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MINING & QUARRY WORLD

No Joke: Knock-Knock on conveyor idlers

On any belt conveyor system that moves bulk materials, the belt must run straight and true to maximise its life, minimise fugitive material and safety hazards, and achieve high system efficiency. There can be many consequences of a mistracking belt, but all result in higher costs and increased maintenance. Even a slight belt misalignment can lead to a variety of issues, from small annoyances to full-blown catastrophes.

The most obvious effects include spillage and dust that require personnel to do cleanup, which is unproductive work that introduces risks from activities in close proximity to the moving conveyor. Spillage from non-centered cargo often gets into idlers and pulleys, reducing bearing life and causing them to seize, leading to friction damage on the belt and potentially starting a fire. A misaligned belt can also come in contact with the stringer, causing fraying, shredding or splice damage. Great lengths of valuable belting can be destroyed with surprising speed, and even the support structure itself can be damaged. A compromised bracket or support can cause a catastrophic idler failure, which could damage other components of the system and require extensive downtime to repair. Further, there is potential for injury from a damaged belt or loose idler not to mention the increased exposure to injury from too frequent a need to clean.

“I’ve been working around conveyors for 20 years, and I’ve seen thousands of belts,” observed Martin Engineering Process Engineer Dan Marshall. “I’ve seen just about every problem that can be caused by a mistracking belt, but one thing I’ve never seen is a belt that runs true right out of the box. All conveyors, no matter how well designed and built, have some belt wander.”

A wide variety of circumstances can lead to mistracking, and operators have tried many things to correct the alignment. Some have elected to place an obstacle such as a block of wood in the belt path, so it won’t travel too far out of line. This occasionally improves the situation, but more often it’s just temporary and the belt will eventually slice through the obstacle.

Many operators have realised that pivoting an idler is a quicker and more effective way to steer a belt. This common approach is called “knocking an idler,” striking it with a hammer to move it slightly and realign the belt.

Equipment manufacturers have also designed components to help align a belt, and these solutions can be successful in specific applications. They include specially-shaped rollers, angled idlers and devices that apply pressure to the belt edge to push it back in line.

“While these mechanisms can improve a belt that’s consistently off-center in one direction, they do not react to dynamic belt movement, meaning that they don’t correct intermittent belt wander,” Marshall continued. “To combat such changing conditions, engineers designed the tracking idler. Unlike the edge correction approach, the device senses belt movement in either direction, and pivots the idler slightly to steer the belt back into position. It doesn’t apply a great deal of force to the edges, which can damage a belt and splices. When the belt is running true, it remains centered, and when it senses a misaligned condition, it gently corrects the belt.”

Wooden block intended to limit belt wander.

"Knocking" an idler with a mallet to change its position.

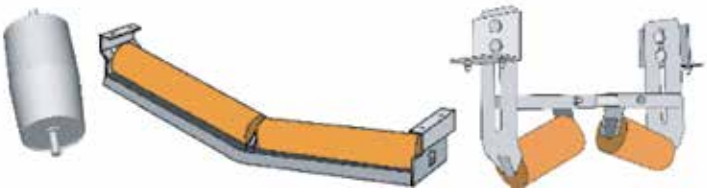
Unfortunately, to accommodate limited space availability, tracking idlers typically have short sensing arms. This requires a fairly large belt displacement to create a small movement of the idler. While these designs do tend to improve tracking, there are limits to how much correction they can deliver, and short sensing arms can actually pinch a belt if the idler pivots too far. To combat this, some operators choose to "tie off" a tracking idler to limit its movement. While the practice can help preserve the belt, it doesn't address significant mistracking.

To overcome the limitations of existing belt alignment devices, Martin Engineering has invented and patented a Multi-Pivot Belt Tracker, which employs sensors, pivoting idlers and geometry to align a wandering belt. The sensors avoid pinching the belt, and the engineered geometry amplifies any detected misalignment to create a greater pivot.

Multi-Pivot Belt Trainers use longer arms than other designs, positioning the guide rolls further from the pivot roller, as well as closer to the belt edge. The closer proximity allows guide rolls to sense very slight misalignments and make immediate corrections. Rather than waiting for a powerful mistracking force, the longer arms require considerably less pressure to move the pivot roller. The result is better correction with no pinch points and less wear on conveyor and tracking equipment, for a longer and more efficient service life. Specific designs are available for both the load-carrying belt path and the return run.

