting the pulp to a two-stage bleaching operation, the first stage being with an acid chlorine-containing bleach liquor and thereafter subjecting the resulting fibrous product to a bleaching treatment with an oxidizing bleach liquor.

8. The method of bleaching pulp resulting from the cooking of wood with a non-acid cooking liquor containing monosulfite, which comprises subjecting the pulp to a two-stage bleaching operation, the first stage being with an acid chlorine-containing bleach liquor, and thereafter subjecting the resulting fibrous product to a bleaching treatment with an alkaline oxidizing bleach liquor.

9. The method of bleaching pine pulp produced by the cooking of pine wood with a non-acid cooking liquor containing sodium monosulfite, which comprises subjecting the pulp to a preliminary bleaching treatment with an acid chlorine-containing bleach liquor and subsequently completing the bleaching operation with a bleach liquor of an alkaline character.

10. As an article of manufacture, pulp from wood fibers not easily bleached, said pulp being characterized by the strength and high white color of the bleached fibers, and having been bleached by subjecting the pulp to a preliminary treatment with an acid

chlorine-containing bleach liquor and subsequently to an alkaline bleach liquor of an oxidizing character, the fibers of the pulp being substantially uninjured.

11. As an article of manufacture, a pulp consisting essentially of pine fibers of high strength and high white color, said fibers having been bleached by subjection to a preliminary treatment with an acid chlorine-containing bleach liquor followed by treatment with an alkaline bleach liquor of an oxidizing character, substantially as described.

12. As an article of manufacture, a pulp consisting essentially of pine fibers of high strength and high white color, said fibers resulting from the cooking of pine wood with a non-acid cooking liquor containing a monosulfite, and said pulp having been bleached by subjecting the pulp to a preliminary treatment with an acid chlorine-containing bleach liquor, followed by treatment with an alkaline hypochlorite bleach liquor.

13. The method of treating unbleached cellulosic fibrous material, which includes treating the fibrous material, in the presence of an amount of acid sufficient to render the mixture acid, with an amount of an active chlorine reagent sufficient to render the resulting fibrous material readily bleachable to a high white by a bleaching liquor consisting essentially of a solution of a hypochlorite such bleaching liquor containing an amount of available base sufficient to give it a non-acid reaction, and thereafter subjecting the resulting fibrous material to a bleaching treatment with an oxidizing bleaching liquor.

14. The method of treating unbleached cellulosic fibrous material, which includes treating the fibrous material, in the presence of an acid, with an amount of an active chlorine reagent sufficient to render the resulting fibrous material readily bleachable to a high white by a bleaching liquor consisting essentially of a solution of a hypochlorite such bleaching liquor containing an amount of available base sufficient to give it a non-acid reaction, and thereafter subjecting the resulting fibrous material to a bleaching treatment with an oxidizing bleaching liquor including an amount of available base sufficient both to neutralize such uncombined acid as may then be present and to facilitate bleaching of the resulting fibrous material to a high white.

15. The method of treating unbleached cellulosic fibrous material, which includes treating the fibrous material, in the presence of a sufficient amount of suitable acid to maintain an acid reaction throughout the treatment, with an amount of an active chlorine reagent adapted to render the resulting fibrous material readily bleachable to a high white by a bleaching liquor consisting essentially of a solution of a hypochlorite such bleaching liquor containing an amount of available base sufficient to give it a non-acid reaction, and thereafter subjecting the resulting fibrous material to a bleaching treatment with an oxidizing bleaching liquor containing an amount of available base sufficient to effect an alkaline condition in the bleach liquor during the latter treatment.

16. The method of treating unbleached cellulosic fibrous material, which includes treating the fibrous material with an active chlorine reagent to render the resulting fibrous material readily bleachable by an alkaline bleaching liquor, thereby producing a product including uncombined mineral acid, and thereafter subjecting the resulting fibrous material to a bleaching treatment with an alkaline oxidizing bleaching liquor.

17. The method of treating unbleached cellulosic fibrous material, which includes treating the material with an amount of an active chlorine reagent sufficient to render the resulting fibrous material bleachable by an alkaline oxidizing bleaching liquor in the presence of water and an amount of mineral acid which will give an acid reaction to the pulp and thereafter bleaching the resulting fibrous material with an alkaline oxidizing bleaching liquor.

