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Knock-Knock on Conveyor Idlers

Ausrichtung von Tragrollen an Gurtförderern

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1 The problem

On any belt conveyor system that moves bulk materials, the belt must run straight and true to maximize its life, minimize 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 the risk of injury from activities in close proximity to the moving conveyor. Spillage from non-centered cargo also 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. Further, a misaligned belt can 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.

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.

Figure 1: "Knocking" an idler with a mallet to change its position

Many operators have realized 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 (▸ Fig. 1).

Figure 2: Tracking idler (all photos and graphics by Martin Engineering Company, Neposet, USA)

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.

Unfortunately, to accommodate limited space availability, tracking idlers (▸ Fig. 2) typically have short sensing arms. This requires a fairly large belt displacement to create a small movement of the idler. While these designs 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 overcome the limitations of existing belt alignment devices, Martin Engineering has invented and patented a Multi-Pivot Belt Tracker (▸ Fig. 3), 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 (➧ Fig. 4).

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

2 Case study

The Ash Grove Cement plant in Chanute, USA, has received dozens of safety awards since the facility's modernization 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, aggregate ≤ 100 mm would be loaded onto the conveyor. Upon 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 spillage 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 ten hours a day, seven days a week," Wolken explained.

Along with excessive unscheduled downtime, the belt on the limestone conveyor began to fray from contact with the structural components of the system, likely contributing to further misalignment and spillage. Even incidental contact drastically reduces the belt life and can degrade the splice.

2.1 Diagnosis

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

2.2 Preventive Solutions

Martin technicians pinpointed the problem areas on each of the conveyor belts and offered an economical solution that utilized modern belt tracking technology where it was needed. Across the eight conveyors, the technicians recommended installing 28 Martin® Trackers™ (➧ Figs. 5 and 6) Many of the units control the belt return, but there are also upper trackers strategically placed in problem areas.

Utilizing 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. 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.

Figure 3: Multi-Pivot Trainer for the load-carrying run

Figure 4: Multi-Pivot Trainer for the return run

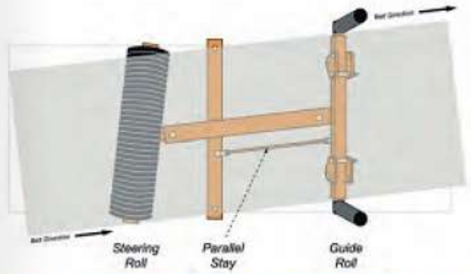

Figure 5: The tracker pivots against the mistracking, using the force and weight of the belt to redirect it

Figure 6: The return side Martin Tracker lifts the belt slightly for appropriate contact

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.

2.3 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.

2.4 Final remarks

The belt now stays centered from pulley to pulley, drastically reducing the amount of spillage. 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, improving efficiency and eliminating the need for maintenance staff to interrupt their work to get the system running again.