Whitepaper

3/8/19

Bottle unscrambling

Generally, automated bottle orienters as discussed in a previous whitepaper are preferred for reasons of speed and ergonomics. On the other hand, sometimes they are impractical for a variety of reasons. When bottles have to be loaded on the line manually, unscrambling tables can be used.

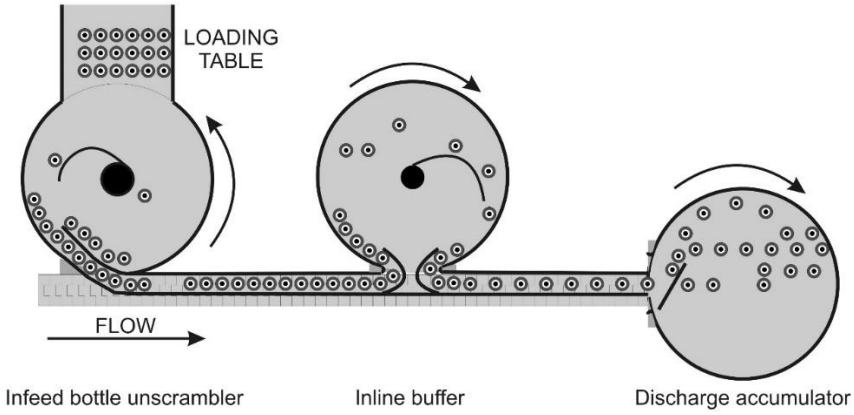
Unscrambling tables take bottles from a mass of randomly organized bottles to single file for discharge to a conveyor. Occasionally, they will discharge in multiple lanes.

Unscrambling tables also serve as buffers, accumulating a supply of bottles so that the operator doesn't need to be loading them one by one.

Unscrambling tables come in 2 styles, rotary and linear:

Rotary unscramblers

Rotary unscramblers are sometimes called turntables. The problem with this nomenclature is that turntables can also be used for end of line accumulation or inline buffering. The only difference between the 3 applications is in the guiderail configuration. "Unscrambler" tells us that it is used for converting mass bottles to single file and "rotary" tells us that it does this via a turntable.



Rotary unscramblers consist of a disk, usually stainless steel but sometimes plastic or other materials, mounted on a base. The base can be open or it can be enclosed in a cabinet as seen here. The cabinet, while a bit more expensive, generally gives a more pleasing aesthetic to the equipment.

Turntable disks typically range in diameter from as small as 24” to as large as 60” in diameter. Larger and smaller sizes are also possible if needed. Speeds are usually a few RPM often via DC motor with a potentiometer for speed control. Drive should be through a transmission or belt of chain drive. While DC motors can be turned down to a very slow speed, when they are they can stutter and impart a jerky motion to the unscrambler. This jerky motion will cause bottles to fall over. A speed reducer allows the motor to run a 50%, or some other fraction, of it’s normal speed while the unscrambler disk runs dead slow and smooth.

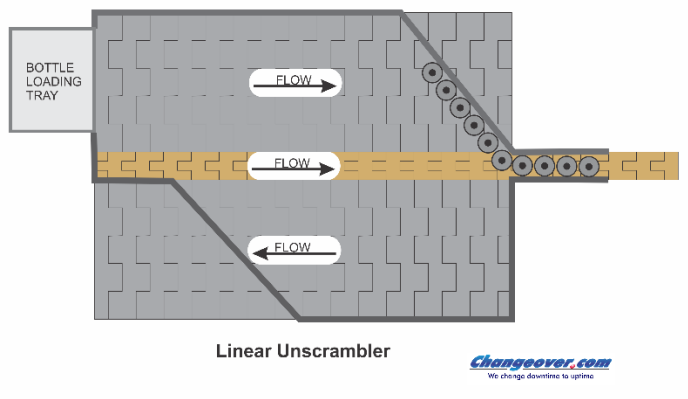
Support for the disk will also contribute to smoothness. Some unscramblers support the disk directly on the frame with some low friction wear strips of UHMWPE (Ultra High Molecular Weight Polyethylene). A better solution is 3-4 sets of rollers on ball bearings to provide less friction. This will be especially true with larger diameter disks and heavier bottles, such as glass.

Because of the slow disk speed, centrifugal force which would normally push the bottles to the outside has little to no effect here. Guides will be required to single-file the bottles to the exit. Guides need to 1) Direct the bottles away from the loading area and 2) direct the bottles to the exit lane. Different schemes may be used as needed but usually include a center guide to sweep the bottles to the outer edge and an outer guide to help single file them and guide them into the discharge.

