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Cylinder Separator

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CYLINDER SEPARATOR

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The cylinder separator is a length sizing separator which lifts undersize particles out of a mass of seed. In this respect it is similar to the disc separator, but in other ways it is quite different. Before the operation will be explained the parts will be named and described.

Feed Hopper. The feed hopper is that part of the machine that receives the seed yet to be cleaned from the elevator or from some other means. From the feed hopper the seed are fed into the machine for the cleaning operation. If desired, the feed hopper can be equipped with a mechanical roll feeder, which provides uniform feeding when very light materials or small volumes are being handled. Most feed hoppers on cylinder machines are small and provides only for the receiving of the seed into the machine.

Cylinder. The cylinder is similar to a drum with both ends removed, that revolves about a horizontal central shaft. The walls of these hardened steel cylinders are lined with semi-spherical indents. The size of the shells will vary from machine to machine. They will range from 17 inches in diameter to approximately 24 inches in diameter. They also vary greatly in length. Some measure 56 inches long, others measure as long as 90 inches.

Indent sizes are listed in 64ths of an inch, similar to screens used in the air and screen machines. They range from a number 4 to a number 36.

There are many possible shapes of indents. The two basic types are the hemispherical shape and the cone shape. The hemispherical shape or round bottomed indent would be excellent for round seeds. A cone shaped indent would discharge better for seed which do not roll as easily.

It is not practical to install more than one size or shape of indent in any one cylinder.

A change in the angles of the sides, the shape of the sides and bottom, the depth of the indent in relation to the width, etc. will affect the operation of an indent cylinder. It would be impractical for the indents to be changed to take out each shape of seed separately, so a happy medium must be reached whereby the combination of the depth of the indent, the angle of the sloped sides, etc., will do the most good on the most seeds which will normally be encountered.

Receiving Trough. A receiving trough is provided to accumulate the lifted particles and convey them to a discharge spout. The trough is in a horizontal position extending the length of the cylinder. It is located near the center of the cylinder with the separating edge adjusted to the desired position for proper

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cleaning. The lifted particles are conveyed through the trough to the discharge spout by means of an auger.

Leveler or Conveyor. It is necessary to have some means of conveying seed through the machine in order to discharge the particles too large for the indents. In most machines this is done by one of two methods. In some of the smaller, especially shorter cylinder type machines this is accomplished by elevating the feed end of the machine to a point that will allow the rejected material to flow uniformly through the cylinder. Most machines, however, use some mechanical means inside the cylinder to perform this operation. A screw conveyor in the bottom of the cylinder will break up the rotation of the core and also convey the material. Another method is the use of grain line blades which break up the mass and also convey.

Retarder. The retarder is described as a dam at the discharge end of the machine. It may be adjusted to hold the seed at any desirable level. Without the retarder, the seed mass would be less at the discharge end of the machine. This is due to the smaller particles being lifted out of the seed mass. Without the use of the retarder, surging might possibly result. Surging is the rocking back and forth of the seed mass as the cylinder rotates. By retarding the discharge, the depth of the seed can be increased to the point where no surging occurs and the best separation can be accomplished.

Operation of Cylinder Separator. Indented cylinders operate on the centrifugal force principle in which the speed of the cylinder holds the shorter seeds in the indent, lifting them out of the mass until the indent is inverted to the point where gravity causes the lifted particles to fall out of the indent. The shape and size of the indent, the size, shape, seed coat texture, the moisture and the weight of the seed combine to make certain seeds lift close to the vertical center at the top of the revolution before they fall out. It is only practical to use one size and shape of indent in a cylinder so variation in separations is accomplished by two adjustments: speed change, which increases or decreases centrifugal force, and the setting of the edge of the trough which catches the desired liftings. The two adjustments give the cylinder separator extreme flexibility, and the adjustments are supplemented by the fact that the physical characteristics of the seed, other than its size, also affect the height or distance the seed will carry before it falls out of the indent.

Since centrifugal force holds a particle in the recess of an indent with sufficient force to lift it out of a mass of seed, the indented cylinder is most efficient in lifting materials which weigh over 45 pounds per bushel. The speed may not be increased beyond the point where it will carry the material in the indents beyond the center of the cylinder (above the center shaft) otherwise the material will not fall out of the indents before they are lifted high enough to be caught in the trough. Between these extremes of speed the maximum efficiency can be obtained.

