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[54] **METHOD FOR FEEDING MATERIAL TO A MECHANICAL PRESS**
4 Claims, 9 Drawing Figs.

[52] U.S. Cl. **100/37,**
 100/74, 100/92, 100/130; 198/66
 [51] Int. Cl. **B30b 9/02,**
 B30b 12/00
 [50] Field of Search 100/37, 38,
 73, 74, 75, 92, 93, 117, 118, 130, 131; 198/52, 53,
 54, 66, 57, 58; 214/(Inquired)

[56]

References Cited

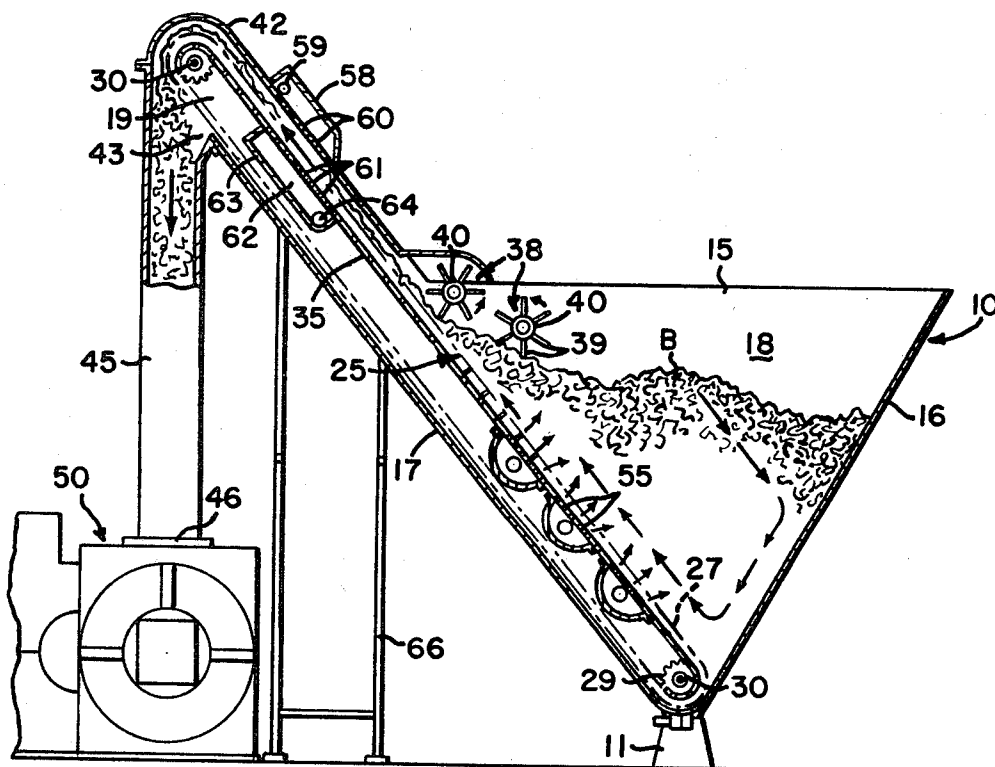
UNITED STATES PATENTS

