HOW TO CONVEY SEEDS TO MINIMIZE MECHANICAL INJURY

James M. Beck

Since all of you are interested in quality seed and because most seed are considered fragile GIVE YOUR SEEDS A GENTLE RIDE . . . wherever they're going.

MECHANICAL INJURY

Mechanical injury is a damaging thing that happens to a seed in a direct, positive manner. I think we can say that pressure is the big enemy in conveying seed. Anytime extreme pressure is applied we have damage. Place a seed under your foot and press, or slam one against a hard surface; the pressure exerted by your weight or the pressure from the change in velocity ruptures the seed and renders it useless.

Every time anything is required to change direction and velocity, a pressure is exerted on one side of it. The shock transmitted to a seed is in direct proportion to the velocity of the particle and object struck and the extremeness of the angle.

In order to reduce or eliminate damage to seeds, we must do two things: reduce velocity and change the direction of the material only as often as necessary.

The one thing most affecting the material being handled, as far as damage and contamination are concerned, is design of the complete conveyor unit including hoppers, discharge spouts, clean-outs and that part of the conveyor that comes in contact with the seed.

SEED CONVEYORS

The conveyor selected for any step in a seed processing line should: (1) minimize damage to the seed, (2) have adequate capacity to serve the receiving, processing or storage requirements, and (3) be self-cleaning or easily cleaned.

Mr. Beck is Engineer Technician, Seed Technology Laboratory, Mississippi State University.
Figure 1 shows a bean storage facility at Selkirk, Kansas, designed to meet these three requirements. The receiving, elevating transfer, distribution and outloading are handled by seven Beltveyer units. Beans are brought in by truck and dumped into an undertruck conveyor which feeds a tubular unit. The beans then go through a cleaner which dumps in a horizontal conveyor which carries the product to the bucket elevator. A shuttle-veyor distributes the beans into hopper bottom bins. Unloading is accomplished with a trough-veyor running underneath the bins which discharge into the tubular conveyor (which serves double-duty) to load trucks. A grain auger is used to move the waste materials from the cleaner. Figure 2 shows the new 8 inch Beltveyer Tubular Conveyor that operates from gas, electricity, PTO, or hydraulic power. It is built by Speed King Manufacturing Company, Inc., Dodge City, Kansas.

A conveyor is a mechanism that moves material from one location to another in a continuous manner. This definition includes horizontal conveyors and vertical conveyors (elevators) as well as conveyors operating on a inclined plane.

A short description of several types of conveyors particularly suitable for handling seed follows.

**Flight Conveyors:**

A flight conveyor consists of one or two endless power driven chains carrying properly spaced scrapers or flights for moving material along the length of a stationary trough. Material fed into this trough is thereby pushed along its length for discharge at the end of the trough or through intermediate discharge gates.

Flight conveyors are used for either horizontal or inclined paths and are frequently installed where the angle of inclination is comparatively steep. Some flight conveyors can be made so that they are reversible, but it is necessary to modify the terminals to handle the maximum chain tension under different circumstances of conveying. When only one discharge spout is required at the end of this type conveyor, it is practically a self-cleaning mechanism; however, when a number of intermediate discharges are needed there can be a slight carry-over of material from one spout to the next. If the manufacturer is advised of the seed being handled, certain steps can be taken to combat this situation. One thing that can be done is to locate brushes over each outlet where the biggest part of the carry-over occurs. It is usually desirable to have any surplus material carried out the last spout to prevent mixing.

Figure 1 and 2 from photographs supplied by Speed King Manufacturing Company, Inc.
Figure 3 and 4 shows a standard take up connected to a divided inlet spout and intermediate trough section and a cross section of a Super-Flo trough. The flights are shaped to the contour of the trough. The flanged cover fits snugly over the double flanges of the trough and a gasket is continuously fitted between the trough and cover. The Barron clamp can be released quickly by finger pressure to allow immediate access for inspection or maintenance. Figure 5 illustrates a combination horizontal and inclined conveyor which includes a special bend section to accommodate the transition between horizontal and inclined conveying. Super-Flo flight conveyors are manufactured by Screw Conveyor Corporation, Hammond, Indiana.

Belt Conveyors:

A belt conveyor is an endless belt operating between two pulleys with idlers to support the belt and its load. Belt conveyors handle bulk and packaged material in large or small volume and can carry up slopes to 27°, depending upon the nature and condition of the material handled. They are low in power and maintenance costs, deliver uniform volumes at high or low speed, have few parts subject to wear, and are simple, quiet and reliable. The initial cost of a heavy duty, high capacity installation is rather expensive, but utilization of a belt system often results in surprisingly low over-all costs per ton handled.

Essential parts of a belt conveyor are the belt, the drive, and driven pulleys, tension adjustment mechanism, idlers and loading and discharging devices. Material may be discharged over the end of the belt, or along the sides by using diagonal scrapers or by tilting the belt. The most satisfactory way to discharge seed along the length of a troughed belt is with a tripping mechanism consisting of two idler pulleys that divert the belt into the shape of an S. The material is discharged over the top pulley into a side chute. Trippers are usually mounted on tracks so that they can be moved to any position along the length of the belt. A compact Tripslinger with high-speed reversing belt that gives left or right 90° discharge is available for Troughveyors. With its low-profile design and extended slinging ability, storage capacities can be substantially increased with this unit.

Figures 3, 4, and 5 from photographs supplied by Screw Conveyor Corporation.
Figure 6 illustrates a belt conveyor where the load-carrying portion of the belt is supported by a smooth trough shaped steel surface. Figures 7 and 8 show the conventional methods of discharging material from a belt conveyor - tripper and end discharge.

