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AN INTRODUCTION TO BROWN PULPERS, FINISHERS AND SEPARATORS

INTRODUCTION

Brown International Corporation is the designer and builder of pulpers, finishers, and classifiers. Our first machines were developed for the citrus juice industry in 1947, and were used to control the level of pulp in freshly extracted juice. BROWN'S technical and engineering staff has continually improved the standard machines, as well as developing new concepts in response to customer needs.

DESCRIPTION

Brown International Corporation makes two totally different styles of separators. The paddle type is the most versatile. It is used, for example, in the production of fruit purees, seeded or seedless berry products, and tropical fruit juices. The other style is a screw type design. It is very well known in the citrus and pineapple juice industries. Both perform separations based on size or texture, each one operating in a distinct manner.

PADDLE SEPARATOR

The basic operation of a paddle separator is easily understood. A product enters into the inside of a cylindrical screen and is moved across the screen by rotating paddles. As the raw material is spun across the screen and moved down the length of the screen, separation occurs. Liquid and particulate smaller than the hole size of the screen pass through the screen. The residual advances down the screen and is discharged out the end as pomace. The idea is simple enough, but in order to achieve the efficiencies, quality, and consistency required in modern production, fine-tuning is required.

ADVANTAGES OF PADDLE SEPARATORS

Paddle finishers are adjustable. Thus, they can be adapted to changing conditions on a standard product, or adjusted to run a variety of products. There are five adjustments that can be worked with:

1. The velocity of the paddles (rpm)
2. The angle (pitch) of the paddles
3. The distance of the paddle from the screen (clearance)
4. The type of screen selected (hole size and helix)
5. The feed rate of the material being separated

1. Multi-speed machines can be built using a mechanical vari-drive, or a frequency inverter. Most separators, however, are sold with a fixed speed drive. Belts and pulleys can be changed if the fixed speed needs to be changed. Most Paddle finishers run between 300 and 1000 rpm.
2. The term "pitch" refers to the "twist" in the paddle or the angle of the paddles relative to the centerline of the screen cylinder. The pitch, along with the rpm, determines the residence time of the raw material inside of the screen. A larger pitch will carry the material forward at a faster rate, and spin the product against the screen through fewer revolutions before it is discharged.
3. The distance of the paddle to the screen (called paddle clearance) is the easiest adjustment to make. It is common for a given process to require adjustments in the paddle clearance during a season as the maturity of the raw material changes. The inlet clearance is always set less than, or equal to the outlet setting. The reason is, there are really two distinct phases occurring in the separator. The wetter product passes readily through the screens on the inlet end. The paddles are set closer to the screen on the inlet end to develop a centrifugal effect. As the feed material advances down the separator, there is a concentration of the fibrous content and a great drying effect takes place. A somewhat wider clearance at the discharge end allows a "tumbling" action to develop between the paddles and the screens. Minor changes in paddle clearance can have dramatic effects on the product quality and efficiencies of the extraction.
4. Brown International Corporation supplies many different screens with the holes created by punching, drilling and photo etching. Common screen hole sizes are:

| <u>Inches</u> | <u>mm</u> | <u>Inches</u> | <u>mm</u> |
|---------------|-----------|---------------|-----------|
| .010 | 0.25 | .060 | 1.5 |
| .020 | 0.50 | .078 | 2.0 |
| .023 | 0.60 | .094 | 2.4 |
| .027 | 0.70 | .125 | 3.7 |
| .033 | 0.85 | .250 | 6.2 |
| .045 | 1.20 | .375 | 9.5 |

Some processes require more than one pass using different screen sizes. For example, to make peach puree, it is common to pass blanched whole peaches through a separator set up with 0.250 screens to remove the pits, and then, to pass the rough puree through a second separator with 0.033 screens to remove the skins, stems and other defects. A fine puree results.

Some products do not move down the screen well and causes the screens to be over worked. Friction caused heat can build up to the point of burning product onto the screens. Vibrations and motor overload can result. A unique BROWN solution to this problem is to weld a helical strip onto the inside of the screen. These helical screens will convey even the most difficult product through the working area of a separator.

5. With most products, the feed rate must be reasonably consistent to balance the separation process. Sometimes there may not be enough product available to run the machine at full capacity. In this case, the paddle clearances may be increased, or the rpm reduced to avoid excessively drying out or burning the discharge. Or, a machine may be running at near maximum capacity so that increasing the feed rate sharply decreases the efficiency. The most important point about the feed rate is consistency. A variable feed rate will reduce efficiencies.

In summation, paddle finishers may be adjusted as follows:

| <u>VARIABLE</u> | <u>ADJUSTMENT</u> | <u>EFFECT ON THE DISCHARGE</u> | <u>EFFECT ON THE CAPACITY</u> |
|------------------|-------------------|--------------------------------|-------------------------------|
| Paddle Velocity | Faster | Dryer | Increase |
| | Slower | Wetter | Decrease |
| Paddle Pitch | Greater | Wetter | Increase |
| | Lesser | Dryer | Decrease |
| Paddle Clearance | Increase | Wetter | Increase |
| | Decrease | Dryer | Decrease |
| Screen Size | Increase | Dryer | Increase |
| | Decrease | Wetter | Decrease |
| Feed Rate | Increase | Wetter | Increase |
| | Decrease | Dryer | Decrease |

SCREW FINISHERS

The screw finisher is a special use machine that operates on a different principal than the paddle separator. Screw machines are very well suited for certain applications in the citrus, pineapple and tomato juice industries. It is also used to de-water fresh spinach and extract juice from disintegrated carrots and celery. The applications that work well on a screw finisher all separate a fibrous pulp from a liquid stream.

DESCRIPTION

Inside a screw finisher, a close fitting screw turns at between 300 to 650 rpm, pushing the raw material across the cylindrical screen, forcing the fibrous portion against an air activated valve at the end of the cylinder. The screw has a constant camber, and does not actually squeeze the raw material throughout the screw in the manner of a screw press. Some pressure does build up at the end of the cylinder as the fibers build against the air-controlled valve. When the internal pressure exceeds the set pressure on the valve, the fibrous mat moves past the valve and is discharged. The valve can be set between 0 and 65 psi.

The screw finisher requires a fibrous material to operate the discharge properly. Also, the fibrous material must be sufficiently abrasive to be conveyed by the screw. Larger solid objects, such as seeds from stone fruits, will cause the valve to open and allow the liquid phase to escape along with the large solid objects discharged, disrupting the fiber pad that creates the pressure, which operates the pressure valve.

The amount of pressure on the pressure valve will determine (along with the screen used) the amount of pulp or solids left in the juice. Brown International Corporation has developed a computerized feedback mechanism for the citrus industry that continually adjusts the amount of air pressure on the pressure valve to produce a constant level of pulp in the juice, regardless of the input variables. This is especially helpful when the fruit is softer than optimal, and is used to avoid unnecessary centrifugation and additional down stream processing.

BROWN technical personnel have experience with a variety of finisher applications. BROWN maintains a pilot plant laboratory for the purpose of demonstration and testing. When necessary, BROWN personnel can assist customers in their own plants with problems and new applications.