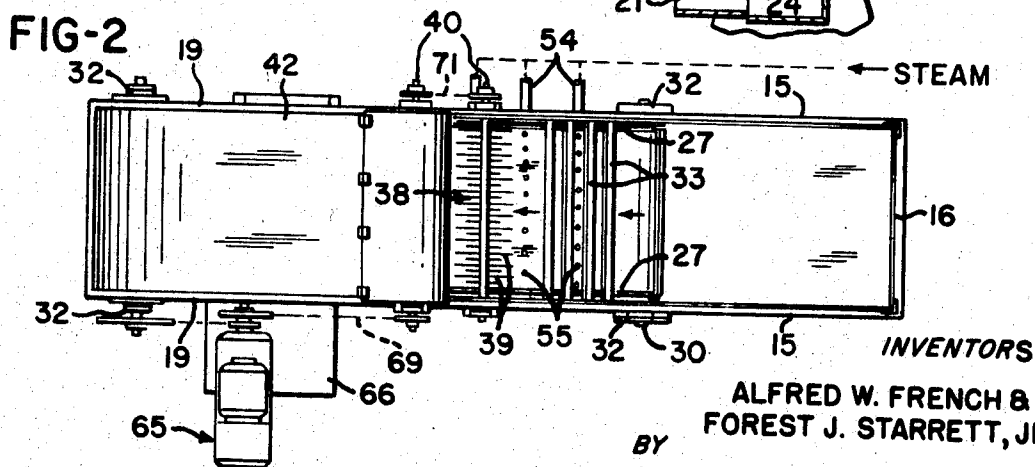
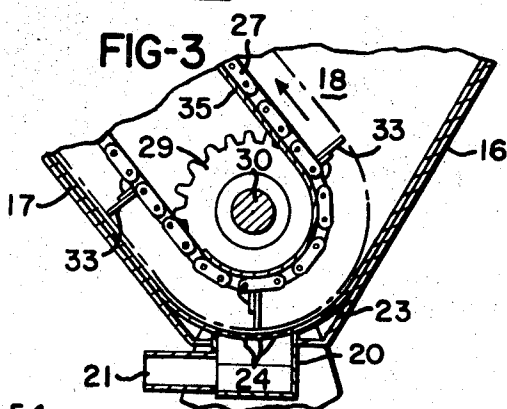
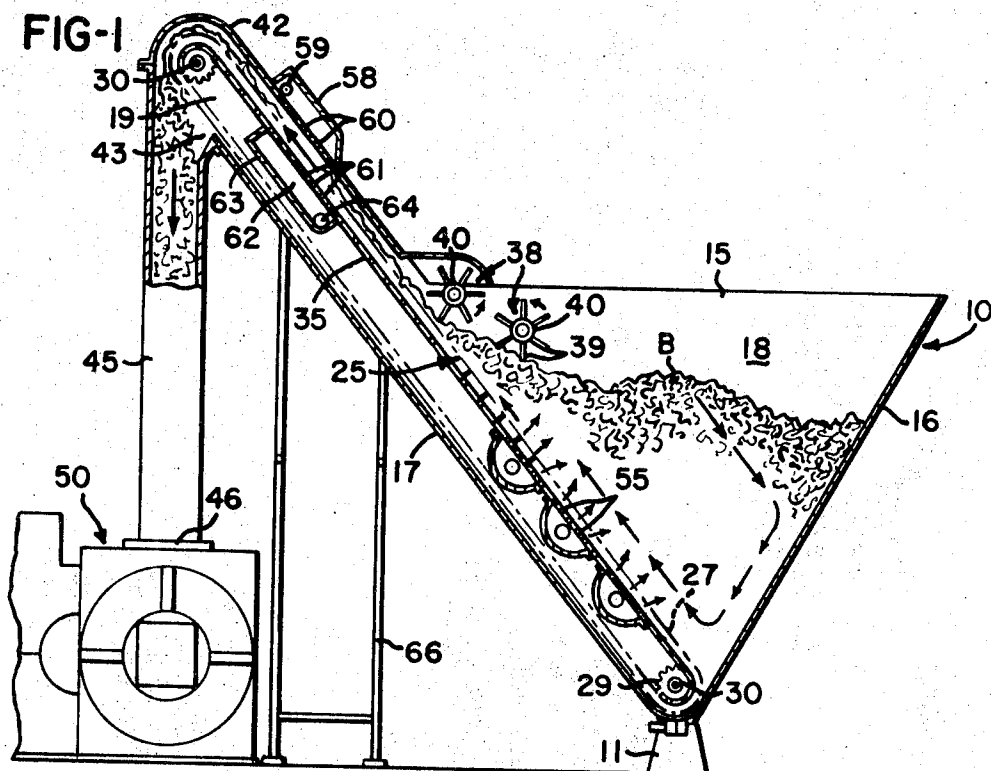
275,960	4/1883	Thomas.....	198/66X
1,627,283	5/1927	Hall.....	100/130X
1,669,086	5/1928	Hall.....	100/130X
1,855,606	4/1932	Luce.....	100/75X
2,311,747	2/1943	Gooch, Jr.	198/66
2,810,467	10/1957	Bogaty	198/57
3,037,445	6/1962	Burner et al.	100/72
3,373,679	3/1968	French	100/74X
3,398,677	8/1968	Theobald et al.	100/117X

