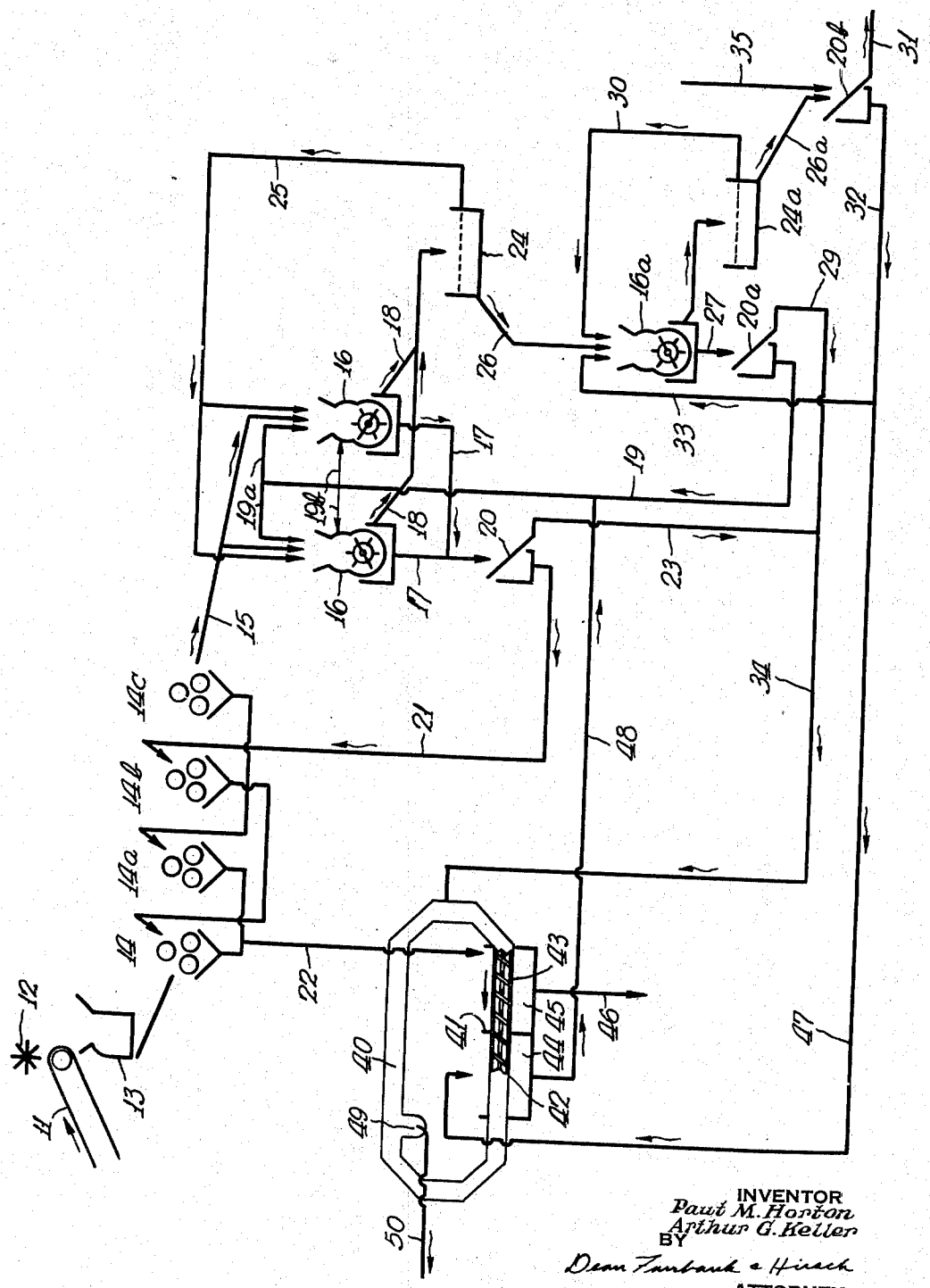
Aug. 25, 1953 P. M. HORTON ET AL 2,650,176

METHODS OF SEPARATING SUGAR JUICE, PITH, AND FIBER FROM STALKS

Filed Oct. 18, 1949




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Patented Aug. 25, 1953

2,650,176

# UNITED STATES PATENT OFFICE

2,650,176

## METHODS OF SEPARATING SUGAR JUICE, PITH, AND FIBER FROM STALKS

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Application October 18, 1949, Serial No. 121,947

8 Claims. (Cl. 127—43)

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This invention relates to the treatment of sugar cane or other pith, fiber and sugar containing stalks such as sorgo, corn or maize, and the main object of the invention is to recover economically and substantially completely the sugar containing juices.

