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COUNTER-CURRENT DIFFUSION TOWER

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Fig 1

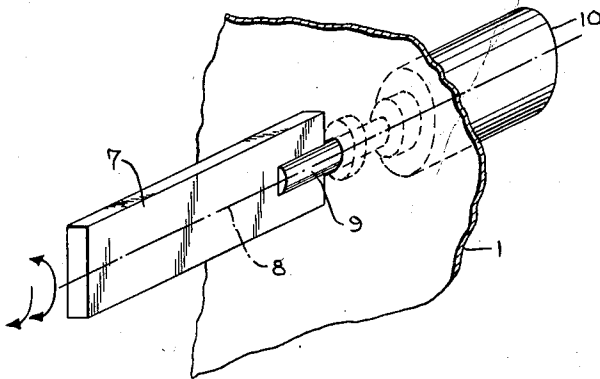
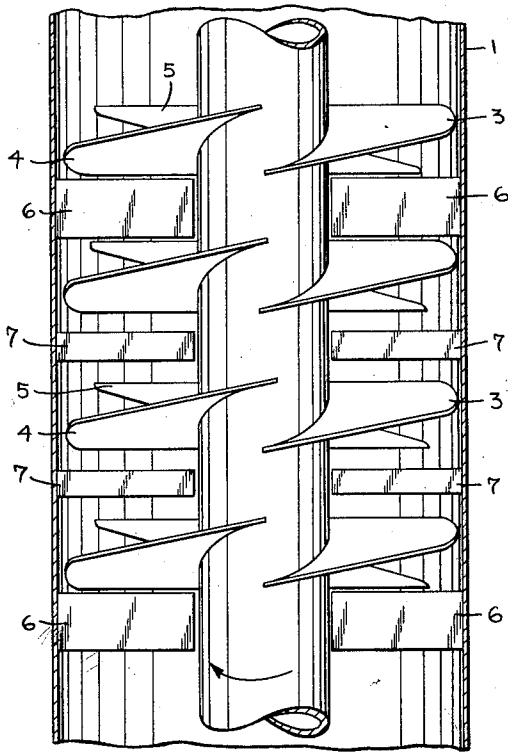


Fig 2

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COUNTER-CURRENT DIFFUSION TOWER

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3 Claims. (Cl. 127—7)

This invention relates to the continuous extraction of comminuted vegetable matter and particularly of sugar beet chips and comminuted sugar cane by diffusion.

For this purpose, vertical extraction towers are being used at a steadily increasing rate.

These vertical towers are circularly shaped; the materials to be extracted are conducted through these towers in an upward direction, whereas the extraction fluid flows in an opposite downward direction.

The manner of charging and conducting the chips may vary; outside screw conveyors are being used which are located at the periphery of the towers and lead into the lower portion thereof; the screw conveyors may also be housed in a tube located in the tower, the materials to be extracted being fed into the upper portion of the tower and transported through the same in a downward direction; thereupon, the traveling direction is reversed and the charge is conducted in the operative sphere of a counter-currently operative main conveyor.

Methods are also known, where the charge to be extracted is pumped into the lower portion of the tower and supplied into the operative range of a screw conveyor effecting the upward travel thereof.

A particular difficulty prevails with regard to the operation of these extraction towers which is caused by the maintenance of a constant all-over surface contact of the charge components during its upward travel with the downflowing extraction fluid.

It is presently the general belief of the art that this important problem may be satisfactorily solved by subdividing the screw conveyor into interrupted separate parts and by locating flow retarders in the spaces or interstices between these individual conveyor parts or sections.

These retarders are in most cases vertical plates fastened to the inner wall of the tower and radially extending into its inner space; a plurality of superposed retarders is generally provided. The retarders extend vertically through the entire height of the spaces between the individual sections or portions of the interrupted screw conveyors and it is the general belief that these retarders, if distributed along the inner face of the tower, effect an upward transport of the chips in the form of coherent bodies or packages. This package-type transport of the chips was considered to be necessary as it is assumed that in this manner the downflowing extraction liquid would be distributed over the cross section of the chip packages or bodies, that the same, therefore, would be uniformly passed-through by the liquid and that all chips contained in the packages would be contacted by the liquid.

Extensive observation has indeed proven that the "package" transport of the chips, whereby the packages completely fill the vertical spaces between the screw conveyor portions, advantageously influence the extraction and the diffusion capacity of the towers.

However, in accordance with experience made by the inventor a great disadvantage of this measure prevails

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insofar as it is impossible to control the density and resistive capacity of these chip packages, to cause them to pass through the tower with a constant uniform speed and remain permeable by the liquid solvent. During the transport of these chip packages through the tower frequent cloggings and stoppages occur, which cause a great pressure increase in the interior of the packages. The cause of these difficulties has never been ascertained.