"Installing trackers is the economical solution, but operators should do a full analysis and consider also addressing other causal issues," Marshall added. "By focusing solely on belt alignment, plant personnel may miss other opportunities to increase production and relieve some of the burden on their system."

Keeping the belt centered and moving quickly is the key to high production, controlled operating cost and a safer



Different component designs for improving belt alignment.

Tracking idler.

A tracking idler tied off to limit its travel.

Multi-Pivot Trainer for the load-carrying run.

Multi-Pivot Trainer for the return run.

workplace. “Misalignment causes downtime and costs money,” Marshall concluded. “But nothing causes more downtime and expense than a destructive belt fire or other catastrophe as a result of inattention to mistracking problems.”

CASE STUDY

The Ash Grove Cement plant in Chanute, Kansas has received dozens of safety awards since the facility’s modernisation in 2001, and when operators experienced several frustrating involuntary shutdowns and rising costs from drifting belts, prevention-minded managers sought an effective solution.

“Although there was one belt that had a particular issue with tripping the emergency stop switch, mistracking was a problem on several belts from the limestone quarry all the way to the raw mill,” said Danny Wolken, Maintenance Planner at Ash Grove Chanute. “We have different materials converging into a single area, and disruption to the flow affects the productivity of the whole system.”

The belt carrying limestone was of particular concern. After passing through the crusher, 4 inch-minus (≤100 mm) aggregate would be loaded onto the conveyor. After leaving the settling zone, the belt had a tendency to crawl up on the side of the idlers. This would disrupt the centered distribution of the material on the belt, causing smaller aggregate to spill along the length of the system until the belt drifted far enough to activate the stop switch, which shut down the conveyor.

The shutdown would have a ripple effect throughout the plant. “Although the limestone conveyor had the worst problems, issues with tracking stretched across all eight conveyors. That adds up, since we run 10 hours a day, 7 days a week,” Wolken explained.

Ash Grove Cement plant in Chanute, KS (USA).

Along with excessive unscheduled downtime, the belt on the limestone conveyor began to fray from contact with the structural components of the system. Having only been replaced 6 months earlier, labor, downtime and equipment expense makes belting one of the costliest components of the system. Incidental contact drastically reduces the belt life and can degrade the splice. The belt damage likely contributed to further misalignment and spillage.

DIAGNOSIS

With a long-standing relationship of providing quality equipment and service, Martin Engineering was asked to inspect the systems and offer solutions. Technicians walked the belts individually and took detailed notes on the unique causes of mistracking for each system.

First, technicians found that when the belt drifted, cargo shifted downward to one side of the belt, causing it to mistrack further. The material lost surface area and spilled over the edge of the belt. The spillage dropped along the entire length of the system, causing product loss, creating potential workplace safety issues and requiring excessive cleanup.

Technicians also suspected some potential manufacturing flaws of the belt attached to the limestone conveyor. If the belt isn’t precisely engineered or properly stored, it can bow or camber, which may have contributed to the tracking and belt damage issues. In addition, the existing tracking systems were found to be inadequate. They delivered only minor corrections to discourage belt damage and quite often broke, requiring additional maintenance. Technicians realised that the belt’s return run also needed a solution for the whole system to remain in line.