Primary Examiner—Peter Feldman

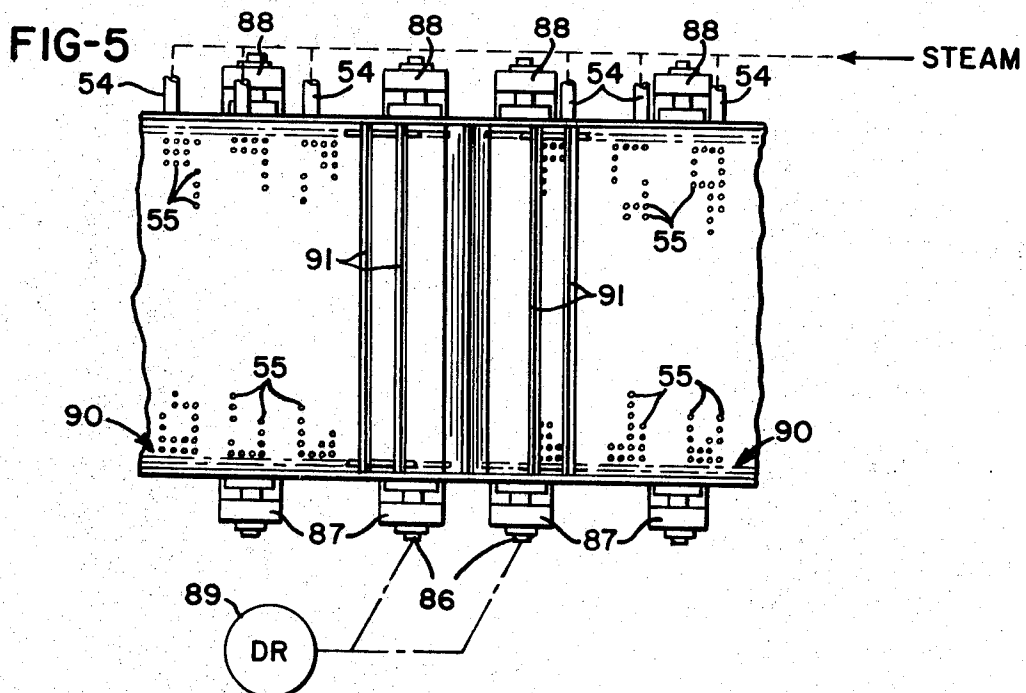
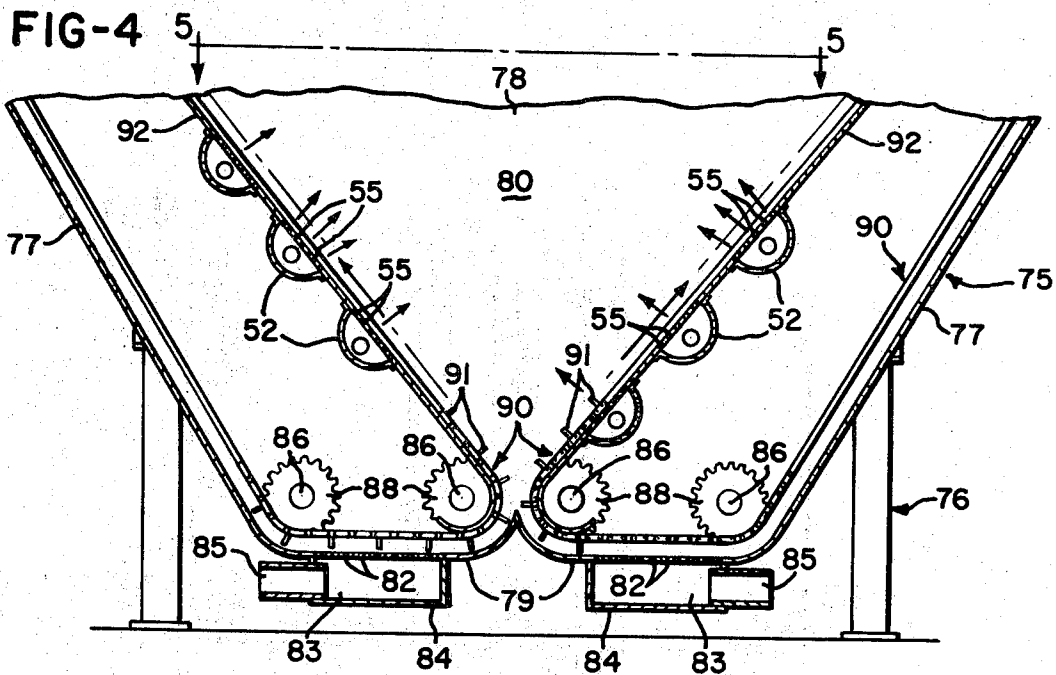
Attorney—Marechal, Biebel, French and Bugg

