The disc separator is a length sizing separator which lifts uniformly shaped and dimensioned under-size particles out of a mass. Disc separation is not affected by surface texture, weight per cubic foot or bushel, nor moisture content of seed to any appreciable extent.

Flexibility within a machine can be achieved by varying the size of pocket, the number of discs of each pocket size, and provision within the machine for returning to the main mass liftings of the various pockets which it may not be desirable to remove. In a normal arrangement the disc pockets are furnished in a progressively larger size from the intake end to the discharge end. In this way, the smallest particles are lifted out of the mass first, with progressively larger liftings being removed as the material passes through the machine.

The disc pocket consists of an undercut recess in the side face of a special, hardened, cast-iron disc. Thousands of these pockets are cast on both sides of a disc. In the center of the disc is a round opening called an "Eye". In the center of the eye are three spokes protruding from a hub which fastens to the "Rotor Shaft" which carries the discs. Midway on each spoke a sheet metal conveyor blade may be bolted. These conveyor blades act as a screw conveyor to move the main mass of material through the eye of the discs from the inlet to the tail end of the machine.

The mass must pass through the eye of each disc in order to reach the tail end of the machine, and is brought in contact with the face of each disc in the course of its travel. The spacing between the outer edge of the disc and the body of the machine is kept as close as possible, without being close enough to squeeze or crush the material being separated. The conveyor blades are made removable so that they can be removed or added (in older model machines) in whatever quantity is needed to make the material travel through the machine at the most efficient rate for complete separation. Since in any separator the capacity and efficiency is determined by the ratio of small particles to be taken out; to the number of apertures, indents or pockets to take them out with; the speed of travel of the main mass through the machine affects the efficiency of the separation.

As mentioned before, disc pockets are a cast recess in the face of a flat disc which operates vertically. The disc pocket functions like an elevator bucket, scooping up seed which will fit into it as the pocket passes through the mass at the bottom of the machine, holding the material in the pocket by centrifugal force. The materials discharge from the pocket in just the same fashion as an elevator bucket discharges its load. This accounts for the minimum speed tolerances allowable in a disc separator. Too slow a speed would allow the material to fall out of the pocket before it should; and too fast a speed...
could prevent the material from falling out of the pocket at all.

**Disc Pocket Design**

Disc pockets are made in three basic shapes. Each shape is made in a number of sizes. There are over 75 different pockets to choose from. Generally speaking, the pockets are consistent in their proportionate dimensions. The pocket size is always referred to, 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 1/2 the dimension of the width. The lifting edge, or undercut part, of the pocket, is the "bottom" and the width measurement is from side to side.

**The "V" Pocket:** The V pocket derives its name from Vetch, and is so designed as to pick up, and hold for discharge round shaped materials. This 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, and tip out of the pocket as the disc revolves around the shaft. (In speaking of sizes in this instance we are referring to round shaped particles which have a diameter approximately the same as the width dimension of the pocket. Obviously, tiny particles much smaller than the width of the pocket could be retained in the pocket in multiples and would lift out of the mass regardless of their shape. In all cases in this discussion, we are referring to separations where the smallest materials have been removed and close sizing between relatively uniformly dimensioned particles is to be accomplished.)

**The "R" Pocket:** This pocket shape derives its name from Rice, and was designed to remove cross broken grains from whole grains. This pocket looks like a "V" pocket, except that it is up-side-down. The lifting edge is flat and horizontal, while the leading edge is round. This pocket will reject round particles, but will lift out cross broken or short tubular, or elongated particles since they have a flat surface to "sit" on.

Both the "V" and "R" pockets are made only in small sizes, seldom exceeding 6 millimeters in width and length. They are made from 2 1/2 mm. up to 6. These pockets are usually used in combination in a set of discs, particularly where a variety of sizes of liftings are to be encountered and versatility is desired.

The letters V and R are always followed by a number, such as, V4, V5 1/2, R5, etc. The number following one of these letters indicates the width dimension in millimeters, i.e., a pocket designated as V4 1/2 is a round lifting edged pocket which is 4 1/2 mm. wide, etc.

**Alphabetically Designated Pockets, Other Than V or R:** Unfortunately these pockets with alphabetical designations are not consistent in sequence as to size, nor do they carry a numeral to indicate their width. The story of the development of the size designations is a rather lengthy one and will not be
discussed at this point. It is sufficient to say that the alphabetically designated pocket, without a numeral suffix, is square-faced.

Those square-faced pockets which are approximately less than 1/4 inch in width have, in most cases, been supplanted by the V and R pockets, although they are still available, and in some specific instances can probably be used to definite advantage over the V and R type pockets.

Generally, the square pockets have two basic functions. One is to rapidly scalp out a small fraction 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 "splitter" separation, where each fraction thus produced is to be resized in separate operations, or on different types of machines. Dividing a material which has a broad range of particle sizes and resizing the fractions separately provides much faster overall capacity and more precise separations.