A further object is to recover all of the pith and all of the fibrous material, and in such form that they constitute valuable by-products.

The fiber is suitable for conversion into pulp by conventional paper making processes, while the pith can be employed as an absorbent in the manufacture of explosives, of animal feeds, and as animal litter or agricultural mulch.

Although various different types of sugar bearing stalks may be employed, the specific embodiment hereinafter described is particularly adapted for the treatment of sugar cane. Our process, while ordinarily intended for use after the last mill in existing milling plants, can be used on cane which has been shredded by passage through a conventional swing hammer mill. In other words, our process, used after a swing hammer mill or shredder, can replace completely the conventional rolling mills used in cane sugar manufacture.

As a further feature, the juice extracted from the cane is filtered through a bed of the pith to remove suspended matter from the fiber, and preferably such bed is a moving one, so that residual juice may be washed from the pith bed and the wash water returned to the system.

The present invention does not involve any improvements in any specific unit employed in the system, with the exception of the juice filter. Therefore, in the accompanying drawings the different units are shown diagrammatically, and it will be understood that in commercial practice each of the units may be any one of various different types suitable for the purpose.

In the accompanying drawing one form of apparatus which may be used is diagrammatically illustrated.

In the apparatus as illustrated, the sugar cane is fed by a conveyor 11 to knives 12 which cut the stalks into short sections. These are delivered to a hammer mill or shredder 13 which breaks up the sections of stalks and forms a mat which is delivered to a mill of any suitable type, and preferably that in which the material passes over a plurality of pairs of rollers and is pressed against each pair by a superposed roller so as to further crush the cane and squeeze out a major portion of the juice. A single mill may be employed, but it is preferable to employ a

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plurality of the mills. As diagrammatically illustrated, the mill has four sections or sets of rollers 14, 14a, 14b and 14c, and the juice extracted in the last mill is delivered to the second mill 14a, the juice from the third mill 14b delivered to the first mill 14, and the juice from the first and second mills delivered through a pipe 22 for filtration as hereinafter described.

The bagasse, containing some sugar, is delivered from the last mill 14c onto a chute 15 or other suitable conveyor, to one or more mills 16, in which the fibers and the pith are separated and residual juices washed from both fractions. These mills 16 are preferably of the type shown and claimed in our copending application Serial No. 103,268, filed July 6, 1949, and include beaters which break up the bagasse in the presence of water to liberate the pith from the fiber and separately deliver these constituents, each substantially free of the other.

The pith, suspended in water, is discharged from the mills 16 through pipes 17, and the fibers are discharged through a chute or pipe 18. The mills 16, as shown, are arranged in parallel, but they may be arranged in series, with the second taking the fiber and water from the first, but each separately discharging the pith. The beating and breaking up of the bagasse in the mills 16 is in the presence of water which may be delivered into the upper portion of each mill 16 through a pipe 19 which has separate branches, one leading to each mill 16. There are illustrated two branches 19a and 19b for each mill, one discharging onto the fiber entering the mill and the other discharging into the material within the mill. The water delivered through the pipe 19 is taken from the system at a later point in the processing, as hereinafter described, and contains some sugar juice, from which pith and fibers substantially free of sugar have been removed.

The water discharged through the pipes 17, and which contains the major portion of the pith, has the pith separated therefrom by any suitable means. As shown, there is provided an inclined screen 20 onto which the pith and water are delivered, and by means of which they are separated. The water, free of pith and containing some sugar juice, is returned through a pipe 21 to one of the cane crushing and pressing mills. As shown, it is delivered to the third mill 14b so that this portion of the sugar is united with that extracted by this mill 14b and delivered from the latter to the first mill, so that all of the sugar juice is discharged through pipe

22. The pith separated at the screen 20 is delivered through a pipe 23 and, as hereinafter explained, later used for filtering the juice delivered from the mill 14.