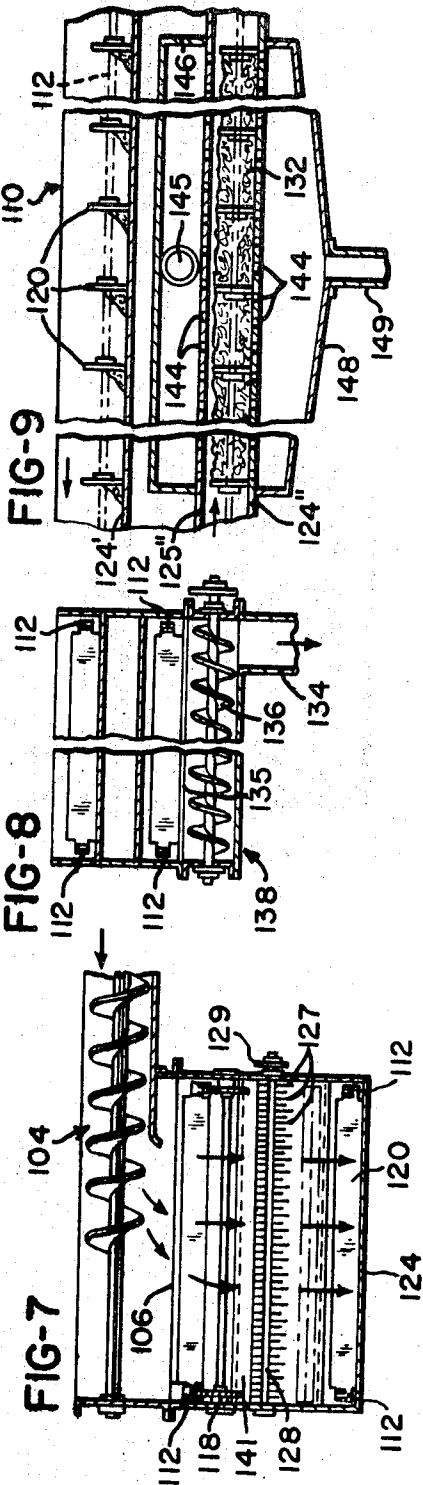
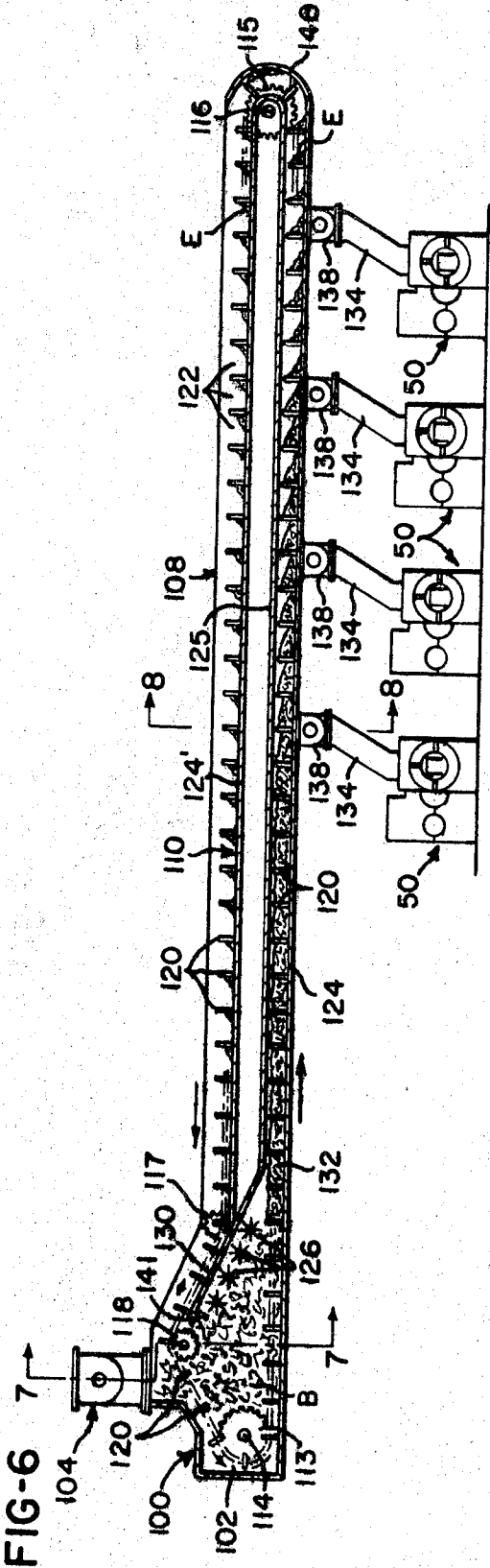
ABSTRACT: A bed of sugar cane bagasse of substantially uniform thickness is formed on an endless conveyor and is fed into one or more mechanical presses for removing liquid from the bagasse, and the expressed liquid is filtered by directing it through the bed of bagasse supplied to the press.





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METHOD FOR FEEDING MATERIAL TO A MECHANICAL PRESS

BACKGROUND OF THE INVENTION

When sugar cane bagasse is fed in an interrupted or irregular manner into a mechanical screw press such as disclosed in U.S. Pat. No. 3,086,452 assigned to the assignee of the present invention, both the power required by the press and the internal pressure within the press fluctuates accordingly. This results in discharge of the material having a wide variation in moisture content as the amount of moisture expressed from the material is directly related to the expressing pressure within the press. The irregular feeding also causes inefficient power fluctuation in the press drive.