Investigations carried-out by the inventor resulted in the following entirely novel and surprising recognition. It was found that the hitherto customary practice of transporting the chip packages or chip bodies through the extraction at the usual small rotary speed of the screw conveyor greatly restricts the leaching efficiency and operative capacity of the towers. Moreover, the surprising fact was ascertained by the inventor that a height reduction of the retarder plates eventually in combination with an increase of the rotational speed of the screw conveyor causes a surprising change of the working conditions. Therefore, in conformity with the invention the height of the retarder plates is kept smaller than the smallest distance between two directly superposed screw conveyor threads.

The retarder plates located in the spaces between two successive screw conveyor portions or threads were converted by the increased rotational speed into vertebral elements, whereby the chips between the individual screw threads were energetically acted upon, agitated, and simultaneously circularly and axially displaced.

Due to the height reduction of the retarder plates the space between two adjacent screw conveyor threads is incompletely filled. The degree of this height reduction will depend upon the nature and particular properties of the chips; the reduced height of the retarder plates should preferably vary between about one fourth and three fourths of the smallest height between the successive screw conveyor sections.

If very finely divided chips are treated the height of the retarder plates should be increased.

Since the size of the chips often varies it is advisable to make the retarder plates' height variable. This object may, for instance, be realized by making the retarder plates rotatable about a horizontal axis; by the rotation of these retarder plates about their horizontal axis the vertical height will vary.

The retarders may also be shaped to act as swivellers by making the same swingable about a horizontal axis; it is interesting to note that the retarding action exerted upon the upwardly moved chips was not handicapped or interfered with by the movement of the retarders, whereas, as already stated above, the diffusion and washing efficiency was greatly improved.

In the known chip extraction towers having vertical flow retarding or damming plates vertically extending throughout the full height of the spaces between two conveyor screw sections the rotational speed of the screw conveyor is adjusted to a 0.6 to 1.3 rotations per minute. In conformity with the invention the rotational speed amounts to between above 1.3 and up to 6 rotations per minute.

In order to further improve the extraction at least four retarders are provided. The length of the individual retarders in the radial direction of the tower may vary.

The above recited measures serve to greatly increase the turbulence of the comminuted chips in the individual superposed transporting zones.

It was found that by the application of the invention the extraction losses of sugar are reduced to about 50 per cent at an equal discharge rate of the extraction fluid.

The invention will now be described more in detail and with reference to the attached drawing.

In the drawing:

Fig. 1 is a vertical sectional view of a diffusion tower for the extraction of sugar beet chips in conformity with the invention, and

Fig. 2 is a perspective view of a retarder plate applied to the inner face of the tower.

The charge such as particularly comminuted sugar beet chips is upwardly moved in the tower 1 in an opposite direction to the downflowing extraction fluid.

The lifting of the charge is effected by an interrupted or subdivided screw conveyor provided with superposed groups of vanes 3, 4, 5.

In the hitherto customary extraction towers vertical flow retarder plates 6 are disposed between individual conveyor screws or portions, which extend throughout the entire height of the spaces between these conveyor screws and are fixed to the inner wall of the tower. The retarders 7 constructed in conformity with the invention only extend through a portion of the spaces or the height between two conveyor screw sections; consequently, the charge is enabled to move and to rotate independently relative to the action of the retarder plates 7. The invention, as explained before, therefore, utilizes this important action of the retarder plates at the same time eliminating their disadvantages.

The retarders or damming plates 7 may be fixed to the tower for a rotation about their horizontal axis 8, 9, see Fig. 2, by a motor 10.

The rotatable plates 7 may be fastened to the tower in any desired also inclined position.

The invention is not only successfully applicable to the extraction of sugar beet chips but also well usable for a washing and particularly cellulose washing action.

Since certain changes in carrying out the above process could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. An extraction tower for comminuted vegetable matter and particularly for sugar beet chips comprising a center shaft, an interrupted screw conveyor subdivided by said shaft into superposed sections, said sections defining vertically superposed free spaces between adjacent threads thereof, said threads serving to transport the charge of said chips upwardly, means to conduct a leaching fluid in opposite direction to the upwardly moved charge, radially extending vertical flat flow retarder plates connected to the tower in said spaces having a height which is less than the smallest distance between two successive screw conveyor threads, said retarder plates being adapted to rotate.

2. In an extraction tower according to claim 1, means for driving the screw conveyor at a rate of 1.3 to 6 rotations of the screw conveyor per minute.

3. In an extraction tower according to claim 1, means for vertically adjusting said retarder plates to vary their operative heights.

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