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PROCESS OF PRODUCING PULP HAVING A HIGH PERCENTAGE OF RESISTANT CELLULOSE.

No Drawing.

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This invention has for its object to produce sulphite pulp (so called) having a high percentage of resistant (alpha) cellulose.

5 It is well known that the alpha cellulose content of unbleached pulp, such as obtained from spruce, for example, may be increased by an alkaline digestion, as the effect of the alkali is to dissolve the less
10 resistant constituents. Such a process involves the consumption of caustic soda and steam, and has heretofore involved the use of a separate high pressure digester in which the alkaline cooking operation is performed.
15 The object of my invention is to produce as high a grade of pulp as can be produced by the last noted process, involving a separate alkaline digestion, but by a much simpler and inexpensive process, in the operation of which no additional equipment or
20 fuel consumption is required. This is accomplished by performing the operation of digestion of the wood in two stages,—first by the employment of an acid sulphite
25 liquor under pressure at the ordinary high temperature, and then by the addition to the digester content (including the liquor) of an alkaline reagent sufficient in amount to neutralize the component acids remaining
30 at the end of the cook, and also to dissolve the less resistant cellulose by maintaining a distinctly alkaline condition during the second step of the operation.

In carrying out the process, the heat of
35 the digested mass, including the pulp and the liquor, is conserved for promoting the alkaline reaction. This may be accomplished by injecting the alkaline reagent into the digester in which the acid digestion
40 is performed, or by delivering it to the blow pit or other receiving vat into which the hot contents of the digester are discharged.

In performing the initial acid digestion
45 of the wood (spruce, for example), one may employ the usual calcium bisulphite solution containing a high percentage of free SO_2 , in which case the chips are cooked as ordinarily at a high temperature and pressure until the fiber has been liberated from
50 the lignin or cementitious components of the wood. In such case, it is desirable to employ for the second step an alkali which will not react with the sulphur compounds

to form insoluble sulphur precipitates, and
55 hence an alkali, such as caustic soda, is preferably employed. But for the acid cooking liquor, I may employ an acid sodium sulphite solution, particularly when it is desirable to recover the soda component from the
60 waste liquor, and in such case I employ in the second step of the operation either caustic soda or sodium carbonate, which is recovered from the waste liquor and makes up losses in the soda content of the acid
65 cooking liquor. Consequently in this instance, the alkali serves two purposes, in that it serves to replenish the acid cooking liquor with the necessary sodium content, and also functions in dissolving the low-
70 resistant cellulose component of the wood undergoing treatment. As an example of the manner in which one may practice the process in accordance with my invention, one may proceed as follows:

75 A suitable digester, such as ordinarily employed in digesting spruce wood chips for the production of sulphite pulp, is loaded with chips and calcium bisulphite cooking liquor, and the operation is carried on in the
80 usual manner until the cellulose fiber is freed from the lignin or cementitious materials. When the cooking operation is complete, there is little free acid remaining in the liquor, but the digester is relieved to permit the escape of much of the residual gas
85 at the high temperature of cooking. Then there is injected into the digester an amount of caustic soda sufficient not only to neutralize the inorganic and organic acids of the
90 mass, but also to dissolve the low resistant cellulose without materially injuring the high resistant or alpha cellulose. The pressure and temperature may be maintained, and circulation assured by the injection of a small
95 amount of steam. The alkaline digestion takes but a relatively short time,—say from thirty minutes to two hours, after which the digester is blown into the usual pit or vat
100 where the liquor is drained off. The pulp is then washed. A pulp thus produced is much cleaner than ordinary unbleached pulp, has a smaller number of specks, and contains a high percentage of resistant cellulose (say
105 92%—94%), with no oxycellulose and substantially no appreciable amount of beta or gamma cellulose and is substantially free from resinous or ligneous compounds. Con-

sequently it may be bleached with only a fraction of the bleach liquor ordinarily employed for bleaching unbleached sulphite pulp.

5 If the acid cooking liquor is produced from a sodium base, i. e. a solution of sodium sulphite, then after the acid digestion is complete, either caustic soda or carbonate of soda is injected into the digester, sufficient
10 ly in excess to maintain the alkalinity of the mass to the end of the alkaline digestion. In this case the added sodium constituent together with the original sodium compound, is recovered from the black liquor by a smelt-
15 ing operation.

In either of the examples cited, however, instead of injecting the alkali into the digester, the acid mass may be discharged from the digester into a blow pit or other vat,
20 and while the mass is still at a high temperature the alkali may be added to and thoroughly stirred into the mass to cause the alkaline digestion before the liquor is drained from the pulp. The residual heat of the
25 mass at the end of the acid digestion is sufficient for effecting the second or alkaline digestion.

In first effecting the acid digestion by the employment of a sulphite cooking liquor, and
30 then following this by the addition of caustic soda for an alkaline digestion, there are certain advantageous results. There is a higher yield of finished fiber based on the raw material, as there are present during the alkaline
35 digestion, certain sulphur groups (sulphites and probably small quantities of sulphides) which tend to keep the liquor in a reducing condition, simulating to a certain extent the conditions found in the digestion of wood
40 by the "sulphate process" so called. In digesting fiber with alkaline reagents, there is a tendency toward alkaline hydrolysis, which in turn results in a corresponding conversion of alpha cellulose to less resistant cellu-
45 lose. This hydrolysis is minimized by the presence of reducing agents which prevent oxidizing reactions, and this is particularly true when the digestion is carried out in the presence of atmospheric oxygen. This is
50 the underlying principle of sodium-sulphate digestion as compared with soda digestion of wood pulp. In my process, I secure the beneficial results of those conditions during the alkaline digestion which mark the digestion
55 of wood by the sulphate process.

Again by my process, I secure a stronger and cleaner pulp, and one which on bleaching is available for nitration or for conversion into cellulose esters.

What I claim is:

1. A process of producing wood pulp having a high percentage of resistant cellulose, which comprises first digesting wood in an acid sulphite liquor under heat and pressure, adding to the hot mass of wood and
60 acid liquor sufficient alkali to render the liquor alkaline, and further digesting the wood in said hot alkaline liquor. 65

2. A process of producing wood pulp having a high percentage of resistant cellulose, which comprises first digesting wood in a sulphurous acid solution containing sodium sulphite under heat and pressure, adding to the heated mass of wood and acid liquor
70 sufficient alkaline sodium compounds to render the liquor alkaline, and further digesting the wood under pressure in said hot alkaline liquor. 75

3. A process of producing wood pulp having a high percentage of resistant cellulose, which comprises first digesting wood in an acid sulphite liquor under heat and pressure in a closed digester, adding to the hot
80 mass of wood and acid liquor in the digester sufficient alkali to render the liquor alkaline, continuing the digestion in said digester, and separating and washing the resultant pulp. 85

4. A process which comprises first digesting wood in an acid sulphite solution under
90 heat and pressure, adding to the hot mass of wood and acid liquor in the digester sufficient alkali to render the liquor alkaline, continuing the digestion in said digester, separating and washing the resultant pulp
95 from the spent liquor of digestion, and recovering the inorganic compounds from the spent liquor.

5. A process which comprises first digesting wood in an acid sodium sulphite solution
100 under heat and pressure, adding to the hot mass of wood and acid liquor in the digester sufficient caustic soda to render the liquor distinctly alkaline, continuing the digestion
105 in said digester, separating the pulp and the spent liquor of digestion, and recovering the sodium compounds from the liquor.

In testimony whereof I have affixed my signature.

GEORGE A. RICHTER.