Vibrating Conveyors:

Vibrating conveyors, also called oscillating or shaker conveyors, move materials uniformly in a continuous flow along a metal trough or tube. The trough is mounted on rigid inclined toggles and is usually driven by a constant stroke eccentric drive. The horizontal motion resulting from the eccentric is transformed into an upward and forward pitching action by the inclination of the toggles. The material moves up and forward with each vibration while the trough returns backward and down. The result is a series of rapid pitching actions which produce a total net movement of the material toward the discharge end of the trough. Short feeding-type conveyors are sometimes powered by an electromagnet that can produce different vibrations depending upon the rate of feed desired.

One of the outstanding advantages of the vibrating conveyor to the processor of pure seed is that it is completely self-cleaning and easily inspected. They are often used to convey seed from beneath a cleaner to an elevator leg on the same level. Figure 9 illustrates a unit of this type.

The vibrating conveyors shown in Figure 10 have a unique design to transmit force in a longitudinal direction only. The drive assembly is not directly connected to the conveying tube or trough: this virtually eliminates vibration transmission to the supporting structure. These units can be installed “as is” in nearly all building - even wooden structures - without extra bracing or reinforcing.

Carter-Day Company, Minneapolis, Minnesota, can supply these vibrating conveyors in length up to 90 feet with provision for multiple feed and discharge points.

Bucket Elevators:

Bucket elevators are probably the most widely used method for elevating bulk materials. Various types and designs are available to meet the requirements of different materials and operating conditions.

Figures 6, 7, and 8 from Universal Industries brochure. Figure 9 from A. T. Ferrell Company brochure. Figure 10 from Carter Day Company brochure.
Buckets are mounted on a chain or belt. They receive material at the boot and discharge it over the head pulley by centrifugal action or by gravity. The centrifugal discharge types are normally used for free-flowing, fine to medium size materials. Those discharging by gravity, which comprise positive discharge, continuous bucket and internal discharge types, are generally used for materials more difficult to handle due to fluffiness, sluggishness, fragility or similar characteristics.

Belt type bucket elevators are quiet, efficient and long lasting. The chief disadvantage of some designs are that speed may damage seed and the enclosed units are difficult to clean out.

Based upon the method of discharge, bucket elevators can be classified into four types:

1. Centrifugal Discharge

Elevators of this design have buckets mounted on a belt or chain at spaced intervals. The buckets are loaded by scooping up material into them. Material is discharged by centrifugal action as the buckets pass over the head pulley. Since discharge from the buckets is dependent upon both centrifugal force and gravity, the shape of the bucket, the speed and radius of the head pulley and the position and angle of the chute must be in proper relationship for efficient operation. Elevators operated slower or faster than the speed for which they were designed to handle a particular type material causes back-legging, or the material is thrown against the discharge spout. Figures 11 and 12 illustrate the principle of operation and the construction of this type elevator.

2. Positive Discharge

Elevators of this design operate successfully at low bucket speeds and are suitable for handling light, fluffy and fragile materials and those having a tendency to stick in the buckets. Buckets are mounted at spaced intervals on a pair of chains. They are loaded by scooping up material from the boot or by feeding the material into them. After passing over the head pulley, the buckets are inverted over the discharge spout, thus providing a positive discharge of material. Figures 13 and 14 illustrate the principle of operation and the construction of this type elevator.

3. Continuous Buckets

Elevators of this design are made in a number of types for handling many bulk materials ranging from light to heavy and from fine to large lumps. Buckets are spaced continuously and loaded by direct feeding.
Spillage between buckets is prevented by their close spacing. As buckets discharge, the material flows over the preceding bucket whose front and projecting sides form a chute. Figures 15 and 16 illustrate the principle of operation and the construction of an "Easy Dump" Universal elevator.

4. Internal Discharge

Internal discharge elevators provide excellent means for the continuous, gentle handling in bulk of relatively small, fragile material. Buckets are internally loaded from a chute extending through either side of the casing. They are so designed and positioned that they overlap during loading and are inverted to discharge the material into a chute at the top of the elevator. Some elevator designs use one foot and one head shaft; others are equipped with one foot and two head shafts, and still other have two foot and two head shafts. Some are cased, some are not. Figure 17 illustrates an open type with a metering hopper driven from one of the two lower shafts. This type elevator is gaining in popularity among seedsmen because of its gentleness in handling seed and ease of cleaning.

Since the seed is fed into the slowly moving overlapping buckets of an internal discharge elevator no boot is needed. With no boot, the friction caused by the buckets moving through the mass is eliminated, no seed can become crushed between pulley and belt or chain and sprocket and the seed need not fall any further than the depth of the bucket during feeding. Since the buckets move too slowly to exert an appreciable centrifugal force, the seed is discharged from each bucket by gravity into a chute which may be spouted to either side. When the chains are lubricated with graphite, the unit is practically self-cleaning. If it is not cased, inspection for cleanliness is simple.

Figure 18 shows the Universal "El-Con", a combination elevator and conveyor that replaces the need for two separate pieces of equipment... a bucket elevator and conveyor. It can be manufactured in a number of different configurations from the model shown to the Z, C or other shapes to fit exact requirements.

One of the main features of the El-Con is its gentle handling characteristics, allowing you to handle the most delicate products without breakage or damage.

Figures 11, 12, 13, 14, and 15 from Link-Belt Catalog 1050. Figure 16 from Universal Industries brochure. Figure 17 from J. L. Mitchell Company brochures.
In handling seed we must keep in mind that there is no way for injuries to seeds caused by conveying equipment to be healed once they occur. GIVE YOUR SEEDS A GENTLE RIDE... wherever they're going.
FIGURE 11

FIGURE 12