This invention relates generally to a process for treating sugar cane bagasse and more particularly to a method for treating bagasse from which the sugar containing juice has been expressed to separate it into a pulp component and a fiber component.

Bagasse is the name given to the cellular material which forms the remains of sugar cane after the sugar containing juice has been extracted. In processing raw sugar cane, the cane stalks are first fed into a crushing roller and then into a series of roller type mills which squeeze the cane and force the sugar containing juice from the broken cells for further processing and refining treatment. After substantially all of the sugar containing juice has been expelled from the cane, the remainder, which is then called bagasse, consists of relatively long fibers of substantially pure cellulose together with a large amount of pith, which consists of broken cells and other materials, as well as 2 to 3% by weight of retained sugar. At this stage, the moisture content of the bagasse is relatively high, generally ranging between 48 to 52% by weight. Heretofore, it has been customary to use this bagasse as a fuel for heating and refining the expressed juices, but this is relatively inefficient because of the high percentage of retained moisture in the bagasse. It has been recognized that the long cellulosic fibers retained in bagasse have a high degree of potential utility for such purposes as paper pulp and the like, but the presence of the retained pith has heretofore prevented the effective and economical utilization of the fiber because of the detrimental effect of the retained pith on the finished product. For example, if it is attempted to make paper from a pulp containing a large amount of retained pith, the paper is brittle and of extremely poor quality.

Although the bagasse as it leaves the last juice extracting mill contains a certain amount of loose pith which is easily removed, a large amount of pith remains tightly attached to the fibers and causes them to adhere together and thereby interferes with further processing of the fibers. Heretofore, it has been proposed to treat the bagasse with further milling processes using hammer mills or disc mills in which the bagasse is subjected to a fluid treatment in an effort to provide a washing action to aid the mechanical process in separating the pith particles from the fibers. However, such processes have not been able to produce a finished fiber of high enough purity at a low enough cost to allow its industrial use. It is therefore a primary object of this invention to provide a novel and improved process for treating bagasse as it is discharged from the final sugar extracting mill to separate it into a pulp fiber and pith components.

It is another object of this invention to provide a process as set forth in the preceding object in which the separation of the pith from the fiber is accomplished dry without the addition of any water, steam or other fluid to the bagasse before or during the separation treatment.

It is another object of this invention to provide a novel and improved process for treating bagasse to separate it into fiber and pith components in which each of these components has a high degree of purity and is relatively free from contamination by the other component.

It is still another object of this invention to provide a new and improved process for treating bagasse to separate it into fiber and pith components which is adapted to receive the bagasse directly from the sugar mill and to process it in a simple, rapid and economical manner so as to allow the treatment to take place as a continuous process which may be incorporated with the earlier steps of treating the cane during the sugar refining process.

Other objects and advantages of this invention will readily become apparent to those skilled in the art upon a more complete understanding of the invention as described in the following detailed description and as illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a diagrammatic showing of the process for treating the sugar cane bagasse to separate it into its fiber and pith components;

FIGURE 2 is a detailed diagrammatic showing of the equipment used for separating the pith from the fiber; and

FIGURE 3 is a perspective view of parts broken away of the apparatus shown in FIGURE 2.

Turning now to the drawings in greater detail, the raw sugar cane is processed by first passing it through pressure rolls 10 after which it is passed through a series of mills 12, 14, 16, 18 and 20 which serve to squeeze the sugar containing juice from the cane in the well known manner. The bagasse is discharged from the last mill 20 and at this stage it contains approximately 2 to 3% by weight of sugar and about 48 to 52% by weight of moisture. From this last mill 20, the bagasse is discharged into the separating apparatus indicated generally at 22 where it is received in the hopper 24 (see FIGURE 2). The hopper 24 contains a rotary metering unit 25 to prevent clogging in the hopper and to insure a steady rate of feed of the bagasse into the separating apparatus. From the hopper 24, the bagasse enters an elongated cylindrical chamber 27 through the inlet indicated at 28.

In the chamber 27, a shaft 30 passes from end to end therethrough and is driven by a suitable drive motor indicated at 31. The shaft 30 has a number of hubs 33 spaced along its length, and on each of these hubs 33 is pivotally attached a swinging hammer 35. The hammers 35 are generally arranged to form a helix so that they will gradually move the material in a helical path within the chamber from the inlet 28 to the opposite end in a gradual manner. The hammers 35 have rounded ends 36 which extend adjacent the walls of the chamber 27 and serve to agitate the bagasse and cause the fibers to be rubbed vigorously across each other. This action, which separates the pith from the fibers is accomplished by the internal friction of the fibers rubbing against each other as they are agitated rather than by actual contact with the swinging hammers 35. The rounded ends 36 are provided to prevent any cutting or chopping of the fibers which would destroy their value for later use.