The combination of centrifugal force and indent size lift the shortest particles or seeds the fartherest out of the main mass. Intermediate sized seeds fall out sooner than the small seeds, and the longest fall out of the indents first. Some materials are too large to lift at all and roll along in a thick "rope" on the bottom of the cylinder. Without a means of stirring this mass as it works its way to the tail end of the cylinder, stratification of light weight and chaffy seeds would take place. Some separators are equipped with a screw conveyor, without a housing around the flights, which runs in this mass. The screw has the triple function of conveying the mass toward the tail end of the machine, eliminating stratification and maintaining a level mass in the bottom of the cylinder. Other separators have leveling blades mounted inside the cylinder to aid in maintaining a level mass of seed. If some method of leveling the seed were not provided the seed mass would tend to pile up at the head end of the cylinder where the seed enter the machine. This is especially true of the lighter material. Under such conditions the upper side of the grain level at the head of the cylinder would be so high that material could fall into the trough at the feed end due to sheer volume being raised by centrifugal force. At the tail end of the cylinder where the seed mass would be practically depleted, the seed would very quickly be lifted out of the restraining mass and would have too high a lift to get to the edge of the selection trough.

At the feed end of a cylinder separator there is naturally a large quantity of considerably undersize particles, two or three of which may fall into an indent at one time. As these are depleted, the intermediate sizes are lifted out of the mass at approximately the center of the cylinder length. At the tail end of the cylinder the final and most critical size selection by the indent is accomplished.

As mentioned earlier, lightweight seeds whose bushel weight is less than 45 pounds cannot be separated as sensitively as heavier weight seeds. For this reason the cylinder is more practical to apply on small grains, corn and soybeans, than it is on grasses. The larger the indent used, the more critical the weight factor becomes. Centrifugal force requires weight to be effective. Dropping a seed out of an indent requires a relatively heavy specific gravity, and the rounder the seed, and the slicker the seed coat, the easier the indent will affect the distance it will travel circumferentially. Hence, a wet seed will not slide out of the indent as readily as a slick dry one.

Adjustments on Cylinder Separator.

1. Rate of feed. It is necessary that the rate of feed be controlled. If the rate is too slow, then the failure to reach capacity becomes a problem. If the rate is too fast, then not enough time is allowed for cleaning. If the feed varies, all particles will not have the same length of time to be separated as did other particles. The procedure for controlling the rate of feed is simple; it is done by the opening and closing of a gate.

2. Position of trough. The degree of separation is controlled by the position of the separating edge of the trough. The separating edge is that edge adjacent to the rising side of the cylinder. If some of the long seed are lifted out by the indents, the trough is set too low. If the trough is set too high, the short seed picked up by the indents will fall back into the mixture and be discharged with the long seed at the end of the cylinder.

3. Speed of cylinder. The desirable speed can be determined by setting the trough level and then adjusting the speed of the cylinder so that the seed picked up by the indents will fall into the trough from the top of the cylinder. It is important that the cylinder be run at the correct speed. If the speed is too fast, the indents will pick up some of the longer seed that would normally be rejected. If the speed is too slow, the indents will reject some of the short seed that should be lifted. The speed is adjusted by changing a variable speed drive.

4. Action of leveler or conveyor. In those machines that use an increase in elevation of the feed end of the machine as a means of conveying, an adjustment is sometimes necessary. This is done by increasing or decreasing the elevation the desired amount to properly convey the material through the cylinder.

5. Position of the retarder. The retarder is adjusted to maintain a proper level throughout the entire length of the cylinder. The adjustment of the retarder will depend on the type of seed being processed, and the amount and size of the material being lifted.

In summarizing length separators, one cannot say that an indented cylinder is better than a disc or vice versa. Each performs certain separations better than the other, although their uses overlap in some instances. The disc is accurate, flexible, and consistent in the middle-sized seed groups. The cylinder is flexible without changing the cylinder size. In general, it performs best on seeds having a high weight per bushel. Each machine is better in certain groups of seed mixtures. Neither can eliminate the other completely.