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Length Separations By Disc and Cylinder

H. H. Underwood

LENGTH SEPARATIONS BY DISC AND CYLINDER

Hal H. Underwood[1/]

Within the last quarter of a century, those of us connected with agriculture have seen many phenomenal changes brought about through a changing world of mechanization and of unpredictable circumstances.

We have seen mechanization leap ahead in all phases of agriculture. Seed production and processing has grown from a simple "fanning mill", with seed produced on small plots, single crop operation, hand rogued and hand harvested, to our present day scientifically selected farms for the production of specialized seed crops.

Through the growth of this phase of agricultural and commercial seed production, those of us connected with the processing of these seed crops can realize and appreciate the problems we have inherited through mechanical means of harvesting.

The chemical industry has made tremendous progress in helping eradicate many noxious seed plants that are a serious threat to seed production and marketing of seed crops. Mother Nature always seems to have a way of combatting our challenges and continues to favor us with a new challenge as we progress.

Mechanization on today's seed plants holds the secret of a profitable operation. Selection of equipment that will meet the rigid and strict demands for certification of processing and maintain the highest possible standard of quality requires a thorough knowledge of the equipment available for the problem at hand.

To meet the demands of the seed industry, the equipment manufacturers have designed machines to fulfill these requirements. Some existing equipment adaptable to other agricultural industries have been redesigned; the disc and cylinder separator which was originally designed for the flour mills has played a major part in adapting itself to meet the demands of the seed processor.

The Disc Separator Principle

The Disc Separator was developed and designed in about 1919 and was the first type length sizing separator to be built and manufactured in the United States. The disc is a unique method of molding pockets or cups in the face side of a disc to rotate vertically in a mass of material. The disc pockets function like an elevator bucket, scooping up seed which will fit into the disc pocket rotating vertically in the mass of material in the body of the machine. The short material

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[1/] Mr. Underwood is associated with Simon-Carter, Minneapolis, Minnesota; engineers and manufacturers of machinery for separating, sizing and cleaning grains, seed and other free flowing granular material.

is held in the pockets by centrifugal force. This material is discharged in the same fashion as an elevator bucket discharges its load. Each disc consists of thousands of undercut recessed pockets in the face side of a specially hardened cast iron disc. These pockets are cast on both sides of the disc, making a honeycomb effect. In the center of the eye are three spokes protruding from a hub which fastens to a rotor shaft. Each spoke is so constructed that a short metal conveyor blade can be fastened to the spoke. The conveyor blade acts like a new screw conveyor to move the main mass of material through the eye of the disc from the inlet to the tail end of the machine. The conveyor blades are made removable so that they can be removed or added in whatever quantity is needed to make the material travel through the machine at the most efficient rate for complete separation. The mass of material must pass through the eye of each disc in order to reach the tail end of the machine, and the rolling and tumbling action of the material allows the material to come in contact with the pocket of each disc as it travels through the machine. The disc being a length type separator lifts out of a mass vertically dimensionally undersized particles, and the disc separator, like any other type separator is affected in its capacity and efficiency by the number of smaller particles to be removed. Discs are manufactured in four (4) diameters of 15", 18", 21" and 25". The various diameters compensate for capacity requirements. The RPM of the disc separator is constant. (See Note #1). Too slow or too fast speed will affect the efficiency of this unit.

Disc Pocket Design

Disc pockets are made in three basic shapes. Each shape is made in a number of sizes. There are over seventy-five (75) different pockets to choose from. Generally speaking, the pockets are consistent in their proportionate dimensions. The pocket size is always designated and measured by its width, measured radially from the center of the disc. The length or height of the pocket is essentially the same dimension as the width; and the depth is approximately one-half (1/2) the dimension of the width. (See Note #2). The lifting edge, or undercut part of the pocket is the bottom, and the width measure is from side to side.

Pocket Shapes

The "V" pocket derives its name from vetch. It is so designed as to pick up and hold or discharge round shaped materials. The pocket has a round lifting edge and a squared horizontal leading edge. Tubular, cylindrical, or elongated particles have no flat surface at the bottom of the pocket to sit on,

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Note #1: Approximately 58 to 60 RPM normal rotor speed.

Note #2: This is true when referring to the "V" and "R" type pockets

and will tip out of the pocket as the disc revolves. In this discussion we are referring to separations where the smaller particle is to be removed and close sizing between relatively uniform dimensional particles is to be accomplished.

The "R" pocket derives its name from rice, and was designed to remove cross-broken grain from whole grain. This pocket looks like a "V" pocket except that it is upside down. The lifting edge is flat and horizontal while the leading edge is round. This pocket will reject round particles, but will lift cross-broken or short tubular or elongated particles since they have a flat surface to sit on. An example of this would be lifting buckhorn plantain from orchard grass or fescue.

The "V" and "R" pockets are made only in small sizes, seldom exceeding 6 millimeters in width and length. The letters "V" and "R" are always followed by numbers, such as V4, V5 1/2, R4, R4 1/2, etc. The number following each of these letters indicates the width dimension in millimeters. A pocket designated as V4 1/2 is a round lifting edge pocket which is 4 1/2 mm. wide, etc.