It will be appreciated that the fibers are relatively long and thin but are held together by the pith which takes the form of relatively small cells, some of which may contain residual materials and often a certain amount of silica and other hard materials which aid the rubbing action to scrub the fibers until the fibers are separated from one another and the tightly clinging pith is removed.

By the time the material reaches the outlet 38 at the end of chamber 27 away from inlet 28, substantially all of the pith has been removed and substantially pure fibers are discharged from the outlet 38 into a suitable receiving container 39.

The bottom wall portion of chamber 27 is formed with a fine screen 42 to allow the pith to be removed from the
fibers as rapidly as it is broken loose. The pith falls through the screen 42, which is made fine enough so as to prevent the passage of fibers, and falls into a channel 43 extending along the underside of chamber 27 below the screen. The channel 43 contains a screw conveyor 45 driven by a motor 46 and adapted to convey the pith therein in the opposite direction to that in which the material is being conveyed in chamber 27. That is, the pith is conveyed from the end adjacent the outlet 38 back to the end adjacent the chamber inlet 28 where it is discharged to a passageway 48 to pass into a pith receiving container 50. The discharge passageway 48 is provided with the fan 52 driven by a suitable motor 53 to provide a continuous current of air from the chamber 27 passing radially through the screen 42 into the pith channel 43 and thence through the discharge passageway 48. This air serves to prevent the moisture on the bagasse from allowing the pith particles to adhere to the fiber and by the action of the air stream, the pith particles are caused to separate and pass through the screen 42 without clogging.

The depithed fiber which accumulates in the container 39 consists almost entirely of pure cellulose fibers which are then ready for further processing for the manufacture into pulp suitable for paper making. Generally, this fiber is substantially free of pith which will be present only in the amount of a few percent of the total by weight.

The pith which is collected in the container 50 has only a small amount of fiber mixed with it, and this fiber is generally of very short length which does not interfere with the utilization of the pith as a filtering or absorbent material or further use as a fuel, feed or fertilizer.

The following represent three examples of runs of different varieties of bagasse which was processed by the aforesaid process directly after discharge from final sugar expressing mill. In each case, the initial moisture content was approximately 50%, and the yield percentage is based on dry bagasse free from dirt and soluble material which are included in the pith content in the final composition of the fiber.

<table>
<thead>
<tr>
<th>Run</th>
<th>Bagasse Variety</th>
<th>Original Composition</th>
<th>Final Composition</th>
<th>Yield of Pith Fiber</th>
<th>Pith Fiber Pith Fiber</th>
<th>Pith Fiber Pith Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F. 31-436</td>
<td>30.4 69.6 94 6 7.9 92.1 99%</td>
<td>30.4 69.6 94 6 7.9 92.1 99%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>F.O.J. 2755</td>
<td>34.6 65.4 94 6 7.9 92.1 99%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>C. 30-52</td>
<td>21.9 78.1 94 6 7.9 92.1 99%</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

While the preferred method of practicing this invention has been described in considerable detail, it is recognized that the invention is not limited to the specific details and apparatus shown and described and various modifications and rearrangements may be made by those skilled in the art without departing from the scope of the invention as defined in the following claim.

What is claimed is:
A dry process of producing substantially pith free fiber from bagasse comprising feeding at a metered rate, fresh fragments of bagasse having a moisture content of up to 50 percent in one end of a fixed cylindrical vessel having a treating zone including a circumferentially continuous inner surface of unobstructed uniform diameter, at least a portion of said surface being a foraminous material, moving the fragments of bagasse in a helical path around the inner periphery of the vessel from said one end to the other end by contact with rotary agitating members rotating at an angular speed sufficient to maintain the bagasse fragments spread in a layer over the inner surface of the vessel to subject the bagasse to transverse rubbing because of the differential speed between the portion of the bagasse at a zone adjacent the surface of the vessel and a zone radially inward adjacent the agitating members whereby the individual fibrous fragments of bagasse are forced across each other by reason of the differential speed of rotation to loosen the pith particles therefrom while subjecting the fragments to an outwardly directed radial current of air over the foraminous portion of the periphery of the vessel so as to prevent the moisture from causing the pith to adhere to the fiber and to remove the loosened pith particles, and discharging processed bagasse fibers from said other end of said vessel to produce a fiber containing less than 9 percent retained pith particles.

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