It is also common for the juices or liquid discharged from the press to contain small foreign particles or "fines," and thus usually it is necessary to subject the liquid to a straining operation for removing the fines. For example, the liquid may be filtered through a fine mesh endless screen which moves across the top of a collecting tank or the liquid may be directed through a rotary driven screening device.

SUMMARY OF THE INVENTION

The present invention is directed to improved method for feeding fibrous material such as sugar cane bagasse to one or more mechanical presses capable of continuous operation such as a mechanical screw press or disc press. The apparatus is especially suited for receiving the material in irregular surges and to distribute or supply the material at a uniform rate to a single press or a series of presses and thereby minimize fluctuations in power required by each press in addition to minimizing wear on the press bearings and other components. The invention also provides a simplified method for filtering or clarifying the juice or liquid expressed from each press.

According to one embodiment of the invention, the sugar cane bagasse which is discharged in surges from a diffuser is collected within a hopper having an inclined bottom wall. An endless drag conveyor has an upper reach supported by the inclined wall and is arranged to convey the material from the hopper to the inlet of a mechanical screw press. A rotary kicker member is positioned within the hopper and spaced above the inclined wall and cooperates with the endless conveyor to form a material supply bed of substantially uniform thickness. The liquid expressed from the material within the mechanical press is directed through the material supply bed which serves as a filter to remove the fines and other foreign particles.

In accordance with another embodiment of the invention, the bagasse which is discharged from the diffuser is collected within a chamber from which extends an endless drag slat conveyor having a distribution reach and a return reach. A rotary kicker is mounted within the chamber to form the material into a uniform supply bed or the distribution reach for delivery to one or more mechanical presses. Any excess material remaining in the distribution reach after supplying the presses is returned by the return reach to the collecting chamber. As in the first embodiment, the liquid discharged from each press is directed through the material supply bed for filtering and clarifying the liquid. Furthermore, in each embodiment, provision is made for introducing steam or other hot fluid into the material for macerating and heating the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view partly in section of a press feeding apparatus constructed in accordance with the invention;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged fragmentary section of the apparatus shown in FIG. 1;

FIG. 4 is a fragmentary vertical section of a modified form of the apparatus;

FIG. 5 is a fragmentary plan view of the apparatus as taken generally along the line 5-5 of FIG. 4;

FIG. 6 is an elevational view in part section of apparatus constructed in accordance with another embodiment of the invention and illustrating somewhat schematically an installation of the apparatus for feeding a series of presses;

FIG. 7 is a section of the apparatus taken generally along the line 7-7 of FIG. 6;

FIG. 8 is a section of the apparatus taken generally along the line 8-8 of FIG. 6; and

FIG. 9 is a fragmentary section showing a modification of the apparatus shown in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings which illustrate preferred embodiments of the present invention, the apparatus shown in FIGS. 1-3 generally includes a hopper 10 supported by base members 11 and adapted to receive surges of material such as sugar cane bagasse B discharge from a diffuser or a roll mill. The hopper 10 is preferably constructed with a pair of generally triangular-shaped vertical sidewalls 15 connected by sloping bottom walls 16 and 17 to define a receiving chamber 18 having a V-shaped configuration. The sidewalls 15 include upwardly extending portions 19 which are connected by the bottom wall 17 to form an extension of the hopper 10.

Mounted on the bottom of the hopper 10 is a manifold 20 (FIG. 3) having a drain outlet 21 which receives liquid through a part cylindrical bottom plate 23 having a series of small drain holes 24 defining a screen. The holes 24 provide for drainage of liquid from the bagasse B contained within the chamber 18.

Mounted within the chamber 18 adjacent the bottom wall 17 is an endless conveyor 25 which includes a pair of parallel-spaced endless chains 27 (FIG. 3) directed around corresponding sprockets 29 mounted on shafts 30. The shafts are rotatably supported by bearings 32 (FIG. 2) mounted at the bottom of the sidewalls 15 and on the upper end portion of the extending wall portions 19. The endless conveyor 25 includes a series of uniformly spaced drag slats or members 33 which are mounted on the chains 27 and extend laterally across the hopper 10. The lower reach of the conveyor is supported by the bottom wall 17 of the hopper 10 while the upper distribution reach is supported by an inclined wall member or plate 35 extending parallel to the bottom wall 17.

