4-1-1992

Dimensional Size Separators

B. Wallace

DIMENSIONAL SIZE SEPARATORS

Bill Wallace[1]

Why do we use dimensional separators? When there is a close overall size difference between seeds or particles to be separated, we think of sizes or grades, or it is more precise to think of differences in terms of the three dimensions - width, thickness, and length.

WIDTH: Seeds having the same length and thickness but differing in width can be separated by screens with round perforations.

THICKNESS: Seeds with the same length and width but differing in thickness can be separated by screens with oblong perforations.

LENGTH: Seeds with nearly the same width and thickness but differing in length can be separated with a rotating indented disc or indented cylinder with indentations or pockets of the correct size to lift shorter seed, but not so large or deep to lift the longer seed.

When do we use dimensional separators? In any seed conditioning operation, dimensional separators should follow the basic cleaning accomplished by the air-screen cleaner which makes use of screens and air separations to remove light trash, dust, and undesirable material, both larger and smaller than the crop seed. Remember that without the removal of the trash, dust and other over or under sized material prior to dimensional sizing, the separators can not operate effectively or efficiently.

Disc Separator

The disc separator or the indented cylinder separator is used to make length separations in the seed conditioning plant. Their principle of operation is the same - lifting a shorter product from a longer product. But the two separators are completely different in design and operation. The disc separator consists of a series of cast iron discs which rotate together on a horizontal shaft inside a

---

[1]Consultant to the Seed and Grain Industry, Bill Wallace & Associates, Hot Springs, AR.

cylindrical body (Figure 1). Each disc contains many recess pockets on each side. Seed enter the intake end of the disc separator and are conveyed through the open centers of the disc toward the discharge end of the machine. As the disc revolves through the seed mass, the pockets lift out short seed but reject longer seed. Longer seed which are rejected by the disc pockets are conveyed by flights on the disc spokes to the discharge end of the machine and exit through the tailings gate.

A combination of centrifugal force and the fit of the seed into the pocket holds the seed in the pocket as it is lifted from the seed mass. The pocket discharges its seed after it passes the top vertical center of its rotation in the same way that an elevator bucket discharges its load. Disc separators are manufactured in three diameters - 15", 18", & 25". The number of discs on the shaft and roto layout (pocket sizes) determine the capacity of a unit.

Disc pockets are made in three basic shapes and each shape is made in a number of different sizes. The pocket is always measured by its width. The length or height of a pocket is essentially the same as the width. The depth is approximately one-half the width. The under-cut side of the pocket is referred to as the bottom or lifting edge.

The "V" pocket gets its name from vetch. It is designed to pick up and remove round shaped seed with its round lifting edge.

The "R" pocket gets its name from rice and was designed to remove cross-broken rice seed from whole seed. The "R" pocket looks like an up-side down "V" pocket. It will reject round seed but will lift out cross-broken or short tubular, elongated seed. The "V" or "R" pockets are followed with a number such as V 5 1/2 or R 6, which indicates the width of the pocket in millimeters.

Square-faced pockets designated only by letters are available in sizes greater than 1/4" in width. Discs of this size are used to lift wheat from oats, rice from straw, or as cleanup discs at the end of a roto layout.

The term "Roto Layout" is used to indicate the size of disc pockets from the feed end to the discharge end of the disc separator. If the disc pocket size varies from feed end to discharge end, the separation is more versatile but the capacity is reduced. If the disc pocket size is the same from feed end to discharge the separation versatility is limited, but the capacity is greatly improved.

Indented Cylinder

The indented cylinder separator is a rotating, almost horizontal, cylinder with a movable or rotating horizontal trough mounted inside it (Figure 2). The rotating cylinder has recesses, indents or "pockets" which line the inside surface of the cylinder. As the seed are fed into the feed end of the rotating indented cylinder,

