From Powder and Bulk.com

Ask Joe! Column

How to Design a Volumetric Belt Feeder

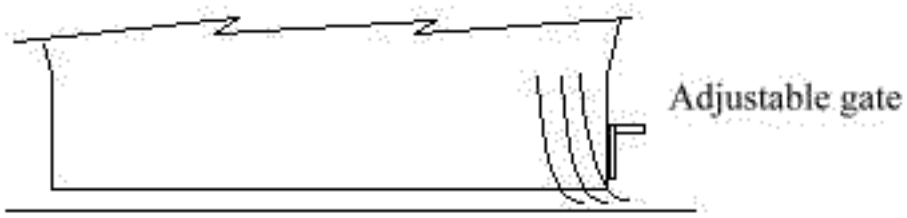
by Joseph Marinelli

When using a hopper with a slotted outlet configuration, you are pretty much limited to using a belt feeder or screw feeder to withdraw your product. Belts and screws can be designed as volumetric devices, since they discharge a particular volume of material per unit time. This is done by control of belt speed or screw rpm. We discussed screw feeder design in previous articles, recognizing that a screw is a good device when you require it to be enclosed or you have a headroom constraint. A belt feeder is preferable to a screw when handling certain bulk solids, and you would typically use a belt when:

1. You require a large slotted opening to prevent arching
2. You are handling large particles, sticky or fibrous materials
3. Dust is not a problem

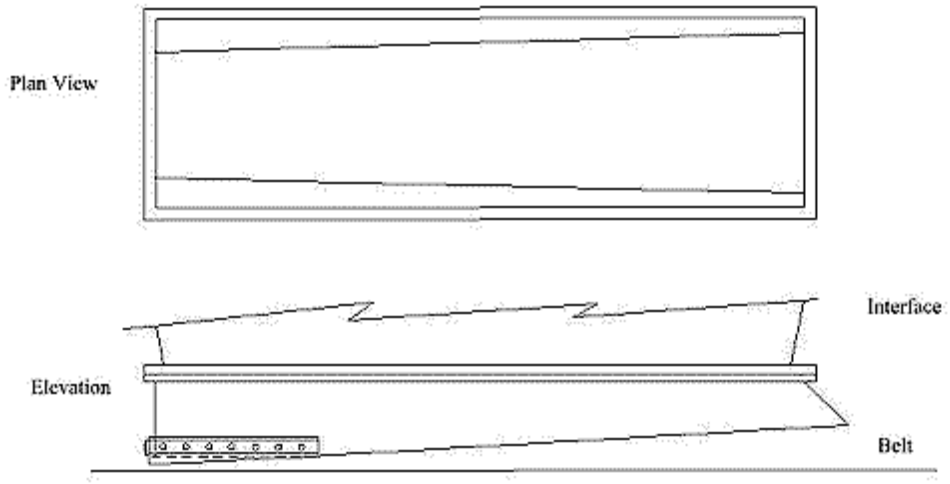
Assuming that your hopper is designed to give you reliable mass flow, the belt feeder must be capable of maintaining the mass flow pattern and withdraw material uniformly over the entire outlet cross-sectional area. The key to this approach is to ensure that the feeder increases in capacity in the discharge direction. This is an extremely important statement that will be made several times during our discussion.

Figure 1: Adjustable Gate Hopper on Belt Conveyor



In this article we will suggest ways to design belt feeders. Take, for example, the approach shown in Fig. 1. This design shows the material being discharged from the bin or hopper, directly onto the belt below. Notice that a gate is used to regulate the amount of product that is allowed onto the belt. Also notice that the material is being withdrawn preferentially from the front of the hopper. Obviously, if mass flow is required because of the flow properties of the material, this approach serves to create a funnel flow pattern (some material moving, the rest remaining stagnant). A stable rathole can form, causing a flow stoppage, erratic feed, flushing and or segregation. As well, this preferential flow channel can cause solids compaction, wear on belts, and excessive power required to move the belt.

Figure 2: Optimum Design



Does this mean we cannot use a belt under a mass flow bin? Absolutely not! As with screws, the capacity of the feeder must increase in the discharge direction in order for the material to be withdrawn uniformly over the entire outlet. In order to reliably deposit solids onto a belt, a properly designed interface between the bin and belt is recommended. The optimum design of an interface is shown in Fig. 2. Notice that the bin or hopper is not modified but a properly designed interface is used to achieve the increased capacity in the discharge direction. Also notice that the interface increases in capacity in elevation view as well as in plan view.

The slant nose provides stress relief as material is transferred to the discharge end. Flat or troughed idlers can be used to support and train the belt. Troughed idlers will provide a more rigid belt. If flat belts are used, the idlers should be closely spaced so as to prevent belt sag. Skirts can also be used to prevent spillage. Be sure that the skirts expand slightly in the direction of belt travel so as not to interfere with material flow.

The rule of thumb to obtain the increased capacity is to increase in plan view and elevation view, approximately j" per foot of outlet length. Others have used about a 3° to 5° increase to obtain the proper increase in capacity. Also remember that width of the interface slot outlet at the back is set by the required slotted opening to prevent arching. Additionally, the sidewall angle of the interface should be at least the required angle for mass flow for a wedge shaped configuration (it can be steeper).

The above approach will allow you to reliably discharge product onto a belt feeder or conveyor. Keep in mind, that a belt can be converted from volumetric feeder to a gravimetric feeder, simply by adding weigh idlers upstream of the bin outlet. The signal from the weigh idlers will cause the belt to speed up or slow down according to the set point.

++++++++++++++++++++++++

Welcome to Ask Joe!, a monthly column by our resident materials handling guru, Joe Marinelli of Solids Handling Technologies. Joe addresses the issues that bug you the most. And Joe knows!! Formerly with Jenike & Johanson, Solids Flow and Peabody TecTank, Joe is an expert on materials handling.

For past articles, **Ask Joe!** Archived Articles.

Guest articles for the **Ask Joe!** Column are always welcome, for more information please contact Joe Marinelli directly at his email address: joe@solidshandlingtech.com.