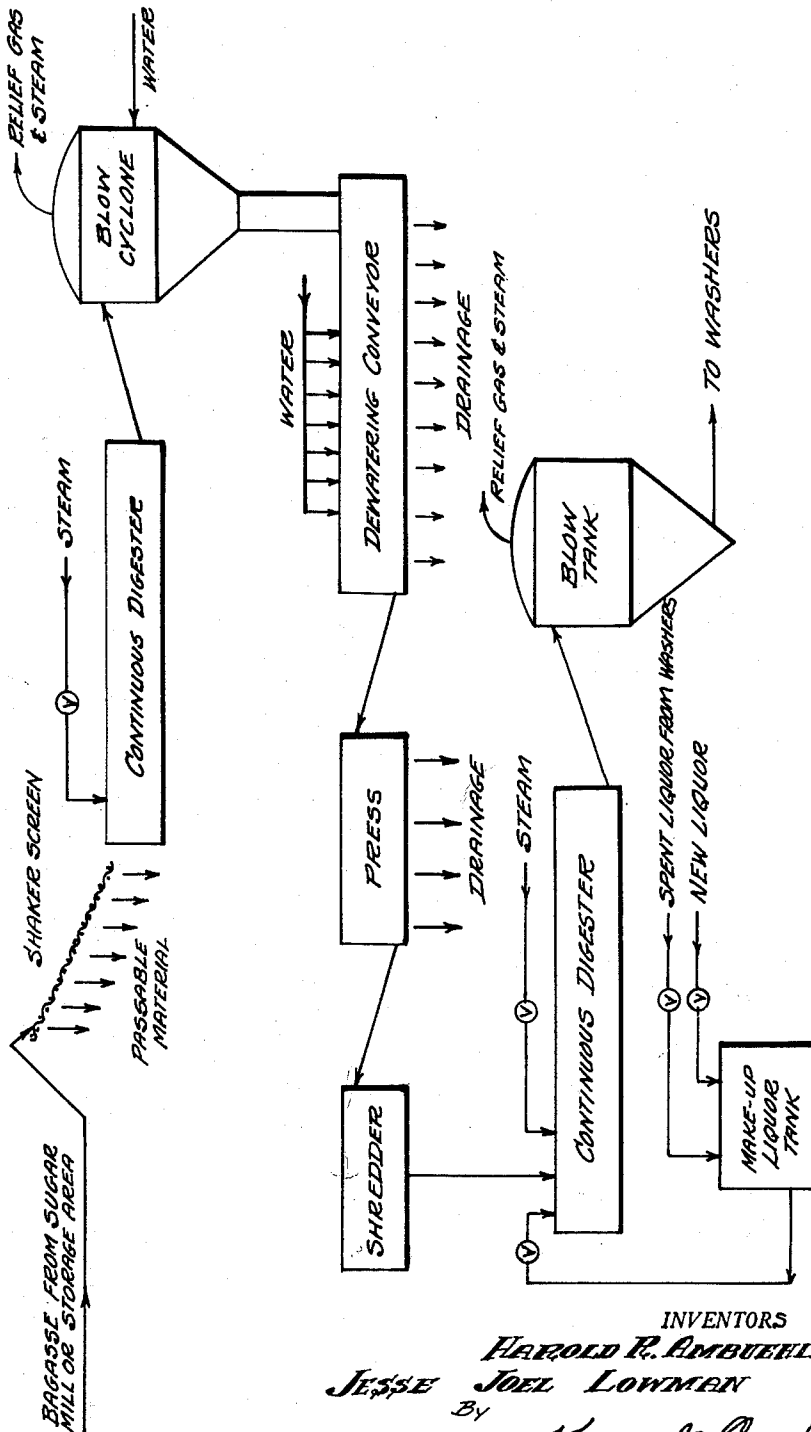


March 12, 1963

H. R. AMBUEHL ET AL
CONTINUOUS PULPING PROCESS FOR THE PRODUCTION
OF PAPER PRODUCTS
Filed March 18, 1960

3,081,218



INVENTORS
HAROLD R. AMBUEHL
JESSE JOEL LOWMAN
BY
Kimmel & Crowell
ATTORNEYS

1

3,081,218

CONTINUOUS PULPING PROCESS FOR THE PRODUCTION OF PAPER PRODUCTS

Harold R. Ambuehl, W. 204 Thorn St., Colfax, Wash.,
and Jesse J. Lowman, R.F.D. 2, Box 400, San Agustin, Fla.

Filed Mar. 18, 1960, Ser. No. 15,993
10 Claims. (Cl. 162-19)

This invention relates to a continuous pulping process for the production of paper products, and has particular applicability to a process for the pulping of sugar cane bagasse or other similar fibrous, non-woody, ligno-cellulose containing plant materials for the manufacture of newsprint or other paper products.

A primary object of this invention is the provision of an improved process for the continuous production of pulp from bagasse or similar material which results in a pulp of exceptionally strong character which is readily bleachable and suitable for use in the production of papers with a high furnish content up to and including 100% pulp furnish.