**Disc Separator Adjustments and Separation Control**

The disc pocket can make extremely sensitive length sizing selection. In most applications the material consists of varying degrees of length or shape, and it may be desirable to separate the stock into more than one length size or to remove one or more differently shaped particle groups from the main mass. As mentioned previously, it is possible to arrange a group of discs on a single shaft using one to as many as six different pocket sizes and types to provide selective fractioning of the input material.

As the disc pocket lifts and ejects a particle of a particular shape or size the particle falls on a "liftings discharge trough" set between each disc, which directs the material to a "liftings discharge hopper" at the front of the machine. At the outside end of the liftings troughs is a small screw conveyor which is covered by hinged trap doors. If the doors are "down" the lifted material passes over the door into the liftings discharge hopper. If, for any reason, the operator does not want the liftings of a particular disc or group of discs to fall into the discharge hopper, he can raise the trap door which will deflect the liftings into the screw conveyor and be returned to the feed end of the machine where it feeds back into the main mass. This "return conveyor" adjustment is most frequently used at the tail end of the machine where particles may be lifted which the operator would prefer to discharge from the machine with the longer size disc rejects. It literally permits the operator to shorten his machine by blocking off the last few discs, if he finds he is lifting out too much.

The lower edge of the liftings discharge hopper outlet at the front of the machine can be provided with one or two draw-off valves, one near the feed end of the machine and one at the tail end. Since the smallest particles lift out of the mass on the first few discs it may be desirable to draw off the smallest liftings separately from the longer liftings discharged at the center of
the disc shaft. The liftings of the last few discs may be too short to join with the tailings and too long to mix with the center disc liftings or may be in large enough quantity to overload the small return conveyor, so the operator can use the draw off wing valve at the tailings end of the liftings hopper. Using both adjustable valves permits the operator to keep separate three sizes of material falling into the liftings discharge hopper producing three lengths of liftings in addition to the oversize material tailing off the end of the machine which was too long for the disc pockets to lift.

**Grain Level Control**

In the latest design Carter Disc Separators a new feature has been added to provide more positive control, and quick selective adjustment to the rate of travel of material through the eye of the discs without removing or adding conveying blades. Known as the "Grain Level Control" it consists of crescent shaped blades, somewhat similar in appearance to the broad end of a canoe paddle. In the No. 1522 size machine the blades hang from a rod at the back of the disc machine just under the lid. A blade is placed between each disc of the last two-thirds of the disc assembly. Each blade has a steel collar with a square headed setscrew at its upper or "hinge" end, and each retarder blade can be adjusted independently. By loosening the setscrew the blade may be moved forward so as to block off part of the eye of the disc where the grain mass is heaviest. By shutting off a portion of the disc-eye opening the blade retards the rate of travel of the material, causing it to fill the body of the machine more deeply at that point. This makes the material ride higher at the back of the machine, reducing the distance which the disc pocket has to carry the undersize material from the mass to the liftings discharge point. The higher the grain level is at the back of the machine the larger particles the disc pocket can lift. If the grain level is low, the particle has more time to fall out of the pocket before it reaches the ejection or discharge point. By this control the pocket can lift slightly larger or smaller particles and is more flexible in its selectivity.

In most cases (particularly in small pocket layouts) as many as six different sizes and shapes of pockets can be used on a single disc shaft. The smallest pockets are mounted on the feed end of the disc shaft, with progressively larger pockets toward the tail end. Since the pocket shapes, in addition to their dimension, can be selected to meet varying separation conditions, the operator frequently finds that one particular group of discs can remove a specific sized or shaped particle more effectively than another. By using the grain level control blades he can hold the material longer at that group of discs, increasing the lifting capacity at that point only, without changing the grain level at any point in the machine. Changing the grain level does not materially change the input capacity but only increases or decreases the liftings percentage of the retarded flow area. Usually if the separation to
be made is an easy one, or if the pockets tend to lift the desired size readily, the retarders would be moved out of the disc eye area so as to keep the grain level low. As the disc pockets wear down losing some of their lifting ability, raising the grain level in the machine permits them to work at peak efficiency for a longer time before disc replacement is made necessary.

At the tailings discharge outlet, in the end frame of the machine, an adjustable gate or retarder is provided to control the rate of discharge and the grain level for the last few discs.

Using these adjustments in combination provides the disc separator with broad flexibility of selectivity and can produce more than one length size at a time.

**Disc Separation Limitations**

The disc separators have broad applications in most types and textures of products, efficiently handling such separations as crumbled leaf pieces from leaf stems in dry spices, to length sizing of shelled peanuts (without damage or nut breakage), and are not affected by weight or surface moisture. Most dry materials which are normally not free flowing can be remarkably easily conveyed through the machine. However, some materials may wedge in the pockets causing plugging and lost efficiency. For example, compressed powdered pellets, corn and soybeans cannot be separated or handled by disc separation. In this case, we recommend consideration of indented cylinder length separators as an alternate. Laboratory tests can best determine which principle of length separation should be used.