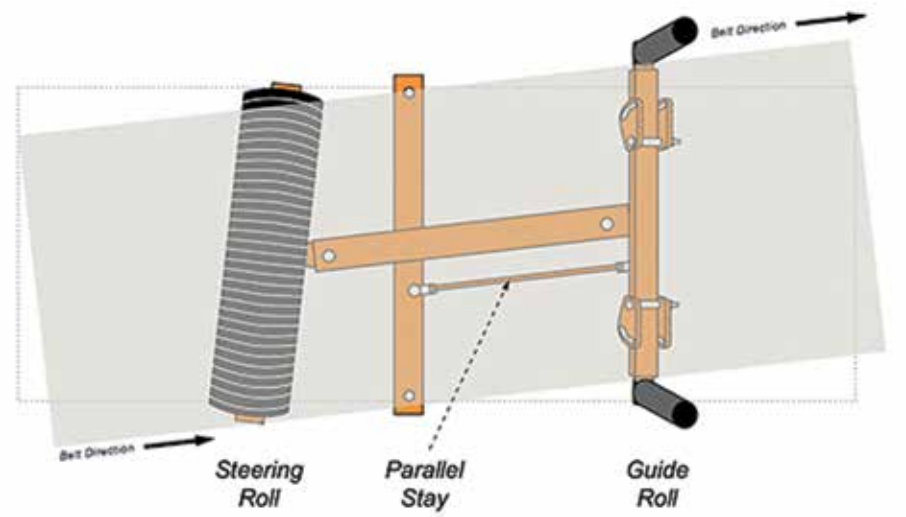
PREVENTIVE SOLUTIONS

Martin technicians pinpointed the problem areas on each of the conveyor belts and offered an economical solution that utilised modern belt tracking technology where it was needed. Across the eight conveyors, the technicians recommended installing 28 Martin® Trackers™. Many of the units control the belt return, but there are also upper trackers strategically placed in problem areas.

Utilising innovative multiple-pivot, torque-multiplying technology, the design has two sensing arms that extend out to either side of the conveyor with rollers at the tip, which smoothly ride the edges of the belt. The sensing arms detect slight variations in alignment and use the force of the belt to immediately pivot the position of the troughed idlers against the misalignment with equal force, thus returning the belt to its intended path.

With its sensitivity to misalignment, less opposing force is needed for the equipment to realign the belt. Early detection with a reduced range of drift before correction makes the belt run more efficiently, mitigates spillage and results in longer equipment life.

The installation was performed by two Martin technicians during scheduled downtime. Since edges of the belt on the limestone conveyor had serious damage caused by the mistracking, another team replaced the belt as well. The new belt was thoroughly inspected to ensure that it did not contribute to tracking issues.



The tracker pivots against the mistracking, using the force and weight of the belt to redirect it.

Trackers were installed with minimal impact on structural supports except for a few bolt holes. The idler angle of the upper trackers matched the trough angle of the system to ensure a smooth belt path, and the torsion arms were properly aligned with the belt edge.

Three critical areas on the conveyor required tracking: the exit of the settling zone, the entrance to the feed mill and along the return path. A lower tracker placed along the belt path and near the loading zone ensures the belt is aligned as it hits the tail pulley to promote centered loading. An upper troughed tracker at the settling zone exit reinforces a straight belt path as it travels the length of the system.

One of the most difficult installations involved the trackers placed at the entrance to the feed mill. Raised off the ground in the weighing tower, the technicians required some extra safety equipment and time to install those units. This was an important step, because a centered belt entering the head pulley ensures that the belt cleaner blade adequately dislodges adhered material from the belt. Specifically positioned to clean the center of the belt where carryback resides, belt drift may cause some of the material to avoid the blade, dropping spillage and fouling rollers along the return path.

The return side Martin Tracker lifts the belt slightly for appropriate contact.

STAYING CENTERED

The installation of a new belt helped with testing the tracking system to ensure that the trackers are addressing cargo and transport issues and not belt flaws such as camber or cupping. Initial testing revealed positive results, with the belts remaining centered along the entire length of the system.

“Every time we replace a belt it costs approximately $35,000 in equipment and labor, not counting the loss of production,” Wolken said. “Replacing the belt is not a sustainable solution, so seeing the trackers keep the belt in line was a positive result.”

The belt remained centered from pulley to pulley, drastically reducing the amount of spillage. As with any bulk handling, cleanup is always a factor, but operators pointed out that the time and labor for cleanup were significantly reduced. This improved efficiency and lowered the cost of operation.

Observation over time revealed that the belt remained aligned through changes in weather, and none of the belts have come in contact with the emergency stop switches since the installation. This has resulted in a significant reduction in unscheduled downtime, improved efficiency and eliminated the need for maintenance staff to interrupt their work to get the system running again.

“We trusted that Martin Engineering would be able to offer an affordable solution that could solve our problem, and they really came through,” Wolken concluded. “We like the trackers so much that we’re looking into installing them on other systems. They have definitely paid for themselves.”

Cory Goldbeck
Territory Manager, Martin Engineering

Illustrations
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