Mounted within the upper portion of the hopper 10 are a pair of rotary kicker members 38 each including a series of spike members 39 extending radially from a shaft 40 which is positioned parallel to the plate 35 and extends between the vertical sidewalls 15. Covering the upper end portion of the conveyor 25 and the uppermost rotary kicker member 38 is a housing 42 which is mounted on the sidewall portions 19 and cooperates with the bottom wall 17 to define a discharge outlet 43. A chute 45 extends downwardly from the outlet 43 to the inlet 46 of the mechanical screw press 50. While a mechanical screw press is shown for purposes of illustrating a press, it is to be understood that the apparatus of the invention may be used for feeding material to other types of extraction presses or mills.

A series of conduit members 52 are mounted on the underneath surface of the plate 35 and define corresponding chambers 53 which are connected to steam supply lines 54. Perforations 55 are formed within the plate 35 and open into the chamber 53 so that the bagasse B or other material may be heated by steam or other hot fluid to increase the temperature of the material before feeding the material into the press 50. A housing 58 is mounted on the cover member 42 and is provided with an inlet 59. Openings 60 are formed within the cover 42 under the housing 58 and similar openings 61 are formed within the plate 35 generally across from the openings 60 and open into a chamber 62 defined by a housing 63 mounted on the underneath surface of the plate 35. The chamber 62 is provided with a drain outlet 64.

A motor driven variable speed drive unit 65 (FIG. 2) supported by a frame 66 drives the endless chain conveyor 25 through a chain drive 68 connected to the upper conveyor

shaft 30. The unit 65 also drives the rotary kicker members 38 through a chain drive 69 (FIG. 2) connected to the upper shaft 45 and a chain drive 71 connecting the lower shaft 45 to the upper shaft 45.

To illustrate the operation of the apparatus shown in FIGS. 1—3, a portion of the bagasse B which is collected and heated within hopper 10 is dragged upwardly on the plate 35 by the drag members 33 of the endless conveyor 25. Since the bagasse tends to cling together as it moves upwardly on the conveyor 25, the rotary kicker members 42 are so positioned to engage the bagasse above a predetermined distance from the plate 35 and thereby produce a moving bed or mat of bagasse having a substantially uniform thickness. This uniform bed or mat of bagasse is conveyed upwardly around the upper shaft 30 and is discharged downwardly through the chute 45 to the inlet of the press 50.

The kicker members 38 are rotated counterclockwise (FIG. 1) so that the excess bagasse which extends above a predetermined distance from the plate 35 is picked up by the spikes 39 and is rolled or tumbled down into the chamber 18. This tumbling action is desirable to assure that all of the bagasse is heated and saturated by the steam introduced through the perforations 55. As a result of the adjustable speed of the conveyor 25 provided by the drive unit 65, a uniform flow rate of bagasse can be selected for discharge through the chute 45 to assure that the press 50 will receive a continuous and uniform flow of bagasse so that the press will operate smoothly and will continuously discharge dewatered bagasse having a consistently low moisture content.

By directing the press water or juice expressed from the material within the press 50 into the inlet 59 and through the openings 60, the uniform bed of material carried upwardly by the conveyor 25 provides a filter for removing fines and other particles from the press water with the result that the juice received within the chamber 62 and drained through the outlet 64 is substantially clear. The addition of lime to the press water prior to filtering has been found desirable to increase the pH value of the bagasse prior to feeding the bagasse into the press. The higher pH value of the bagasse not only increases the efficiency of the press by making the bagasse somewhat slippery but also helps to reduce corrosion of the press.

It has also been found desirable to supply live steam or hot water through the openings 55 to heat the bagasse within the chamber 18. That is, it has been found that hot bagasse can be compacted within a screw press with less power required to drive the press and without reducing the amount of moisture which can be expressed from the bagasse.

In accordance with a modified embodiment of the invention shown in FIGS. 4 and 5, a hopper 75 is supported by a frame 76 and including a pair of opposed sloping end walls 77 connected by parallel spaced sidewalls 78 and bottom walls 79 to define a chamber 80. Perforations 82 are formed in the bottom walls 79 to provide for drainage of liquid from the material contained within the chamber 80 into the chambers 82 defined by the bottom pans 84 which are provided with drain outlets 85.

A series of lower shafts 86 are rotatably supported adjacent the bottom walls 79 by bearing 87 (FIG. 5), and each shaft supports a pair of sprockets 88 and is driven by a drive 89. Similar sprockets are mounted on upper shafts (not shown) each of which corresponds to the upper shaft 30 shown in FIG. 1. A pair of endless chain conveyors 90 are directed around the sprockets, and each conveyor includes a series of laterally extending drag members 91 similar to the drag members 33 of the conveyor 25 shown in FIG. 1. As shown in FIG. 4, the lower reach of each conveyor 90 extends adjacent the corresponding sloping endwall 77 and the upper reach extends adjacent the upper surface of a wall member or plate 92 so that the material is dragged up the surface by the drag members 91 and discharged from each end of the hopper 75 in a manner the same as shown in FIG. 1.