Alphabetically Designated Pockets

Unfortunately, these pockets with alphabetical designations are not in sequence, as to size, nor do they carry a numeral to indicate their width. Generally, the square pocket has two basic functions. One is to rapidly scalp out small fractions of extremely long undesirables from a more uniformly sized bulk to make the material smoother flowing and reduce unnecessary bulk. The other is to provide a dividing or splitting separation, where each fraction thus reduced is to be re-sized in separate operations, or on a different type of machine. This principle is employed in the combination disc-cylinder machine. Oftentimes we produce two (2) or more clean seed products with a combination machine when handling seed crops that require a mother or booster crop to be produced with the selective seed crop. (See Note #3).

The combination Disc-Cylinder Separator employs the two principles of length separation along with a combination of the three (3) types of disc pocket designs that we have discussed. In the feed inlet or "splitter section", we find the square (alphabetically designed pocket) with the liftings (short material) going to a second section with still smaller pockets, generally with a combination of "V" and "R" type pockets. The tailings from this section will be a desirable product. The rejects from the splitter section will go to a cylinder for recleaning and from this we get our second clean product.

To give a clear explanation of the type length separators used by the seed processors, I find it virtually impossible to go further in this discussion of the length separators without discussing the cylinder separator.

The Cylinder Separator was first introduced and manufactured in the

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Note #3: Example - Vetch, Rye or Oats; Crimson Clover, Ryegrass or Oats; etc.

United States in about 1925. Both the cylinder and the disc employ about the same basic principle of operation today. To each of these principles the the manufacturers have incorporated various adapters to improve on the separation and handling of many type seeds produced. (See Note #4).

One of the most frequent questions asked today is - which machine is best suited for a seed plant operation, the Disc or Cylinder machine? To give an honest answer to this question, there are questions that should be answered by the person buying the machine. What seedscrops are to be handled? Does the operator have a combination of objectionable weed seeds that must be removed? Is the material to be cleaned a grain crop, grass seed crop, legume, oil seed crop, or is it a seed for human consumption? All of these factors are very important when selecting the proper machine.

Many recommendations that were made five (5) to ten (10) years back for some of our seed crops are not current with today's problems.

Through chemical control of some objectionable weed seeds, we may have controlled a particular problem that may have existed some years back, but very often when we eliminate one problem or one weed, we will inherit two new problems.

Disc pocket and cylinder recommendations made in some parts of the United States have changed so rapidly that it is virtually impossible to keep up with them. I am speaking primarily of the grass seeds, such as our fine-leaved fescue, orchard grass, ryegrass, etc. These are crops for which we are recommending more and more the use of the cylinder separator, depending on the basic problem.

Experience with the physical characteristics of certain seed crops is the basis for the type length separator that our recommendations must be made from. Seeds with high oil content are always hard to handle and present many problems while other seeds which are light and fluffy present an entirely different problem, and certainly we would not expect a single machine to handle both type products and do an effective separating job such as may be required.

Excessive foreign material is becoming more and more of a problem for the seed processor due to the method of harvesting our seed crops.

More and more the use of the combine is causing an excessive amount of small sticks, stems and light trash to be present in the clean seed. I am talking about small sticks and material that cannot be effectively screened out with the conventional screen and air machine. We have found that by using the Disc Separator in the final stage of the processing line (before the bagging operation) we can eliminate the small short sticks at this point.

Note #4: Special Hoppers and Feeders - Retarder Rings - Levelling Conveyors, Comb Bars, Grain Level Controls, Special Conveyor Blades Split and Spiked Conveyor Flightings, Return Conveyors, Grain Troughs, etc.

For many leafy grass seed crops, such as fescue, bluegrass, ryegrass, timothy, lespedeza, etc., we often recommend a combination of single rotor disc and cylinder separators. The Hart Uni-Flow Cylinder Separator has been most effective for final cleanup and salvage work. Small weed seeds, such as fanweed, sorrel, chickweed, dodder, buckhorn, Canadian thistle, quackgrass, chess and cheatgrass, may be eliminated with the use of a length separator.

The Disc Separator, like any other separator, does have limitations, but generally speaking, it does have a broad range of applications with most types and textures of products, efficiently handling such separations as crumbled leafy pieces from leaf stems and dry spices to length sizing shelled peanuts, and is not affected by weight or surface moisture. Most free-flowing materials can be easily conveyed through the machine. Certain grasses, such as bluegrass, bromegrass, crested wheatgrass, etc., which are not heavy in bushel weight standards, can sometimes cause problems. Therefore, it has been necessary for us to furnish special accessories for handling this type of materials. To those of you who have this problem or have experienced a similar problem, we will be most happy to discuss this with you. (See Note #4).

I would like also to point out that such products as corn and soybeans have not been successfully separated by the disc separator. The indented cylinder length separator is the unit we recommend for these products.

As we have mentioned before, we often recommend the Uni-Flow Cylinder Separator in the mill line to eliminate the last small percentage of undesirable weeds, and when applied properly, it is doing a job that cannot be accomplished on other type of equipment without the loss of too much good seed. All of the equipment representatives are here to give you any assistance we can, and with the broad range of experience accumulated through many years of work and research in this field, we are in a position to give you our recommendations and help for the asking. It is impossible for us to discuss each individual problem in the short time alloted us in the general discussion of length separators, and we would appreciate the opportunity to visit with you during our stay here and further discuss any problem you might have.