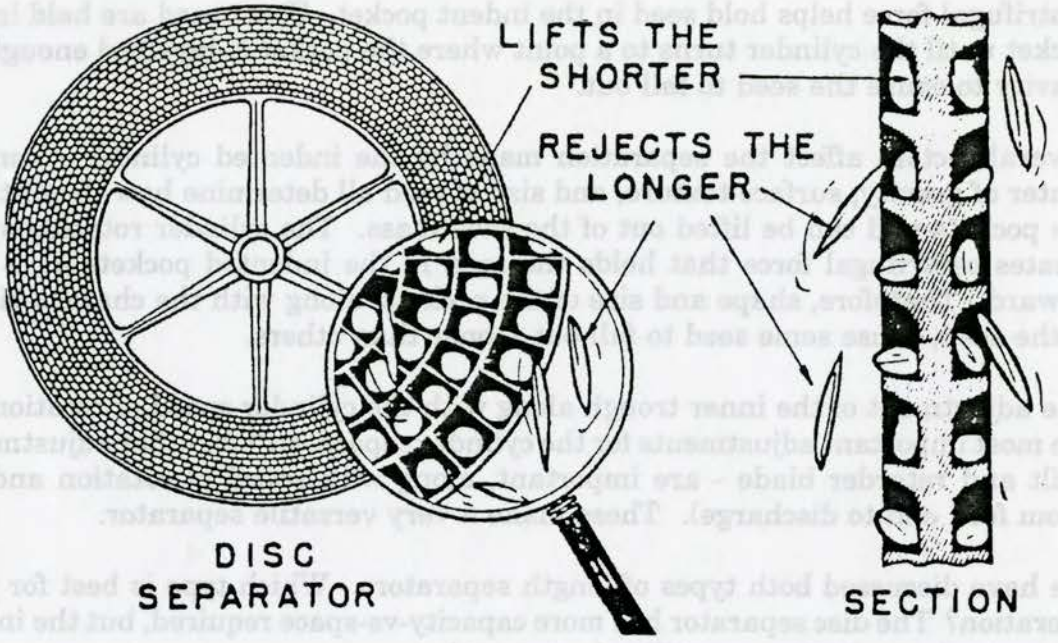

Figure 1. Disc Separator: diagram of separating action.

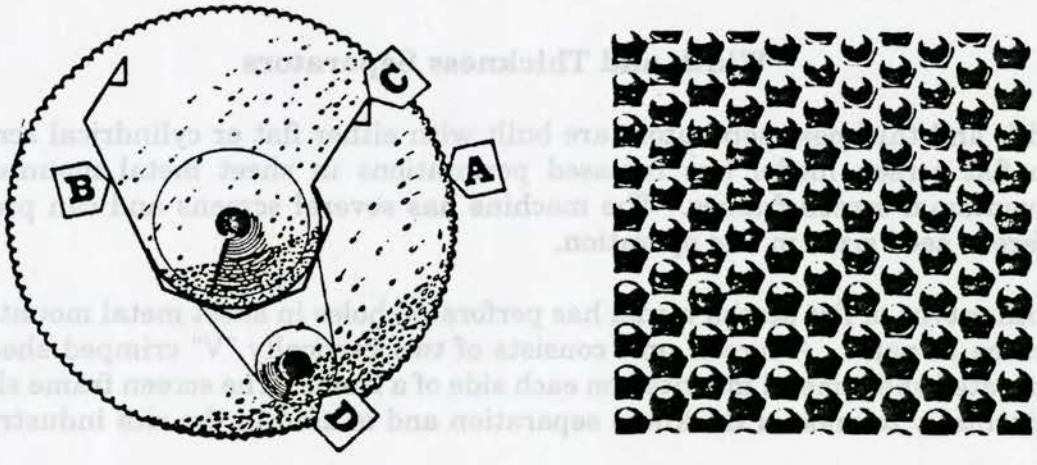

Figure 2. Cross-section of an Indented Cylinder Separator. A, cylinder wall with indents; B, adjustable trough that catches short, lifted seed; C, separating edge of adjustable trough; D, conveyor that conveys long, rejected material out of cyliner. Right: interior surface of cylinder.

centrifugal force helps hold seed in the indent pocket. Short seed are held in the pocket until the cylinder turns to a point where the pocket is inverted enough for gravity to cause the seed to fall out.

Several factors affect the separation made by the indented cylinder. Length, center of gravity, surface texture, and size of seed all determine how they fit into the pockets and can be lifted out of the seed mass. The cylinder rotating speed creates centrifugal force that holds the seed in the indented pockets as it lifts upward. Therefore, shape and size of the pockets, along with the characteristics of the seed, cause some seed to fall out sooner than others.

The adjustment of the inner trough along with the cylinder speed of rotation are the most important adjustments for the cylinder separator. Two other adjustments - tilt and retarder blade - are important, along with speed of rotation and tilt (from feed end to discharge). These make a very versatile separator.

We have discussed both types of length separators. Which type is best for your operation? The disc separator has more capacity-vs-space required, but the indent separator has a better versatility in separation.

I have always used disc separators for small grain, rice, and some grass separations. The indented cylinder has better separation quality when working with a very light seed. So you can see that both separators will do a good length separation, but you should choose the best machine for your application.

Width and Thickness Separators

Width and thickness separators are built with either flat or cylindrical screens. The flat screen model has recessed perforations in sheet metal mounted on conventional screen frames. The machine has several screens and can produce different seed sizes in one operation.