A further object of the invention is the provision of a continuous process wherein continuous control of the cooking and reaction conditions may be continuously provided, resulting in obtaining the maximum strength in the finished material with a minimum degradation of the cellulose.

A further important object of this invention is the provision of a continuous process of this character which will employ the commonly used presently existing apparatus.

A still further object of the invention is the provision of such a process which is extremely low in cost and relatively rapid.

A further important object of the invention resides in the provision of a process wherein a certain amount of the pith is retained in the processed material, in contrast to the prior art wherein all or most of the pith has hitherto been removed, such pith retention resulting in the improved quality of the end product.

A still further specific object of the invention is in the provision of a process including the step of aqueous digestion with an agent containing NaOH alone or in combination with Na₂S, or elemental sulfur.

A further and still more specific object of the invention resides in the provision of a process wherein the material to be pulped is initially passed over a vibrating screen for the purpose of removing a portion of the dirt, dust and pith-type material, and subsequently treated in a continuous digester and pre-hydrolyzed. The pre-hydrolyzed material is subsequently blown into a cyclone where it is sprayed with water and discharged from the cyclone onto a de-watering conveyor where more water may be added if necessary. The de-watered material is then passed to a press, and subsequently to a shredding device where it is de-compressed for an alkaline cooking stage. This alkaline cooking stage is accomplished by heat treating the material in a continuous digester with an aqueous digesting agent which contains NaOH alone or in combination with Na₂S or elemental sulfur. It is then ready for use. The particular times and temperatures as well as other essential elements of the preceding steps of the process will be more fully discussed hereinafter.

Still other objects of the invention reside in the provision of the specific times, temperatures, conditions, steps and sequence of operation all as will be more fully described hereinafter.

The single FIGURE of the drawing is a schematic flow diagram disclosing the various steps of the process in accordance with the instant invention.

2

Referring now to the particular process in detail, bagasse from a sugar mill, or a storage area, or other suitable similar material of non-woody, ligno-cellulose containing plant substance is first passed over a vibrating screen. The material is screened in such manner that not less than 2% nor more than 30% of the dirt, dust and pith-type material is removed. Such screened material may be utilized for steam generation, or for any other purpose for which it is suitable.

In the second step of the process the screened material is passed to a continuous digester where it is pre-hydrolyzed at a temperature of not less than 140° C. nor more than 190° C., for not less than five minutes nor more than fifty minutes. This step results in obtaining the maximum strength in the finished material with a minimum of degradation of the cellulose. In this pre-hydrolysis step the moisture content is maintained at not less than 65% nor more than 90% by weight of the raw material. The pre-hydrolysis stage permits the material to be heated in its own acid state and by controlling the reaction permits the reduction of the pith and pentosan contents in this and the succeeding steps.

The pre-hydrolyzed material is passed from the continuous digester into a blow cyclone, where it is sprayed with water as it is discharged from the cyclone onto a de-watering conveyor. On this conveyor more water may be added if necessary to maintain a consistency of not less than 3% or more than 20% by weight of oven dry material. A wide moisture range is needed here due to the variations in the age or other condition of the raw material and subsequently the amount of washing for removal of the pre-hydrolysis step liquors.

The de-watered material is then passed to a press where the consistency is increased to an oven dry percentage of not less than 15% nor more than 60%. The wide variation in compression permits the use of most of the pressing equipment which is currently on the market.

The fifth step of the operation consists in passing the pressed material to a shredder where it is decompressed by shredding for the next or alkaline cooking stage.

The sixth step or alkaline cooking comprises a very important element of this process, and in this step the decompressed condition shredded material is passed to a second continuous digester along with an aqueous digesting agent which may contain NaOH alone, or in combination with Na₂S or elemental sulfur. The ratio of the cooking agent to oven dry plant material is not less than 2 to 1 nor more than 12 to 1. The combined amount of alkaline cooking agent chemicals based on the oven dry weight of the plant material is to be not less than 5% nor more than 20%, and will have a sulfidity content of 0% to 35%.

The material is heated under pressure in a blow tank to a temperature of not less than 105° C. nor more than 190° C., and is retained at this temperature for not less than 4 minutes nor more than 30 minutes. After this operation the material is passed to the washers, and is then ready for use.

In the process hereinbefore described variations in temperature and time, as well as consistency and quantity of materials have been set out, wherein the process is applicable within the limits defined. These limits will vary as above stated in accordance with the condition and purity of the material.

It has been found, however, that when using, for example two-year-old bagasse, 100% bagasse pulp has been furnished to a Fourdrinier paper machine to produce commercial grades of salable paper under the following specialized conditions. In the first step of the process 3% of the dirt, dust and pith-type material has been re-

moved, and in the second step the pre-hydrolyzation has been preferably achieved at a temperature of 165° C. for a time of 30 minutes, with a moisture content of 76%. The treatment in step 3 in the blow cyclone has been accomplished at a consistency of 11% by weight of oven dry material. In the fourth step the pressing has been effected to a consistency of an oven dry percentage of 36%. The time of the shredding operation of step 5 is immaterial, and it is continued to completion. In step No. 6 a desirable condition exists where the ratio of the cooking agent to the oven dry plant material is 9 to 1, the sulfidity is 27.7% when utilizing NaOH and Na₂S, and the combined amount of the alkaline cooking agent chemicals based on the oven dry weight of the plant material is 13.6%.