18. The method of treating unbleached cellulosic fibrous material, which includes treating the material with an amount of an active chlorine reagent sufficient to render the resulting fibrous material bleachable by an alkaline bleaching liquor in the presence of water and an amount of mineral acid which will give an acid reaction to the pulp and thereafter bleaching the resulting fibrous material with an oxidizing bleaching liquor including an amount of available base sufficient both to facilitate bleaching of the fibrous material to a high white and to neutralize such uncombined acid as may then be present.

19. The method of treating unbleached cellulosic fibrous material, which includes treating the material with an amount of an active chlorine reagent and an amount of mineral acid sufficient to render the resulting fibrous material readily bleachable by an alkaline oxidizing bleaching liquor, and thereafter bleaching the resulting fibrous material by means of an oxidizing bleaching material.

20. The method of treating unbleached cellulosic fibrous material, which includes treating the material, in the presence of water and a mineral acid, with such an amount of an active chlorine reagent as is required to convert part of the organic constituents into compounds readily soluble in water and a substantial part of the organic

constituents into altered compounds removable by an alkaline liquor but which are not readily soluble in water, and thereafter subjecting the resulting fibrous material to a bleaching treatment with an oxidizing liquor.

21. The process of treating unbleached cellulosic fibrous material containing non-fibrous organic constituents resistant to being rendered water soluble by treatment with chlorine and water, which includes bringing the said material and constituents into intimate contact with an active chlorine reagent in acid solution, under such conditions as to convert part of the non-fibrous organic compounds into constituents readily soluble in water and to convert a substantial part of the non-fibrous organic compounds into chemically altered compounds which are not readily soluble in water but which are readily removable by an alkaline oxidizing bleaching treatment, and thereafter bleaching the resulting fibrous material with an alkaline bleaching liquor.

22. The method of bleaching cellulosic fibrous material to a high white, which includes mixing with the pulp a sufficient amount of alkaline hypochlorite in solution and thereafter adding a sufficient amount of acid to render the liquor acid, and mixing the ingredients so as to promote intimate contact between the fibres and the active chlorine material, thereby preparing the fibrous material for the later bleaching treatment, and thereafter bleaching the prepared fibrous material to a high white by means of an alkaline bleaching liquor.

23. The method of bleaching cellulosic pulp to a high white, which includes preparing a mixture of such pulp and water, incorporating with such mixture a regulated amount of water-soluble hypochlorite, rendering the aqueous mixture sufficiently acid to decompose any alkaline hypochlorite then present, thereby obtaining a fibrous product which includes some non-fibrous constituents not readily soluble in water, separating the fibrous material from part of the resulting liquor, and thereafter bleaching the pulp to a high white by means of an oxidizing bleaching liquor.

24. The method of bleaching cellulosic pulp to a high white, which includes preparing a mixture of such pulp and water, incorporating with such mixture a regulated amount of hypochlorite of an alkaline earth metal, rendering the aqueous mixture sufficiently acid to decompose such a hypochlorite, thereby obtaining a prepared fibrous product, separating the fibrous material from part of the resulting liquor, and thereafter bleaching the pulp to a high white with a bleach liquor including a compound capable of oxidizing colored non-fibrous organic constituents then present with the fibrous material.

25. The method of producing bleached pulp of high white from pulps, derived from coniferous woods, which are difficult to bleach to a high white by single-stage treatment with usual bleaching powder liquors, which includes treating such pulp with a hypochlorite bleaching liquor under conditions to convert into compounds readily soluble in water a substantial portion of the non-fibrous organic constituents and to leave with the resulting fibrous product some non-fibrous constituents which are not readily soluble in the liquor then present, separating the resulting fibrous material from a part of the liquor, and thereafter bleaching the fibrous material to a high white by treatment with an oxidizing bleaching liquor.

26. The process of treating unbleached cellulosic fibrous material, which includes treating such fibrous material in aqueous suspension with a regulated amount of a bleaching solution containing an alkaline hypochlorite, insufficient to complete the bleaching operation, adding a suitable acid to decompose some of the then remaining alkaline hypochlorite, and subsequently treating the resulting fibrous material with an oxidizing bleaching liquor.

27. The process of treating unbleached cellulosic fibrous material, which includes treating such fibrous material in aqueous suspension with a regulated amount of a bleaching solution containing an alkaline hypochlorite, insufficient to complete the bleaching operation, rendering the solution acid while it contains some unconsumed bleach, separating the resulting fibrous material from a portion of the resulting liquor, and thereafter bleaching the resulting fibrous material by treatment with a bleaching liquor including a hypochlorite.