Another type of flat screen model has perforated holes in sheet metal mounted on a frame in pairs. A screen unit consists of two vertically "V" crimped sheets of perforated sheet metal mounted on each side of a frame. The screen frame shakes horizontally to make a thickness separation and is used in the rice industry.

The cylindrical model looks similar to the indented cylinder separator with the perforation located in the bottom of the round or slotted indents. Multiples of these units can be made together to produce several different seed sizes in a continuous-flow operation.

Seed are fed into one end of a revolving perforated cylinder and the rotation causes the product to tumble and up-end allowing the smaller seed to pass through the perforations. The larger seed that will not pass through the

perforations discharge out the opposite end of the cylinder. As the cylinder turns, rubber flaps mounted on a shaft press against the outside of the cylinder or shell and dislodges seed that are wedged in the perforations.

Three types of perforations are available for cylinder width and thickness separators (Figures 3 and 4).

1. Slotted perforations punched in the bottom of corrugated spiraled grooves are used for thickness separation.

2. Round, recessed perforations are used for width sizing.

3. Cylinders with ribs placed lengthwise between each several rows of perforations up-end the product and provide gently agitation of the seed.

Several types of feeders are available for multiple or stacked units along with two diameters of cylinders.

Summary

Dimensional separators are an integral part of any seed conditioning plant and should not be considered a cure-all. They are like any other piece of seed cleaning equipment. Select it properly, adjust it properly, don't over-feed it, and with proper maintenance you will have a good product you will be proud to sell.

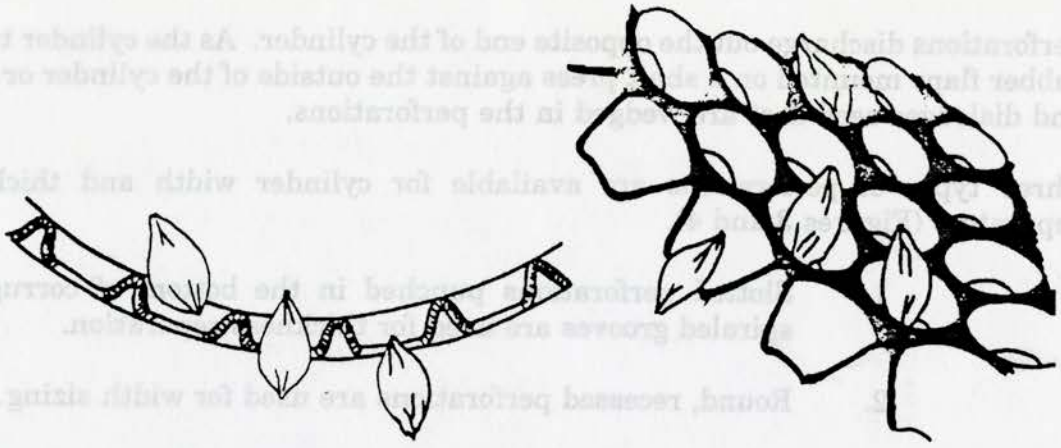

Figure 3. Schematic view of a shell used to make width separations (width).

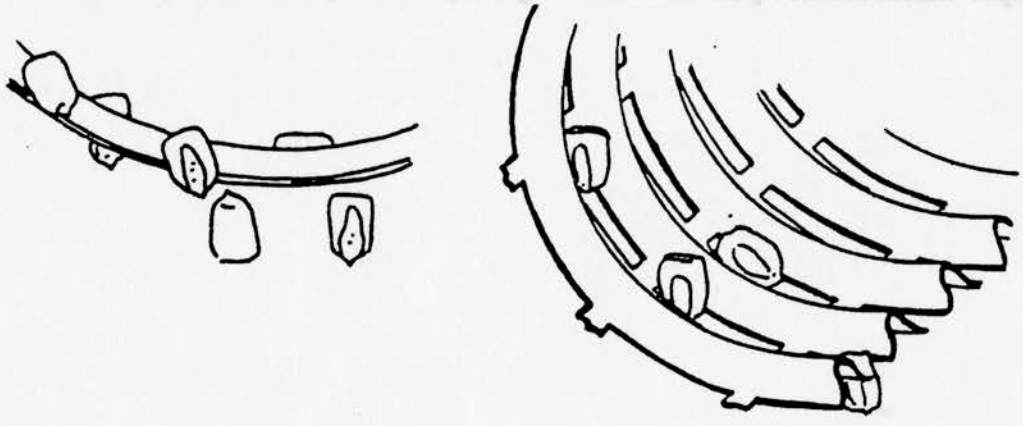

Figure 4. Schematic view of a shell used to make thickness separations (thickness).