This step is achieved at a temperature of 160° C. for a period of 18 minutes.

The above-described specific process is merely illustrative of one of the more highly desirable combinations or arrangements that are achieved by the process of this inventive concept.

From the foregoing it will now be seen that there is herein provided an improved process for the continuous pulping of 100% sugar cane bagasse, or other similar fibrous, non-woody, ligno-cellulose containing plant materials, which produces a highly satisfactory, exceptionally strong, readily bleachable pulp which may be employed in the production of such paper products as newsprint or the like.

As many embodiments may be made of this inventive concept, and as many modifications may be made in the embodiment hereinbefore shown and described, it is to be understood that all matter herein is to be interpreted merely as illustrative, and not in a limiting sense.

We claim:

1. A continuous process for pulping of fibrous, non-woody, ligno-cellulose containing plant materials which comprises the steps of screening the material to remove a proportion of the dirt, dust and pith-type material therein; pre-hydrolyzing the screened material with a moisture content by weight of oven dry material of from 65% to 90% for not less than five minutes nor more than 50 minutes at a temperature not less than 140° C. and not more than 190° C.; spraying the pre-hydrolyzed material in a blow cyclone; de-moisturizing the material; compressing the material and subsequently shredding the compressed material; passing the completely shredded decompressed conditioned material to a continuous digester along with an aqueous digesting agent containing NaOH; and finally, digesting the material, at a temperature of not less than 150° C. nor more than a 190° C. for not less than four minutes nor more than thirty minutes.

2. The process of claim 1 wherein the aqueous digesting agent includes elemental sulfur.

3. The process of claim 1 wherein the aqueous digesting agent contains NaOH.

4. The process of claim 1 wherein the aqueous digesting agent contains Na₂S.

5. The process of claim 1 wherein the aqueous digesting agent comprises Na₂S plus NaOH with a sulfidity content of approximately 27.7%.

6. The process of claim 1 wherein the fibrous plant material comprises sugar cane bagasse.

7. A continuous process for pulping fibrous, non-woody, ligno-cellulose containing plant materials which comprises the steps of screening the material to remove 2% to 30% of the dirt, dust and pith-type material therein; pre-hydrolyzing the screened material at a temperature of not less than 140° C. and not more than 190° C. for not less than 5 minutes nor more than 50 minutes with a moisture content by weight of oven dry material of from 65% to 90%; spraying the pre-hydrolyzed material in a blow cyclone, moisturizing the material to maintain a consistency of not less than 3% nor more than 20% by weight of oven dry material, compressing the material to increase the consistency to not less than 15% nor more than 60% by weight of oven dry material, subsequently shredding the compressed material, passing the material through an alkaline cooking step in a continuous digester with an aqueous digesting agent containing NaOH in a ratio of not less than 2 to 1 and not more than 12 to 1 with the amount of continuous digester chemical based on the oven dry weight of plant material not less than 5% nor more than 20%, and having a sulfidity content of 0% to 35%, and the material is digested at a temperature of not less than 105° C. nor more than 190° C. for not less than 4 minutes, nor more than 30 minutes.

8. The process of claim 7 wherein the continuous digester contains NaOH and Na₂S.

9. The process of claim 7 wherein the continuous digester contains elemental sulfur.

10. A continuous process for pulping of fibrous bagasse from sugar cane which comprises the steps of screening the bagasse to remove substantially 3% of the dirt, dust and pith-type material therein, prehydrolyzing the screened material with a moisture content by weight of oven dry material of substantially 76% at a temperature of approximately 165°, for approximately 30 minutes, spraying the pre-hydrolyzed material in a blow cyclone, de-moisturizing the material to a consistency of substantially 11% of the oven dry weight of material, compressing the material to increase the consistency to 36%, shredding the compressed material, passing the material through an alkaline cooking step in a continuous digester with an aqueous digesting agent comprising NaOH and Na₂S in a ratio of approximately 9 to 1 with the combined amount of digester chemical equaling substantially 13.6% of the oven dry weight of the plant material and having a sulfidity of approximately 27.7% and digesting the material at a temperature of approximately 160° C. for approximately 18 minutes.

References Cited in the file of this patent

UNITED STATES PATENTS

1,931,575	De La Roza	Oct. 24, 1933
2,625,474	Atkinson	Jan. 13, 1953

FOREIGN PATENTS

210,740	Australia	Oct. 9, 1957
---------	-----------	--------------

OTHER REFERENCES

Ind. & Eng. Chem., vol. 6, No. 10, pp. 1 and 2, May 20, 1928.