The water carrying the fiber separated in the mills 16, and substantially free of pith, is delivered by the pipes 18 to a tank 24, where the fiber settles to the bottom. The supernatant liquid which contains some sugar and fine floating material, is drawn off from the upper part of the tank through the pipe 25, and is returned to the mills 16 for wetting the bagasse which is being separated into pith and fiber.

In the form illustrated there are employed two of the mills 16 arranged in parallel. It will of course be obvious that these two may be arranged in series if desired, or that one might serve the purpose of the two.

Preferably an additional pith and fiber separating mill 16a is employed, which is arranged in series with the mills 16. To this mill 16a there is delivered through the pipe 26 fiber which is drawn off from the tank 24, and which may still contain some pith and sugar juice.

The pith and sugar containing juice are delivered from this mill 16a through a pipe 27 to a screen 20a, and the water containing some residual sugar juice is returned to the mills 16 through the pipe 19, hereinbefore referred to, and used to wet the material being processed in the mills 16. The pith separated by the screen 20a is delivered through a pipe 29 which joins the pipe 23 carrying pith from the screen 20, and is used for filtering as hereinafter described. The fiber from the mill 16a is delivered to a tank 24a in which the fiber settles to the bottom, and the supernatant water is delivered through a pipe 30 to wet the material being treated in the mill 16a. The water containing some juice and the settled fibers is withdrawn from the tank 24a through a pipe 26a and delivered to a screen 20b which removes the fibers. The fibers may be further washed, if desired, by water delivered to the screen by pipe 35 and delivered through a pipe 31 for drying, storage, or other purpose. The wash water passing through the screen 20b is delivered through a pipe 32, and a portion of this may be delivered through pipe 33 where it, together with the water delivered through the pipe 30, is used to wet the material in the mill 16a.

The pith separated by the screens 20 and 20a and delivered through the pipes 23 and 29 are united, and all of this pith is delivered through the pipe 34 for the filtration of the juice, as hereinafter described.

All of the fiber separated in the mills 16 and settled in the tank 24 is delivered to the mill 16a, and all of the fiber separated in the mill 16a and settled in the tank 24a are separated from the liquid by the screen 20b, and delivered through the pipe 31 for storage.

The sugar juice separated from the pith in mill 16a goes back to mills 16; the sugar juice separated from the pith discharged from mills 16 goes through pipe 21 back to mill 14b; the sugar juice separated from fiber in tank 24 goes to mill 16a, and a part of the sugar juice separated from fiber in tank 24a goes through pipe 33 to mill 16a. The pith, after being separated by the screens 20 and 20a, is used to filter further solids from the juice. Residual sugar is then washed from the filter bed by the liquid which has passed through screen 20b, and the wash water is returned to the system.

As previously noted, the pith may be and preferably is employed to form a filter bed for the sugar juice. The bed is preferably a progressively advancing one, to one end of which the pith is continuously delivered, and from the other end of which pith with impurities is continuously withdrawn. The pith, after serving as a filter, is washed, and the sugar returned to the system. For this purpose there is employed a closed loop conveyor for the filtering material, and which in structural design may embody certain parts similar to those shown in the Sinden Patents 2,155,874 and 2,465,287.



As diagrammatically illustrated there is provided an annular chamber 40 within which there is mounted an endless conveyor 41 which may be slowly driven in any suitable manner, and from any suitable source of power. Two portions 42 and 43 of the lower wall of the chamber are porous, and one of these forms the top wall of a collecting chamber 44 and the other forms the top wall of a collecting chamber 45. The pith collected on the screens 20 and 20a and delivered through the pipes 23 and 29, is conveyed through the pipe 34 to the chamber 40 adjacent to one end. The juice from mill 14 is delivered through pipe 22 to the chamber 40 adjacent to the rear end of the chamber 45, and in flowing through the pith being advanced by the conveyor 41, is filtered, collected in the chamber 45, and discharged from the system through the pipe 46.