28. The multiple-step process of producing a high yield of high white fibre from wood, which includes mildly digesting the wood and thus producing a pulp containing fibres encumbered with non-fibrous organic matter, subsequently treating the fibres with a mild liquor including chlorine in such a chemical condition as to alter encumbering matter, thereby obtaining an insufficiently bleached pulp, and subsequently bleaching the fibres to a high white with an oxidizing bleach liquor.

29. The multiple-step process of producing high white fibre, which includes mildly digesting wood and thus producing a pulp containing fibres encumbered with non-fibrous organic matter, subsequently treating the fibres with a liquor including a hypochlorite so as to alter encumbering organic matter, thereby obtaining a pulp which is only partially bleached and separating some of the resulting liquor from the partially

bleached fibrous material, and subsequently bleaching the fibres to a high white with an alkaline bleaching liquor containing a reagent capable of solubilizing colored encumbering organic matter then present with the fibres so as to substantially free the fibres from colored encumbering organic matter.

30. The process of bleaching fibrous material obtained from wood by the sulphate process, which comprises subjecting the material to a partial bleaching treatment by means of bleaching liquor including a hypochlorite, removing bleach residues from the partially bleached fibrous material, and subsequently bleaching the fibrous material to a high white by means of alkaline bleaching liquor supplied with an alkaline hypochlorite, at least one half of the total amount of hypochlorite supplied to the fibrous material being utilized in the partial bleaching treatment.

31. The process of obtaining high white chemical pulp, comprised essentially of strong fibres, which comprises subjecting long fibered wood to a mild digesting treatment by means of a digestive liquor containing sodium hydroxide and an alkaline sulphur bearing compound of sodium as its principal digesting agents, thereby obtaining strong unbleached chemical pulp, washing such pulp, subjecting the washed unbleached pulp to a partial bleaching treatment by means of bleaching liquor supplied with a hypochlorite, removing bleach residues from the partially bleached pulp, and subsequently bleaching the pulp to a high white by means of distinctly alkaline bleaching liquor supplied with an alkaline hypochlorite, at least one half of the total hypochlorite being utilized in the partial bleaching treatment.

32. As a new product, bleached chemical wood pulp containing fibres, such product having been obtained by a process comprising the following steps:—(*a*) treating wood so as to produce unbleached chemical wood pulp; (*b*) washing the unbleached chemical wood pulp; (*c*) partially bleaching the chemical wood pulp by means of bleaching material including a chlorine-containing bleaching agent; (*d*) separating liquor including bleach residues from the partially-bleached chemical wood pulp; (*e*) subjecting the partially-bleached chemical wood pulp to a regulated bleaching treatment by means of an alkaline liquor; (*f*) washing the bleached chemical wood pulp.

33. As a new product, bleached chemical wood pulp as described in claim 32, such pulp having good strength and being of a high white color and which substantially holds its color even upon prolonged exposure to air.

34. As a new product, bleached chemical wood pulp as described in claim 32, such pulp being of excellent white color and being further characterized by the presence of relatively small amounts of oxy-cellulose and the absence of high amounts of beta and gamma celluloses.

35. As a new product, bleached chemical wood pulp containing fibres characterized by high white color, such product having been obtained by a process comprising the following steps:—(*a*) digesting wood by means of digestive matter including a sulphur-bearing digestant under conditions regulated so as to obtain unbleached chemical wood pulp without undue injury to the fibres thereof; (*b*) washing the unbleached chemical wood pulp; (*c*) admixing a liquor including an alkaline hypochlorite with the unbleached chemical wood pulp and partially bleaching the same by means of bleaching material including a chlorine-containing bleaching reagent; (*d*) separating liquor including organic matter from the partially-bleached chemical wood pulp; (*e*) bleaching the partially-bleached chemical wood pulp to a high white by means of a bleaching liquor supplied with an alkaline hypochlorite; (*f*) washing the bleached chemical wood pulp.

36. As a new product, bleached chemical wood pulp as described in claim 35, the step (*a*) of the process described in claim 35 including a digesting treatment of the wood by means of a sulphite.

37. As a new product, bleached chemical wood pulp as described in claim 35, the step (*a*) of the process described therein including a digesting treatment of the wood by means of digestive matter including a normal sulphite.

38. As a new product, bleached chemical wood pulp as described in claim 35, the bleaching liquor mentioned in bleaching step (*e*) being maintained distinctly alkaline during such bleaching step.

In testimony whereof we affix our signatures.

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