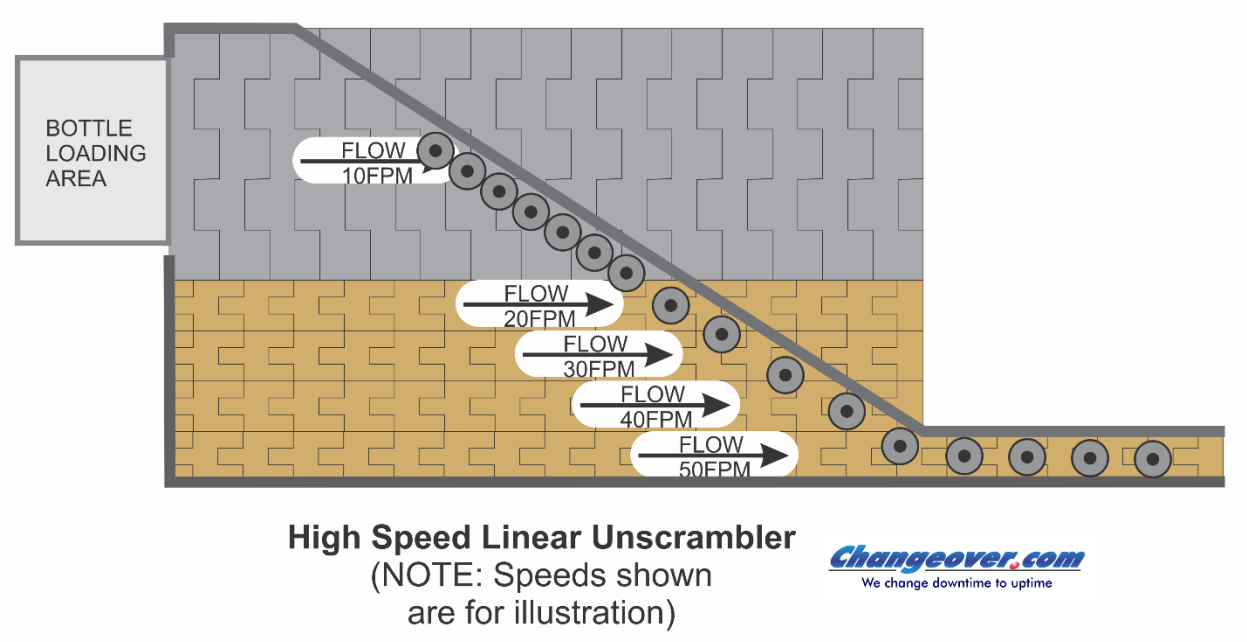
Linear unscramblers

Linear unscramblers are usually a frame with multiple, wide, conveyor chains. The chains run in opposite directions with one leading to an outlet. At the outlet, guide rails direct a single file of bottles onto the discharge conveyor. Excess bottles bubble off and a wide conveyor chain running in the opposite direction carries them back to the infeed side of the table where another guide directs them back onto the other conveyor.

The bottles actually travel in a large oval. Bottle movement is similar to the rotary unscrambler but, because the unscrambler is rectangular, more efficient use of the footprint is possible. The linear unscrambler can also be sized to fit the available space and accumulation need. It can be long and narrow, short and wide or anything in between.

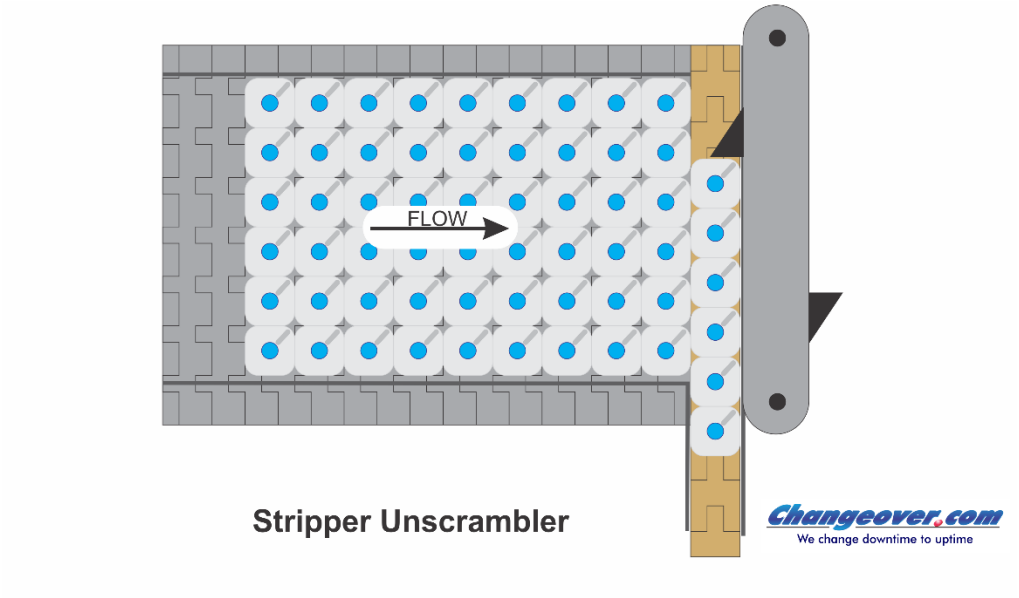


A variation on this uses multiple conveyor chains all running in the same direction. Bottles are loaded onto the loading chain and guided onto successively faster chains. As the bottles move to the faster chains, they are separated and forced against an angled rail. This combination of separation and rail converts them to a single file running at a high speed at the discharge. NOTE: The chain speeds shown are for illustration to show how they gradually increase. Actual speeds will be based on the bottle, system design and line requirements.



Some bottles, such as gallon and half gallon milk bottles, come packaged in plastic wrapped bundles. These lend themselves to another type of unscrambler.

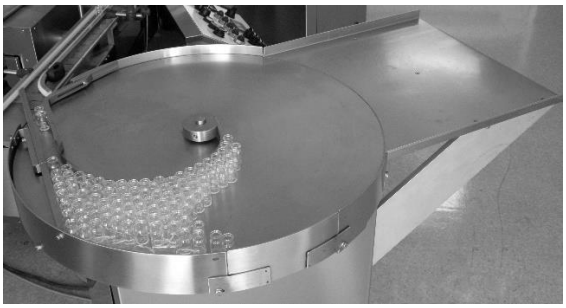
The complete, wrapped, bundle is placed on the infeed conveyor and the plastic wrapping removed. The infeed conveyor pushes the bottles forward to a takeaway conveyor mounted at a right angle. As the bottles move onto the takeaway conveyor, a pusher mounted on a chain pushes the row of bottles forward, getting them out of the way for the next row to move forward. Some systems include automatic debagging systems. This allows a stack of bundles to be placed near the infeed and loaded via robot. This frees an operator for other tasks.



Loading

On lower speed lines, up to 60bpm or so, it is often possible for a single operator to keep up with the loading. This depends on the bottles and how they come to the line. Bottles that are oriented in the case, so the operator can pick several bottles at a time without needing to orient them, will load much faster than bottles that come random in the case.

In either case, there are ways to make their job easier and faster. Placing bottles, especially small or unstable bottles, onto a moving disk or chain can be tricky. It can often lead to bottles falling over. In most cases a stationary loading tray should be provided as shown here.



This tray allows the operator to place a number of bottles onto a stationary surface without worrying about motion or interference from other bottles already on the disk. Once they have placed the bottles onto the tray, the group can be pushed onto the disk. In a group, the bottles will support each other as they are pushed onto the disk. As the group is pushed onto the disk, they will push other, rotating, bottles out of the way. A loading tray can probably double the speed at which an operator can place bottles on the unscrambler.

If the bottles come oriented in a case, a tilting mechanism can further increase efficiency.

The case is opened from the bottom so that the bottles are neck down. The open case is pressed against the vertical tray, a foot pedal is pressed and the tray flips to horizontal. The operator slides case and bottles onto a stationary tray, lifts the case off and pushes the bottles onto the disk or chain.

Higher speed lines will need automated equipment to transfer the bottles from case, bundle, pallet to the unscrambler. The equipment used will depend on how the bottles come to the plant.

Some products are supplied in unsealed reshipper cases. Bottles are removed from the case, filled capped and labeled and replaced in the same case.

Bottles can be supplied neck down or neck up.

This is how it used to be done with neck down bottles. An operator move the case to the unloading area and lift it off the bottles. The bottles would then move to the unscrambler for single-filing. This was pretty bad from an ergonomic standpoint.

Fortunately, today there is automated machinery that does the job. Cases are fed, open side down, to the uncaser. It grabs the case with side belts and gradually lifts the case off of the bottles. As it does, the bottom flaps of the case open allowing the bottles to ride on the conveyor to begin unscrambling. The empty case is carried to an overhead conveyor which takes it to the case packer at the end of the line.

If bottles are provided neck up, a different kind of uncaser is required. Several companies make pick and place systems with picking heads that match the bottle pattern. These reach into the case, grip the bottle necks, lift them out of the case and deposit them on the unscrambler infeed. As robots continue to get cheaper and more capable, this can be simplified using standard robots.

Cans, and some bottles, come stacked on pallets. In the case of cans, stacks are typically 8’ high. Depalletizers align the bottom of the top layer of cans with the unscrambler infeed and sweep the entire layer into the infeed. A pick and place or a robot removes the slipsheet separating can layers, places it on a stack and elevates the pallet to discharge the next layer of cans. Some depalletizers keep the pallet at a constant height and sweep the cans onto an intermediate plate. This plate is then raised or lowered to the elevation of the unscrambler and the cans swept off.

Still other bottles come to the line in bulk. These may be in cases, bags or gaylords. These will require bottle orienteers, covered in a previous white paper, to orient them properly.

Nothing is going to happen until the bottles get on your line. Most likely, that means an unscrambler.