A portion of the wash water which has passed through the screen 20b, and delivered by the pipe 32, is conveyed by a pipe 47 to a point above the rear end of the chamber 44. It there flows through the filter bed to wash residual sugar juice from the bed, and collects in the chamber 44 from which it is returned to the system through pipe 48. The pith which is delivered to the conveyor through the pipe 34 is continuously advanced by the conveyor 41. The residual sugar juice having been washed therefrom, the pith now drops into a pocket 49 on the lower side of an upper run of the conveyor and is discharged from the system through a pipe 50.

Thus, from the cane or other sugar bearing material delivered to the system by the conveyor 11, there are produced three products. All of the sugar juice, substantially free of pith or fiber, is discharged from the system through the pipe 46; all of the fiber washed free of pith is discharged through pipe 31; and all of the pith which has been separated from the fiber and used as a filter bed is discharged from the system through the pipe 50. It will therefore be seen that by our improved process the three main ingredients of the cane, namely sugar, pith and fiber, are substantially completely separated, and the maximum amount of each is recovered.

It will be obvious that suitable valves for controlling the flow of the various materials, and pumps for effecting the flow, would be used, but as these are conventional they have not been illustrated.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. The method of purifying sugar containing juice obtained from crushed stalks containing sugar, pith and fiber, said method including separating the juice from the crushed stalks, breaking up the crushed stalks, separating the pith from the fibers in the presence of water, filtering the juice through the pith, washing sugar juice from the pith, and returning the wash water to the stalks being broken up.

2. The method of recovering valuable products from stalks having sugar containing juice, which includes the step of crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water and separating the fibers from the pith, removing sugar containing water from the pith and returning it to the stalks being crushed, removing sugar containing water from the fibers, and returning it to the stalks being broken up.

3. The method of recovering valuable products from stalks having sugar containing juice, which includes the step of crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water and separating the fibers from the pith, removing sugar containing water from the pith and returning it to the stalks being crushed, removing sugar containing water from the fibers and returning it to the stalks being broken up, forming a filter bed from the pith, and filtering the sugar juice through said bed.

4. The method of separating and recovering the pith and fibers of stalks having sugar containing juice, and purifying said juice, which includes the step of crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water and separating the fibers from the pith, removing sugar containing water from the pith and returning it to the stalks being crushed, removing sugar containing water from the fibers and returning it to the stalks being broken up, forming a filter bed from the pith, progressively advancing said filter bed, filtering the sugar juice through one portion of said bed, washing residual juice from said bed at another point in its path of movement and by the water used in washing the fibers, and returning said water to the pith and fibers being separated.

5. The method of separating and recovering the sugar juice, pith and fibers of sugar containing stalks, which includes continuously advancing and crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water to free the pith from the fibers, separating the fibers from the pith and water, separating the pith from the water, returning the water to the stalks being broken up, delivering the pith to and forming therefrom a continuously advancing filter bed, delivering through said filter bed the juice pressed from said stalks, and washing sugar juice from the fibers and returning it to the stalks being crushed.

6. The method of separating and recovering the sugar, juice, pith and fibers of sugar containing stalks, which includes continuously advancing and crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water to free the pith from the fibers, separating the fibers from the pith and water, separating the pith from the water, returning the water to the stalks being broken up, delivering the pith to and forming therefrom a continuously advancing filter bed, delivering through said filter bed the juice pressed from said stalks, and washing sugar juice from the fibers and returning it to the crushed stalks being broken up.



7. The method of separating and recovering pith, fibers and sugar containing juices from stalks and purifying said juice, which method includes continuously advancing and crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water to free the pith from the fibers, removing the fibers from the water containing sugar and pith, separating the pith from the water and returning the water and contained juice to the stalks being broken up, forming a filter bed from the pith, progressively advancing the filter bed, filtering the sugar juice through the forward end portion of said filter bed, washing the terminal portion of said filter bed to remove residual sugar therefrom, and using said wash water to remove juice from the broken up stalks.

8. The method of recovering separated pith, fibers and sugar containing juices from stalks and purifying said juice, which method includes crushing the stalks and pressing therefrom the major portion of the juice, breaking up the crushed stalks in the presence of water to free the pith from the fibers, forming a progressively advancing bed from the pith, filtering the sugar juice through a portion of said filter bed, washing sugar juice from the terminal portion of said filter bed, and returning said wash water to the pith and fibers where they are being broken up and separated.

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