THE BELT MOUNTED BUCKET ELEVATOR

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Up to now, the conventional belt mounted bucket elevator is the most near perfect piece of machinery for elevating all bulk, dry, granular materials. The reasons I say this are as follows. More work can be done, using less power, with the bucket elevator than any other method. Original cost is at a minimum as is upkeep and maintenance. If it is of an approved construction, it is easily purged of one material before running a different material to reduce contamination and mixing. Last, but not least depending on the speed of the unit, breakage of fragile materials will be at a minimum.

The conventional bucket elevator, as simple as it is, is also the most misunderstood. If a few basic rules are followed and some thought given to the problem, some of these mysteries will be cleared up here, today.

Because we are interested in seeds, and because most seeds are considered fragile, let's see if we can determine first the cause of the breakage. One of the basic laws of physics can easily clear this point up, so lets apply it to our industry and see what comes of it.

I think we can say that pressure is our big enemy here. Place a seed on the floor, place your foot on it, and press. The pressure exerted by your weight on one side of the seed, and by the floor on the other, ruptures the seed and renders it useless. This type of pressure damage is not too common, but it does help us to prove our point.

Anytime extreme pressure is applied to one side of the material, we have damage. How does this happen, and what can we do about it? Everytime anything is required to change direction and velocity, a pressure is exerted on one side of it. Compare the action at this point to that of billiard balls during a pool game. The shock of one ball contacting the cue or the other balls is tremendous, not only to itself but to the target. Also, the shock transmitted is in direct proportion to the velocity of one ball to another and the extremeness of the angle.

In order to reduce or eliminate damage to our 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 unit including hoppers, discharge spouts, cleanouts and that part of the elevator that comes in contact with the material.

From intake to discharge, the points to press here are these; hopper design and placement. The hopper should be of such a design that a maximum

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amount of material will be directed into the buckets to prevent churning in the boot. The hopper should be placed high on the up leg side and never on the down leg side. The material should flow in a straight line from the front of the hopper into the buckets and not from the side of the hopper.

The type of bucket, their shape and size, does not directly affect material damage, though the manufacturers of plastic buckets maintain that the thickness of the lip of their buckets reduces the shearing action at this point. My personal thought on this argument is that if a shearing action is taking place with a steel bucket, the speed is too fast. Later on we will talk about speed and this will be discussed at that time.

The design of the elevator head should be compatible with the type of elevator and of such a design so as to not be contacted by the material unnecessarily, or while the material is traveling at a high rate of speed, or at a severe angle to the casing.

The discharge throat, or spout adapter should, as in the hopper, flow the material directly into the spout with as little swirl or change of direction as possible.

The biggest thing we can do to reduce or eliminate material damage is to use the proper belt speed. Actually, there are two basic types of belt mounted bucket elevators. The only difference is in the type of buckets and the belt speed. Different speeds actually give us different types of elevators.

The continuous discharge type, sometimes called continuous bucket type, we refer to as an "Easy Dump." Continuous discharge elevators run at an extremely slow speed. The v-type buckets are mounted continuously or one immediately following the other. As the loaded buckets pass over the head pulley, the material slides, by gravity, out of the bucket, across the back of the preceeding bucket and out the discharge spout.

The same elevator, speeded up considerably, would be a centrifical discharge type and would throw the bucket load into the discharge spout. It is easy to see that the velocity attained by the material could easily damage it. The damage in the boot too, would be greater because of the higher speeds. If there is a shearing action of the bucket against the material, this of course, would be greater at the higher speed.

Exact speeds too, are critical. If we were to view the discharge action of a well designed unit with a 6" head pulley at various speeds, we would observe the following: at speeds below approximately 100' per minute, the material would fall from the bucket and rain down the legging as the bucket passed over the head pulley. Between approximately 100 to 120' per minute belt speed, the continuous discharge action takes place. Speeds will vary slightly, depending on the material and its angle of repose. For this reason we provide a variable speed sheave for the motor. In correctly engineered elevators, there will be no down legging and this then would be the speed that is least

likely to damage materials. These speeds are used for, of course, extremely fragile seeds, nutmeats, glass marbles and so forth.

If we speed the unit up further to the speed of between 120 to 200' per minute, we will only succeed in throwing the material out of the buckets to just short of the discharge spout, and again it will fall by gravity down the down leg.

Above 200' per minute, we find a mild centrifical action where the material is "lobbed" into the discharge spout in a lazy manner. Material that is not too easily damaged can be handled at this speed which, because of the faster belt speed, will produce more capacity with the same size unit.

As the belt speed is increased above the 200' per minute, the discharge action, as well as the receiving action, becomes more violent and capacity is increased as is the damage to fragile materials. At a point somewhere above 400' per minute, the centrifical action holds material in the cups too long and improper discharging will again occur. This high speed action is similar to swinging a bucket of water around your head; the faster you go, the less chance you have of getting wet.

Now that we have the material elevated, we must clean out our equipment. Because we have selected a properly designed unit, there will be no ledges in the legging or head for material to lodge. Providing bucket cushions or round washers are placed behind belt and buckets, we should not have to clean at this point. The boot bottom will, of course, contain a small quantity of material and it can be cleaned by raking the material out the cleanout door provided, or by dropping it out the bottom if the unit has this feature. As an added precaution, we can vacuum the belt, cups and boot bottom while rotating the belt by hand.

A good thing to throw in here is that you should exercise extreme caution when working on the moving parts of the elevator. Render the starting switch useless by removing a fuse or placing a cover over the switch. Signs are to be ignored, so don't rely on them and don't just trust to luck. People with one arm have not been very lucky.

Most bucket elevator manufacturers show horsepower rating for a standard material such as wheat, which weighs 60# per bushel. Material that varies greatly from this weight will require a different horsepower. A good rule to use when calculating horsepower is to double the tons per hour of capacity, multiply by the discharge height, and divide by 1,000. About 80% of this power is converted to the actual lifting force and the remaining 20% is figured as friction loss and the amount of power necessary to load and discharge the material. Because of the lack of friction between the material being handled and the casing and internal parts, the bucket type, belt mounted elevator is considered the most efficient and gentleness handling device known to man.

The roll of the belt mounted bucket elevator in the seed plant is an important one. The most important things to consider with this equipment is

proper design and correct speeds. Since Oliver Evans invented the bucket elevator in 1792, all industries have used them as an important link in automation.

Probably the most important pieces of equipment in your seed plant today are your bucket elevators. Without these ideal units, it would be necessary to lift the materials either with much more expensive systems, or by hand. Just like with your automobile and truck, periodic preventitive maintenance and adjustment is necessary to keep them running properly. If it is synchronous with your other pieces of equipment, the materials will flow through your plant smoothly and at a low cost. Profits will be higher because of less capital expenditure and less labor and probably the most important, quality will be increased because of a minimum amount of contamination and mixing.