While not shown, a series of rotary kicker members 38 are mounted within the upper portion of the hopper 75 in spaced relation to the wall members 92 in the same manner as the kicker members 38 mounted within the hopper 10 as shown in FIG. 1. It has been found that the hopper 75 having twin conveyors 90 is particularly desirable for feeding a uniform flow of sugar cane bagasse simultaneously to a plurality of dewatering screw presses 50 or other presses when a single conveyor hopper is not sufficient to handle the capacity. It also can be seen that the drag members 91 slide across the bottom walls 79 and prevent clogging of the drainage perforations 82 in the same manner as the self-cleaning operations shown in FIG. 3.

Conduits 52 are mounted on the underneath surfaces of both wall members 92 in the same manner as shown in FIG. 1, for supplying steam or hot water from the lines 54 and through the perforations or openings 55 for heating the bagasse within the hopper 75. It has been found desirable to maintain or increase the temperature of the bagasse within the hopper 75 to at least 160° F. and preferably within a range of 180° F. to 200° F. so that, as mentioned above, the bagasse becomes slippery and will flow more smoothly through the screw press 50 with the result that less power is required to operate the press and the bagasse discharged from the press has a uniformly low moisture content.

Referring to FIGS. 6—9 which illustrate another embodiment of the invention, the apparatus includes a housing 100 defining a receiving chamber 102 into which sugar cane bagasse B is supplied from a source such as a diffuser (not shown) which normally discharges the material in periodic surges. The bagasse is discharged from the diffuser into a laterally extending screw conveyor 104 (FIG. 7) which directs the bagasse laterally and into an inlet opening 106 at the top of the chamber 102.

Extending horizontally from the housing 100 is an elongated housing 108 which encloses an endless conveyor 110 having a pair of spaced apart endless chains 112 (FIG. 8) which are directed around a pair of sprockets 113 rotatably supported on a shaft 114 within the receiving chamber 102 and a pair of drive sprockets 115 rotatably mounted at the opposite end of the housing 100 on a shaft 116. The endless chains 112 are also directed around sprockets 117 and 118 rotatably supported within the upper portion of the receiving chamber 102 to provide a slight incline of the conveyor 110 within the receiving chamber.

A series of uniformly spaced drag members 120 are mounted on the chains 112 as shown in FIGS. 7 and 8 and define a corresponding series of open top and bottom compartments 122 between adjacent drag members 120. As shown in FIGS. 6 and 8, the housing 108 has a bottom 124 which slidably supports the drag members 120 along the lower distributing reach of the conveyor 110, and a top member 125 covers the lower reach. Similarly, the housing has a bottom member 124' which supports the drag members along the upper return reach of the conveyor.

To prevent the bagasse from jamming the movement of the conveyor, a series of kicker members 126 constructed substantially the same as the kicker members 38 shown in FIG. 1, are rotatably mounted within the receiving chamber 102. Each of the kicker members 126 includes a series of spikes 127 (FIG. 7) which extend radially from a laterally extending support shaft 128 which is driven in a clockwise direction as shown by the arrow in FIG. 6 by a suitable drive unit (not shown) connected to the sprocket 129 (FIG. 7) mounted on the end of the shaft 128.

As shown in FIG. 6, the kicker members 126 are positioned at different elevations in relation to the bottom wall member 124 and are covered by a ramp member 130 which forms an extension of the top wall member 125 so that the pile of bagasse B is progressively reduced in height to form a substantially uniform layer or bed 132 of material which is generally flush with the top of the drag members 120. Thus the bagasse extending above the drag members is rolled back into the receiving chamber 102 producing a tumbling action of the pile

of bagasse. If desired, steam or hot water may be introduced into the bagasse for heating the bagasse, as for example, by employing self-cleaning perforations within the bottom wall 124 of the chamber 102 and mounting steam supply conduit members 52 on the bottom wall in the same manner as shown in FIGS. 1 and 4.

The bed 132 of bagasse is carried by the drag members 120 within the compartments 122 along the lower distributing reach of the conveyor to feed one or more mechanical presses such as the screw presses 50 having inlets connected by corresponding feed chutes 134 to a corresponding series of openings 135 formed within the bottom wall member 124. As shown in FIG. 8, preferably a transfer screw 136 is rotatably supported within a housing 138 mounted on the underneath side of the bottom wall member 124 for each press 50 to feed the bagasse which drops through the opening 135 into the smaller feed chute 134.

