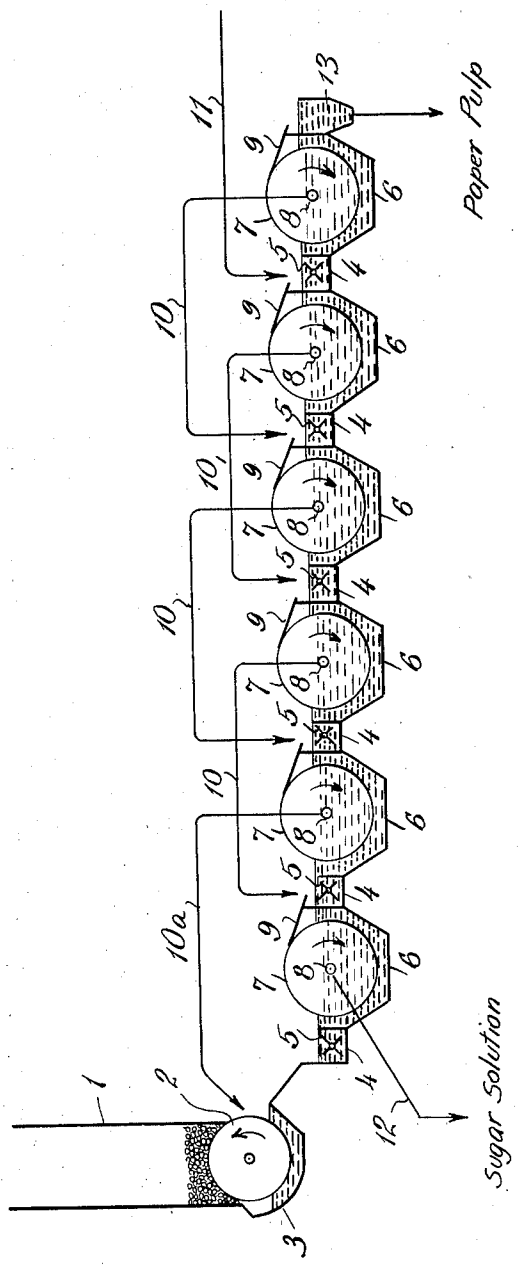
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CELLULOSIC PRODUCT

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UNITED STATES PATENT OFFICE

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CELLULOSIC PRODUCT

Original application filed August 30, 1927, Serial No. 216,348, and in Cuba June 2, 1927. Divided and this application filed April 3, 1928. Serial No. 267,037.

This invention relates to a cellulosic product derived from sugar-cane. A process of producing the product is claimed in my copending application Serial No. 216,348, filed August 30, 1927. This application for the product is made separately in compliance with the requirement for division of said application.

In the production of sugar, particularly from sugar-cane, it has heretofore been the usual practice to tear or crush the cane into shreds and then to pass the shredded cane between heavy rolls by which the saccharine juices are squeezed out of the plant tissues. These rolls are of cast iron, weighing frequently as high as fifteen tons each; and the cane is passed successively through several sets of such rolls adjusted progressively closer together.

In some cases it has been the practice to add water to the cane just prior to passing it through some of the rolls. This dilutes any juice remaining in the cane and facilitates its removal.

It has also been suggested to shred the cane and then after thoroughly drying it to saturate it with water, which is later pressed out carrying with it a large part of the sugars. Another method which has been proposed is to slice or "granulate" the cane and remove the sugar by a diffusion process.

In all of these processes the pieces of cane must be large enough to permit ready diffusion of the water generally about one quarter inch, and the residue is in the form of a coarse stringy mass commercially known as "bagasse". This bagasse has been generally regarded as a waste product and burned in the steam plant of the sugar mill.

However, in recent years, due to the diminishing supply of forest wood, considerable attention has been attracted to bagasse as a raw material for the manufacture of paper pulp. Although much research has been conducted and many plans have been proposed for making paper from bagasse, none has been attended with great commercial success. So far as I am aware, the only important commercial utilization of bagasse is in the production of insulating wallboard, in which, after a special preliminary treatment, the coarse filaments of the bagasse are pressed into a loose felt. The filaments of this board are not to be confused with the fibers or fiber aggregates of a paper pulp, but resemble more closely blades of dry grass or hay.

I have discovered that I am able to recover sugar from the sugar-cane more completely than has heretofore been considered possible, and at the same time to produce a new cellulose pulp in a form which is well adapted for the production of paper, board and other paper pulp or cellulose products.

My process for producing this product consists, briefly, in separating the cane by grinding or abrading it into individual fibers or aggregates of relatively few fibers so small as to be unsuitable for any of the prior methods of sugar recovery. This abrading action will not only separate the fibrous portion into substantially individual fibers but will break or disrupt all the individual cellulose cells which contain the sugar. This comminuted material I disperse in a solvent bath in which it is agitated until the solvent is thoroughly worked into the fibers, the solvent —or, more accurately, the sugar solution— is then separated from the comminuted cane and the latter redispersed in a second bath. In this bath the material is again agitated in the same manner as in the first, after which it is again separated.

These steps of dispersing, agitating and separating are repeated as often as is necessary to complete the separation of sugar from the cane. In order to avoid adding unnecessary amounts of liquid I circulate the solvent counter-current to the cane; that is I add fresh water only to the final bath; and the weak solution separated from each bath becomes the solvent liquid for another until in the initial bath it is removed as relatively concentrated sugar solution and taken to the boiling house.

The fibers of this pulp product, since they have not been subjected to the injurious crushing action of the usual sugar mill, are stronger and altogether more desirable than fibers which have been produced from bagasse

and, having been substantially separated, they are in a condition suitable for the manufacture of paper or board.

I have also found that when my invention is followed a considerable economy in power is effected, since I eliminate entirely the use of crushing rolls and shredders.

In the practice of my invention I prefer to use a combination of apparatus such as I have shown in the accompanying diagrammatic drawing. Each element of this combination is an apparatus already well known to the art. However, I believe myself to be the first to use such apparatus in the present combination, and I believe that the process, as well as the product, resulting from the use of this apparatus is novel.

Referring now to the drawing, I have shown at 1 a hopper or magazine adapted to hold a supply of sugar-cane or other material to be treated. At the bottom of this hopper is a grindstone 2 running in a receptacle 3 containing a bath of solvent liquid. This apparatus will be recognized as a "magazine grinder" known to the art of making wood pulp. The magazine 1 is shaped adjacent the stone 2, so that, as the latter revolves, the cane is crowded against the stone and held from passing through to the receptacle 3. In this way, the individual fibers or fiber aggregates are torn away from the cane, the cellulose cells are ruptured or broken, and both are distributed into the liquid bath, producing a pulp resembling "mechanical" wood pulp or "ground wood". This pulp passes directly to an agitator or mixing box 4, or may first be screened to remove larger pieces of cane which may have found their way into the pulp. An agitator blade 5 in the mixer maintains the pulp in suspension.

The overflow from the mixing box 4 passes into a separator 6, which in the present case is shown as a pulp thickener, well known in the paper making art. In this form of separator a cylindrical screen 7 revolves partially submerged in the pulp so that the water, or liquid, passes through the screen and is drawn through the opening 8, while the solid portion of the pulp is deposited on the screen, carried out of the bath and scraped by the doctors 9 into a second mixing box 4. The pipe 10 discharges the weak solution from a subsequent separator 6 into this mixing box. Any number of separators and mixing boxes may be used according to the nature of the material being treated and the conditions, such as the temperature of the water and the velocity of the passage through the apparatus.

Into the last mixing box fresh water is directed from the pipe 11, and from the first separator the strong sugar solution is discharged through the pipe 12 to the sugar boiling house. The liquid from the second separator is conducted through the pipe 10^a to the grinder 2, where it is sprayed uniformly over the surface of the grindstone. The pulp from the last separator is discharged into the conduit 13, from whence it is taken directly to a paper making plant or to a machine where it is made into pulp lap for shipment. The counter-current washing of the finely divided vegetable material is enhanced by the successive separations of the pulp from the liquid. This repeated separation and redistribution of the water through and into the fibers, thereby dissolving all of the sugar, while the mechanical treatment to which the material is thus subjected produces a further separation and "brushing out" of the fibers, which reduces the amount of beating required in the subsequent treatment of the paper pulp.

If the pulp is to be used immediately in the manufacture of paper or board, one or more of the agitators may be of the type known to the paper art as "continuous beaters", having a perforated back-fall through which the beaten pulp is withdrawn to the separators. Likewise, each of the units of the apparatus is intended to be exemplary, and I may use any other units which accomplish similar results.

I have found in practice using the process and apparatus described above that it is possible to obtain almost complete extraction with only thirty percent dilution of the natural juice content of the cane. This is materially less than is required, for example, in the continuous diffusion apparatus now used in the beet sugar industry. Since all of the water must be evaporated, it is evidently important to reduce to a minimum the amount of water added during the extraction of sugar from the cane.

I believe that the increased efficiency of my extraction process is in a large part due to the reduction of cane to minute particles—aggregates of relatively few fibers each mixed with the pithy part in which all the cells are ruptured. Because of this thorough separation, every cell of the plant tissue is exposed to the leaching action of the solvent and a substantially complete extraction of the sugar takes place. In the accompanying claims I have used the term "fibers" to define this separation into individual fibers or aggregates of relatively few fibers and to distinguish from the shredding and separation into relatively coarse filaments as known to the prior art.

It is preferable in the leaching process to use as solvent only distilled water. A cheap source of distilled water for this purpose is found in the condensed vapors from the evaporators in the sugar house. In this way all unnecessary impurities, which might be introduced with the solvent, are avoided and the sugar refining simplified to that extent.

It has heretofore been thought necessary when preparing bagasse for paper making to separate the pith from the fibers of the cane.

I have found, however, that when the cane is treated according to my novel process this is unnecessary and a good grade pulp is produced utilizing all of the cellulose contained in the cane. The fiberless cellulose in which the cells have been ruptured may even improve the quality of the paper, since it is readily hydrated to form a binder for the fibers. My pulp resembles in many respects mechanical or ground wood pulp and may be similarly used alone or in admixture with chemical pulps for the production of newsprint, board, etc., etc. Also, the fibers may be subjected to a chemical treatment to dissolve any remaining non-cellulose material for the production of pure cellulose or chemical pulp. Such chemical treatment is greatly facilitated by the comminuted condition of the pulp.

I claim:

1. The cellulosic product comprising abraded sugar-cane from which substantially all sugar has been removed.

2. The cellulosic product comprising abraded sugar-cane from which substantially all sugar has been removed and which contains the water-insoluble non-cellulose constituents of the cane.

3. The cellulosic product comprising abraded sugar-cane fibers and sugar-cane pith from which substantially all sugar has been removed.

4. The cellulosic product comprising abraded sugar-cane fibers and sugar-cane pith from which substantially all sugar has been removed and containing the water-insoluble non-cellulose constituents of the cane.

5. The cellulosic product comprising sugar-cane fibers substantially separated and purified by the removal of the water-soluble matter therefrom and in which the cells of the non-fibrous cellulose have been ruptured.

6. The cellulosic product comprising sugar-cane fibers and sugar-cane pith in which the cells have been ruptured and which contains practically no water-soluble materials.

7. A fiber board comprising abraded sugar-cane from which substantially all sugar has been removed and which contains the water-insoluble non-cellulose constituents of the cane.

8. A fiber board comprising abraded sugar-cane fibers and sugar-cane pith from which substantially all sugar has been removed and containing the water-insoluble non-cellulose constituents of the cane.

9. A fiber board comprising sugar-cane fibers substantially separated and purified by the removal of the water-soluble matter therefrom and in which the cells of the non-fibrous cellulose have been ruptured.

10. A solid fiber board comprising abraded sugar cane from which substantially all sugar has been removed and which contains the water-insoluble non-cellulose constituents of the cane compressed together into a solid mass without air spaces.

In testimony whereof I affix my signature.

E. ANTONIO VAZQUEZ.