

GIVING IT THE SOFT TOUCH

THE LATEST GENERATION OF TUBULAR DRAG CABLE CONVEYORS PROVIDE CRITICAL PROCESS AND PRODUCT QUALITY BENEFITS FOR BREAKFAST CEREAL PROCESSORS—MINIMISED PRODUCT DAMAGE, IMPROVED PRODUCT SAFETY, REDUCED CLEAN-UP AND FASTER CHANGEOVERS—OVER TRADITIONAL CONVEYING SYSTEMS. BY **JIM MCMAHON**, LEAD AUTHOR, ZEBRA COMMUNICATIONS

WHATEVER the food item—from frozen pizzas to fresh burritos, baked goods to candy or health bars to processed cheese—the need for transporting food products from the initial receipt of raw materials through each process stage in the food production line with high throughput, minimised product damage and a high level of product safety is of critical importance.

Despite utilising the best processing equipment to manufacture and package food products, if the material handling systems being used for moving these products into and out of the equipment is inefficient, then the finished products and throughput volume will be compromised.

One industry that is heavily dependent on the use of conveying systems is breakfast cereal manufac-

turing, where a variety of different conveyor applications with varying levels of efficiency have traditionally been utilised to transport cereal products between sequences of processes.

CRITICAL CHALLENGES

Breakfast cereal processing plants are beset with several critical conveying challenges. One of the most important challenge is ensuring that the finished product emerges from the various processing steps undamaged before its final packaging.

Keeping the clusters, loops, puffs and flakes whole can be a significant challenge given that at the end of most machine processing steps, the product is made to fall and drop down onto a conveyor system before being taken to the next process. The idea is to get that product through the processes and into the packaging as gently as possible to avoid breakage.

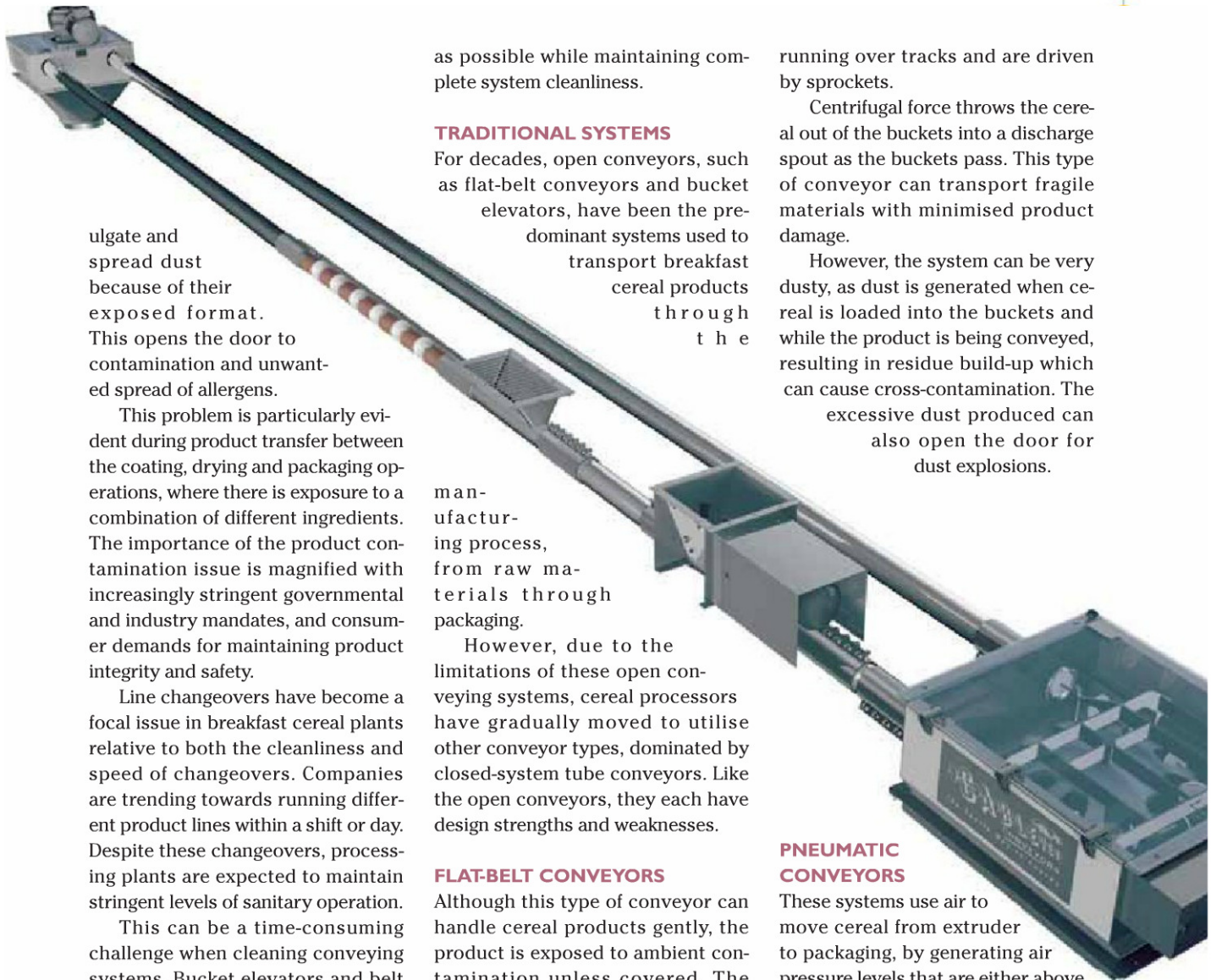
Breakfast cereal plant managers and plant engineers know that how their product is conveyed during the entire manufacturing process plays an important role in ensuring minimum waste, as raw goods are transformed into finished cereal products ready for packaging.

Product contamination is another key issue influencing conveying in breakfast cereal production. In every step of the process, from receipt of the raw materials through packaging, precluding any foreign matter from entering the process stream is a critical objective.

Traditionally used in cereal processing, bucket elevators and belt conveyors have an open profile, which not only permit the entry of cereal dust and foreign particles into the food stream, but also prom-

One challenge in processing breakfast cereals is keeping the clusters, loops, puffs, and flakes whole.





ulgate and spread dust because of their exposed format. This opens the door to contamination and unwanted spread of allergens.

This problem is particularly evident during product transfer between the coating, drying and packaging operations, where there is exposure to a combination of different ingredients. The importance of the product contamination issue is magnified with increasingly stringent governmental and industry mandates, and consumer demands for maintaining product integrity and safety.

Line changeovers have become a focal issue in breakfast cereal plants relative to both the cleanliness and speed of changeovers. Companies are trending towards running different product lines within a shift or day. Despite these changeovers, processing plants are expected to maintain stringent levels of sanitary operation.

This can be a time-consuming challenge when cleaning conveying systems. Bucket elevators and belt conveyors are particularly notorious for requiring significant time for cleaning because of their various interlocking components.

Every minute spent disassembling a conveyor system for cleaning consumes valuable production time. However, if not cleaned properly, that batch of cereal that needs to be discarded in-process because of contamination is lost profit. Worse still, consumers could be negatively impacted, resulting in potential injury, costly recalls and impacted brand reputation. To resolve these issues, cereal processors are charged with administering changeovers as quickly

as possible while maintaining complete system cleanliness.

TRADITIONAL SYSTEMS

For decades, open conveyors, such as flat-belt conveyors and bucket elevators, have been the predominant systems used to transport breakfast cereal products through the

manufacturing process, from raw materials through packaging.

However, due to the limitations of these open conveying systems, cereal processors have gradually moved to utilise other conveyor types, dominated by closed-system tube conveyors. Like the open conveyors, they each have design strengths and weaknesses.

FLAT-BELT CONVEYORS

Although this type of conveyor can handle cereal products gently, the product is exposed to ambient contamination unless covered. The cover, however, collects cereal residue and must be removed and cleaned between runs to reduce the risk of cross-contamination, which is usually a tedious task.

The cereal product, when introduced onto the conveyor, is typically dropped from the processing machine, which produces dust and at that point, can cause product damage.

BUCKET ELEVATORS

Bucket elevators use a continuous line of buckets, either attached to each other on a rubber belt or attached by pins to two endless chains

running over tracks and are driven by sprockets.

Centrifugal force throws the cereal out of the buckets into a discharge spout as the buckets pass. This type of conveyor can transport fragile materials with minimised product damage.

However, the system can be very dusty, as dust is generated when cereal is loaded into the buckets and while the product is being conveyed, resulting in residue build-up which can cause cross-contamination. The excessive dust produced can also open the door for dust explosions.

PNEUMATIC CONVEYORS

These systems use air to move cereal from extruder to packaging, by generating air pressure levels that are either above or below the atmospheric pressure.

There are two main types of pneumatic conveyors: the dilute phase conveyor and the dense phase conveyor, which differ by rate of speed and pressure. Both of these systems can be set up as a pressure or vacuum system.

Pneumatic conveyors enable flexibility, allowing them to reach many multiple destinations with one system. They are also able to convey cereal at very high rates without product breakage and with minimal dust dissemination.

One of the main problems with this type of conveyor is its high

power consumption. Pneumatic conveying is the most expensive method for moving cereals.

AUGER CONVEYORS

Known as flexible screw conveyors, they can transport cereals vertically, horizontally and at any angle. They consist of a stainless steel flexible screw enclosed in a rigid steel tube or flexible plastic tube driven by a motor.

The enclosed tube rotates around a central shaft, transporting the cereal according to the screw design and rotational direction. When the breakfast cereal reaches the end of the tube, it is discharged into the process machine or container for packaging.

These conveyors have a throughput of up to 100,000 pounds per hour. Auger conveyors, however, have limitations on how much product



they can transport before effecting product breakage, which can be significant.