As illustrated in FIG. 6, the conveyor 110 is constructed with a capacity to supply the material at a somewhat greater rate than is necessary for maintaining each of the housings 138 filled with material when the presses 50 are operating at maximum capacity. Thus excess material E remains in the lower distributing reach of the conveyor 110 after feeding the final screw press 50 and is carried around the end of the conveyor enclosed by the semicylindrical housing portion 140 and along the upper return reach of the conveyor where it is released to drop past the downwardly formed end 141 of the ramp member 130 onto the top of the pile of material.

In a suitable construction of the apparatus, the conveyor 110 has a width of approximately 5 feet and the kicker members are positioned to form a material bed 132 having a substantially uniform thickness of approximately 8 inches. The conveyor 110 has been driven at a rate of approximately 6 feet per minute to feed a predetermined supply of material into the lower distributing reach of the conveyor. Preferably, approximately 25 percent excess material E is carried along the lower reach of the conveyor to assure that the final screw housing 138 is maintained completely filled with material.

A modification of the embodiment shown in FIGS. 6-8 is shown in FIG. 9. As mentioned above, it has been found desirable to use the uniform bed of bagasse as a filter for removing fines and undesirable particles from the juice which is expressed out of the bagasse by the screw presses 50. To provide this feature in the apparatus shown in FIG. 6, a section of the housing 108 is provided within perforations or openings 144 in the top and bottom wall member 125'' and 124'', respectively. Contaminated juice is fed through the inlet opening 145 formed, within a housing 146 mounted on the upper wall member 125'' and feeds into the bed 132 of bagasse. Filtered juice is collected within the pan 148 mounted on the bottom wall member 124'' and drains into the conduit 149.

From the drawings and the above description, it can be seen that the apparatus formed in accordance with the present invention provides several desirable features and advantages. Basically, the apparatus is adapted to receive surges or an irregular supply of hard to handle material such as sugar cane bagasse and then distribute a uniform mat or bed of material for feeding one or more expressing devices such as a series of mechanical screw presses. The apparatus produces this uniform supply of material by retaining within the receiving chamber the excess material which projects above a predeter-

mined distance on the feed conveyor.

Another important feature is provided by the conduits 52 for introducing steam into the bagasse while in the receiving chamber for raising the temperature of the bagasse to a predetermined minimum level and thereby provide a more efficient and effective processing of the bagasse B in each screw press 50. The embodiment shown in FIGS. 6 and 7 provides the additional feature of two inclined conveyors for handling a higher capacity of bagasse and feeding a plurality of presses.

A further feature is provided by the cooperation between the lower end of the conveyor 25 or conveyors 90 and the corresponding bottom drainage openings 24 or 82 whereby the drag members 33 or 91 sweep past the openings and prevent them from clogging with material. A similar self-cleaning action of the steam inlet openings 55 is provided by the sweeping movement of the conveyor drag members 33 or 91. The embodiment shown in FIGS. 6-8 not only provides a steady, uniform supply of material to each of the presses, it assures this continuous supply by carrying an excess of material which is directed back to the main source material for recirculation.

Still another important feature of the invention is provided by the filtering means shown in FIGS. 1 and 9. That is, by directing the expressed juice or liquid through the uniform bed of bagasse as it is fed to the inlet of a press, fines and foreign particles are removed from the expressed juice. In addition, the material is effectively macerated before it enters the press.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

We claim:

1. A method of processing sugar cane material, comprising the steps of collecting batches of the sugar cane material within a hopper having an inclined bottom wall, conveying a portion of the sugar cane material upwardly adjacent said wall with an endless conveyor, forming the sugar cane material being conveyed upwardly by said conveyor into a bed of substantially uniform thickness by retaining within said hopper the sugar cane material above a predetermined distance from said conveyor, and feeding the bed of sugar cane material from said conveyor into a mechanical screw press for expressing juice from the material with minimum fluctuation of pressure within the press.

2. A method as defined in claim 1 including the step of heating the sugar cane material within said hopper by directing a flow of hot fluid upwardly into the material being conveyed upwardly by said conveyor.

3. A method as defined in claim 1 including the step of directing a flow of liquid through the bed of sugar cane material prior to feeding the bed of material into the screw press.

4. A method as defined in claim 1 including the step of simultaneously conveying a second portion of the sugar cane material within said hopper upwardly adjacent another inclined bottom wall of said hopper by another endless conveyor, forming the second portion of sugar cane material into a second bed of substantially uniform thickness, and feeding the second bed of sugar cane material into a second mechanical screw press.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,561,351 Dated February 9, 1971

Inventor(s) Alfred W. French and Forest J. Starrett, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 34, "six" should be --sixty--.

Column 6, line 35, "can" should be --cane--.

Signed and sealed this 10th day of August 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents