BULK HANDLING TODAY

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March 2017

A SEISMIC SHIFT IN BELT CLEANING

SAFETY: SETTING A NEW BENCHMARK

BULK HANDLING TODAY

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Contents

4 **Leeasa** News

5 **CMA News**

Cover Story
6 Hydraulic Direct Drives Offer Unbeatable Conveyor Productivity

8 **SAIMH**

Water Recovery System
9 Significant Decrease in Water Consumption

Exciters
11 Putting Quality to the Test

Conveying
14 A Seismic Shift in Belt Cleaning

Safety
19 Setting a New Benchmark

Beltcon
21 Quantifying the Effects of Idler Bearing Misalignment on Bearing Life

29 **Market Forum**

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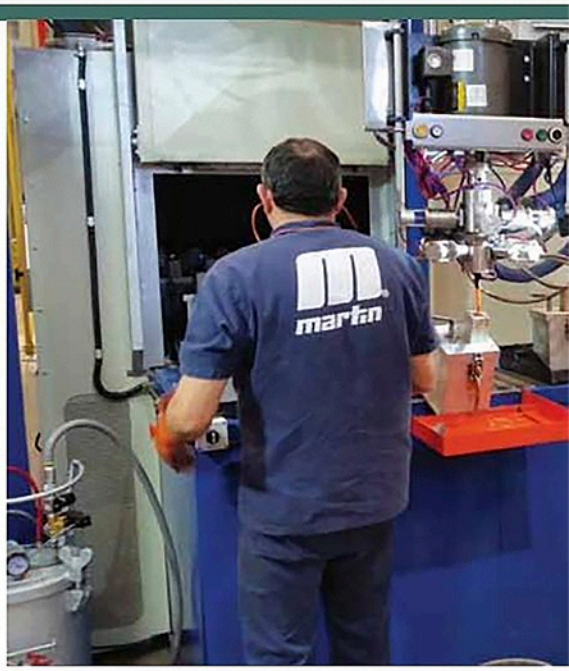
A Seismic Shift in Belt Cleaning

Whether it's a coal mine, cement plant, quarry or food production facility, one of the first things conveyor system operators should do when they start their day is a walk-through to get a feel for how the cargo is moving.



Being able to identify indicators and causes of material flow issues is a large part of ensuring that production is running at peak capacity. And experienced operators know that a number of problems, including mistracking, carryback, spillage, pulley fouling or idler malfunction, can actually be an indicator of a single root cause: insufficient belt cleaning.

Primary and secondary cleaner blades remove adhered cargo from a conveyor belt and return it to the material flow. Without them, carryback and spillage can cause expensive equipment breakdowns that result in unscheduled downtime, increased maintenance and potential safety hazards.

In addition to premature equipment failures, fugitive material requires personnel for cleanup, at the expense of valuable man-hours. Worse, it puts staff in close proximity to a moving conveyor, which always carries an element of risk.

Although many belt cleaner users probably don't realise it, blade freshness is a significant issue for moulded urethane products

Polyurethane cleaner blades

Although many belt cleaner users probably don't realise it, blade freshness is a significant issue for moulded urethane products. Urethane is a hygroscopic material, so it tends to absorb moisture from the ambient air over time, which is the primary cause of its gradual loss in physical properties. The process eventually decreases the cleaning performance and shortens wear life.

Because belt cleaners are a wear item, having spare blades in storage can be convenient, but most polyurethane formulations only have a shelf life of around two years from the date of manufacture. In most cases, the blade's physical properties will degrade within that time to the point that both its performance and durability will be compromised.

Unfortunately, by the time it arrives at a customer location, the age of the product is frequently uncertain, and the production date is rarely stated on any label.

Inventory

Most manufacturers produce their cleaners in large lots, based on projected sales volumes, often causing them to sit on inventory for a lengthy period before being sold. Many companies also sell their products through distribution, which can extend the shelf time even more. The result is a moulded component with a reduced life expectancy before it's even used, particularly if the customer is also stocking replacement blades for any period of time.

In this scenario, the process creates several inventory stages, first at the urethane manufacturing level, second at the belt cleaner manufacturer level, then at the dealer level and finally, the user level. This translates into a significant amount of aging before the blade ever contacts a belt.

Optimum design

Another potential obstacle is the use of polyurethane moulding equipment originally engineered to produce any number of products that could range from automotive parts to toys to shoes. While some suppliers use this standard equipment to fabricate their own blades, these machines may not be of optimum design for the specific demands placed on conveyor belt cleaners, leading to issues in consistency and quality.

Blades can display irregularities in the polyurethane's structure, typically showing up as hard and soft spots that result in inconsistent wear, shorter service life and uneven cleaning across the belt plane. Frequent blade replacements, along with the increased labour for maintenance and cleaning, raise the cost of operation.

A different approach

In response to these issues, Martin Engineering has custom-engineered a modular polyurethane moulding cell specifically designed to generate the highest quality belt cleaner blades in the world.

Using special proprietary software and computerised control, the Martin Polyurethane Work Cell precisely blends the components of each urethane

formulation to deliver maximum performance and life expectancy, with blades usually ready to ship directly to the customer within 24 hours of being ordered.

"The work cell can create a wide range of colour-coded polyurethane blade formulations using an automated computer-controlled process to manufacture blades within very close tolerances," explains engineering and development manager, Rudolf Beer.

"We are one of the only belt cleaner suppliers that produces its own blades, having made them in North America for several years and shipped them around the world. Now we're able to replicate the same tightly-controlled manufacturing process in our other global business units."

Six continents

Developed at Martin Engineering's Centre for Innovation located in Neponset, Illinois (USA), one work cell is currently operational in South Africa, and a unit has also recently been installed in Brazil to serve South America and parts of Central America.

Company officials expect the Europe and Eastern Asia business units to be receiving their equipment soon, setting the foundation for a network that will serve bulk handling operations across the globe. The firm plans to have the work cells in place on six continents by the end of 2017.

"Our goal is to avoid a business model of centralising manufacturing and then trying to sell products around the world," observes Rudolf. "That's what our competitors do. As a result, lead times and costs can be a problem. This new process gives us the capability to centralise only the innovation and design capabilities for our belt cleaners in the US, while consistently manufacturing them to the highest quality control standards in any region."

Built to meet the global needs of customers across multiple industries, the new moulding operation is a way to provide the highest product quality, with shorter lead times, without increasing unit price.

An exacting process

"This work cell can produce superior blades in virtually any shape, but the components of the polyurethane have to be precisely metered and mixed to suit the unique requirements of the application," Rudolf continues.

Polyurethane is a synthetic material, composed of long side-linked chains of molecular compounds, which results in a strong, wear-resistant product when moulded. Martin Engineering's supplier for the chemical components of its urethane formulations is BASF Corporation, one of the world's largest chemical producers, with a supply chain that assures product quality, consistency and availability around the globe.

As a result, customers receive blades with the same quality and guaranteed performance, regardless of the manufacturing location.

Field use

Specific blade formulations consist of specialised liquid constituents that deliver a moulded product soft enough to glide easily over splices without damaging them, but rigid enough to dislodge adhered dust, aggregate and/or wet materials from the belt's surface. Blades for specific materials and conditions have been developed over years of testing and field use.

Very controlled manufacturing methods are required to mix the chemicals and form consistent polymer chains with no air pockets. Air can cause the polyurethane to froth slightly in the mixing process, reducing quality and consistency, and increasing elasticity and degradation through increased moisture absorption.

One work cell is currently operational in South Africa, and a unit has also recently been installed in Brazil to serve South America and parts of Central America

Elevated temperatures

Prior to entering the moulding cell, the chemical mixture is brought to temperature, then run though the system using heated tubes and pumps. Elevated temperatures aid in making the materials easier to pump and mix, and some of the chemical constituents must be kept above 50° Celsius to remain fluid.

Sensors deliver signals about the process to gauges on the top and front of the device to inform operators of the essential workings of the system, including chemical levels, pressure and temperature.

Nitrogen flushing and blanketing prevents atmospheric moisture from contaminating material in the supply drums. They are pumped into a 1 220mm tall vertical chamber, called a degasser, which maintains the process material at temperature and removes any air that may be present.

At the top of the degasser, the chemical is spun against the inner wall of the chamber. Gravity causes the thin layer of liquid to run down the walls to expose bubbles, while a vacuum extracts the remaining air.

Even distribution

The degassed chemical at the bottom of the chamber is run through a filter to extract any impurities. A metered pump then deposits the purified liquid through a precise aperture to enter the mixing head evenly and at the correct speed.

Additional chemicals are added into the mixing head in a similar way, ultimately forming the urethane mixture. Pigments are also mixed in to indicate the properties of the blade, such as hardness, acid resistance, high temperature resistance, etc.

To achieve even distribution, the agitator speed is closely monitored by the system. If the mix head spins too fast, there is a risk of frothing the material, whereas if it spins too slowly, the material won't be mixed thoroughly, resulting in soft and hard spots.

Attached to a pneumatic extension arm, the mixing head is easily maneuvered by operators who pour the mixed polyurethane into an aluminum mould. Blades come in various shapes and sizes, including engineered lengths as long as 3 metres, for cutting customised lengths after delivery.

CARP design

Some Martin Engineering primary and secondary cleaner models use cartridge systems, which are moulded individually at predetermined lengths, whereas flat blades that fit many secondary cleaners can be custom-moulded or delivered in uncut segments. Blade shapes include the patented CARP (Constant Angle Radial Pressure) design, which uses an engineered curve to maintain a constant pressure for consistent cleaning performance through all stages of blade life.

After each mould is poured, the agitator and mixing head are automatically flushed with solvent and made ready for the next batch. The moulds are put into a high-temperature oven to cure for approximately 30 minutes at 70° Celsius. The oven is the only part of the system that isn't manufactured or modified by Martin Engineering.

Each business unit purchases industrial ovens based upon available power in the region, with gas and electric models being the most common.

A new factory-direct blade replacement programme for belt cleaners, delivering fresh polyurethane blades that are specified and custom-fitted on-site and installed free of charge

Two person team

Once the blade is properly cured, it is closely inspected for quality and then boxed for immediate delivery to the customer. "The system only requires a two person team, since the vast majority of the production process is automated," Rudolf explains. "The operators not only manufacture the blade, but also act as an essential layer of quality control and monitoring.

"One person selects the setting and controls for pouring of liquid polyurethane from the mixing head over the mould. The other person removes the completed blade from the mould and packages it for transport."

Depending on the customer location, delivery can

come in many forms, from a wide range of shipping services, or even transported personally by a representative in the nearest business unit, depending on the need of the customer. Professional installation and maintenance services are available, and Martin Engineering has also announced a new factory-direct blade replacement programme for belt cleaners, delivering fresh polyurethane blades that are specified and custom-fitted on-site and installed free of charge.

Safety and easy maintenance

The 11-metre long by 5-metre wide footprint of the work cell can be inverted right or left to suit individual factory floor layouts. Generally set in an enclosed room to avoid contamination of the polyurethane from other activities in the facility, the system requires only enough surrounding space for workers to safely fulfill large work orders.

A single control panel sends and receives data to the degassing and pumping modules. Gauges and meters on the control panel and modules all face the same direction for easy monitoring by operators. Lights and signals are in constant function to indicate potential hazards and deliver clear warnings.

Malfunctions are rare, but if a problem is detected such as a sudden increase in pressure from a clog, the automated system stops, gives operators an ample 15-second warning, and performs a system flush to clear any excess urethane.

Flushing the system

Thanks to the modular design, each segment of the work cell can be serviced efficiently, minimising production delays. With only a single connection to the control panel, for example, the entire degassing unit with pumps, filter and vacuum pump can be simply unplugged and replaced. To maximise the life of the modules, after every five blades produced, the system is flushed with solvent to prevent flow issues or clogs.

"Consistently excellent quality is the result of all this investment in engineering the work cells," says Rudolf. "With today's technology, we are able to remotely monitor the functionality via the Internet, anywhere in the world. Beyond quality assurance and communication, remote monitoring allows technicians to investigate the causes of any faults and offer fixes to operators without having to put someone on an airplane."

Power interruptions

Moreover, the work cell features a universal power supply that will store enough energy to prevent a total shutdown in the event of a temporary power interruption. When some moulding equipment loses power, materials can quickly stagnate and clog the system, forcing a large investment in manpower and time to clean, and leading to long production delays.

By having enough stored power to flush the system, extended periods of downtime for maintenance are avoided and production schedules can be maintained.

"We are changing the process to the needs of the product, rather than changing the product to the specs of the equipment," Rudolf concludes. "We are currently the only belt cleaner manufacturer to design and manufacture a computer-controlled system to deliver the precise control needed to achieve maximum belt cleaner performance and service life. Deployment of these systems to key areas of the world will create a seismic shift in conveyor belt cleaning."

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