At the same time, internal cleanliness can be an issue resulting in cross-contamination risk and the need to disassemble the unit on a regular basis for cleaning.

AEROMECHANICAL CONVEYORS

Aeromechanical conveyors are a completely enclosed, high-capacity mechanical conveyor that can move breakfast cereal vertically, horizontally and at varying angles. Within a stainless steel tube, a wire rope with evenly spaced discs travels at high speeds, running in sprockets at each end of the conveyor.

The high-speed action generates an internal air stream travelling at the same high velocity as the discs. As

AEROMECHANICAL CONVEYORS ARE A COMPLETELY ENCLOSED, HIGH-CAPACITY MECHANICAL CONVEYOR THAT CAN MOVE BREAKFAST CEREAL VERTICALLY



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the cereal is fed in, the air stream aerates, or fluidises it, and carries it to the packaging outlet, where it is discharged by centrifugal force.

The system can move up to 240,000 pounds per hour of cereal. A drawback to this system is that the flow of product can easily become inhibited, causing the conveyor to run without transporting cereal at expected throughput volumes.

Downtime is also a factor because the tension on the wire rope needs to be adjusted at regular intervals.

TUBULAR DRAG CHAIN CONVEYORS

This conveyor gently moves breakfast cereal through a sealed tube with a drag chain pulled through it on a loop. Solid circular discs (flights) are attached to the chain, which push the cereal through the tube. This system



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LEAN-PROCESS SOLUTION

Embodying these requirements, the tubular drag cable conveyor, developed by Cablevey Conveyors, is fast becoming the system of choice for product movement through all phases of breakfast cereal production.

The system gently moves friable cereals through an enclosed tube without the use of air. This latest generation of tubular drag cable conveyors can transport up to 49,000 pounds of breakfast cereal product per hour, at low speed, and with product degradation practically eliminated.

Similar to tubular drag chain conveyors, tubular drag cable conveyors gently move the product through a sealed tube, but instead, it uses a patented, coated, flexible stainless steel drag cable pulled through on a loop. Solid circular discs (flights) are attached to the cable, which push the cereal through the tube. The coated

can move up to 80,000 pounds of cereal per hour, and can run under either pressure or vacuum modes.

One of the drawbacks to this system is the tendency of the chain to accumulate cereal debris build-up, which poses a cross-contamination risk, so it needs to be regularly removed. Also, the chain-drive components need to be regularly adjusted to keep the system in registration, which increases downtime.

As conveying systems evolve, better technology in system design, controls and automation has brought into place a whole new generation of conveyors with vastly improved efficiency for use in this industry. Safer, cleaner processes that reduce waste and deliver cost, labour and energy savings are increasingly being factored into equipment selection. Such conveying systems can have a critical impact on cereal processors' operational costs and the plant's return on investment.

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cable ensures that no debris accumulates within the stands of the cable, as the cable is totally sealed.

Designed for quick cleaning, quick line changeovers and maximised system uptime, the tubular drag cable conveyor system employs sophisticated cleaning mechanisms to reduce debris build-up. The flexible design of this completely enclosed system keeps contamination out, while enabling it to be cleaned-in-place at

operates on low horsepower, utilising energy-efficient variable-speed motors of less than five horsepower each, effectively consuming minimal power compared to other conveyor systems utilised in breakfast cereal manufacturing. The system's production flow can be adjusted to variable speeds.

VERSATILE INTEGRATION

The tubular drag conveyor system

Tubular drag conveyors are ideal for moving products like cereal.

systems for moving the product between extrusion, forming, tempering, flaking and toasting processes, and on through to the coating process.

THE TUBULAR DRAG CONVEYOR SYSTEM HAS THE FLEXIBILITY TO INTEGRATE WITH ANY PROCESSES IN CEREAL PRODUCTION

multiple points from cereal build-up.

For example, an air knife at the product discharge locations in the system automatically releases food particles from the discs and cable. Also, urethane wiper discs attached to the cable eliminate any residual debris from the conveyor system while in progress.

To increase uptime, the system is equipped with a cable self-tensioning device, and is different from other conveying methods which require continual adjustments to their mechanical operating systems.

The tubular drag cable conveyor

has the flexibility to integrate with any processes in cereal production, for the manufacture of flaked cereals, extruded flaked cereals, gun-puffed whole grains, extruded gun-puffed cereals, oven-puffed cereals, shredded whole grains, extruded shredded cereals, and granola cereals.

The conveyor is capable of being integrated into all processing areas, such as receipt, weighing and mixing of raw materials, preconditioning and extrusion, drying, tempering, flaking and toasting, and coating, drying, cooling and packaging.

Tubular drag conveyors are ideal

The system is critically applicable where the product can become damaged, where contamination would be prevalent, or where dust accumulation can be excessive, such as end-of-line processing from coating through packaging. These areas would include the coating process to the dryer, from the dryer to the weigh-filler, from the dryer to the holding silo, and then from these processes to packaging.

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