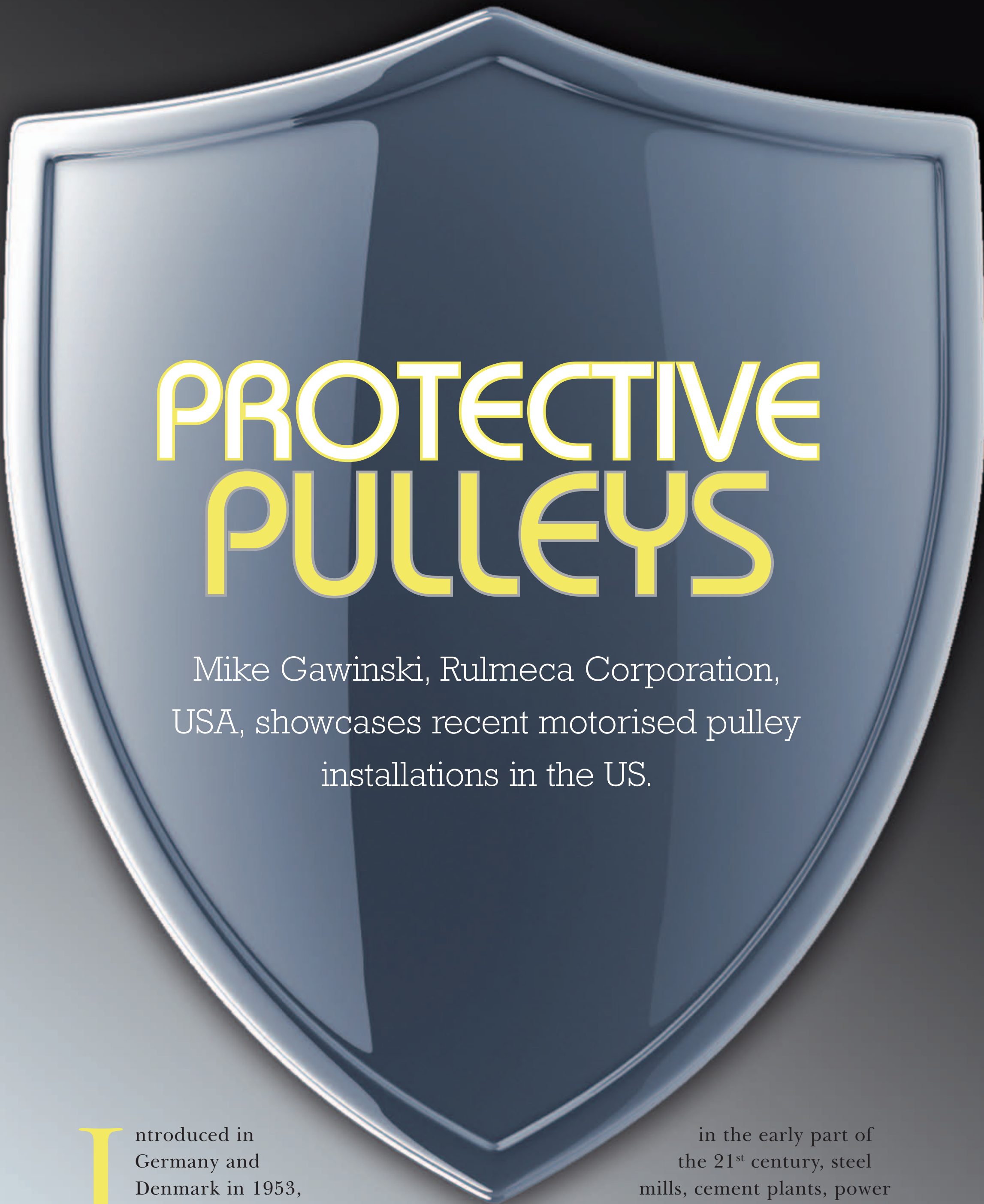

PROTECTIVE PULLEYS

Mike Gawinski, Rulmeca Corporation, USA, showcases recent motorised pulley installations in the US.

Introduced in Germany and Denmark in 1953, Rulmeca's motorised pulley belt conveyor drives made their debut in North America in the 1980s at major ship loading terminals and surface mines.[1] Stone quarries, foundries, iron mines, and recycling facilities took advantage of the product's compact size and reliability in the 1990s. Then, in the early part of the 21^{st} century, steel mills, cement plants, power plants, and coal preparation plants began installing the motorised pulleys to replace old exposed drive systems in North America as well as in Europe.[2]

Motorised pulleys that enclose all drive components within an oil-filled and hermetically sealed pulley shell (Figure 1),

Figure 1. A motorised pulley seals the motor and gearbox within an oil-filled pulley shell.

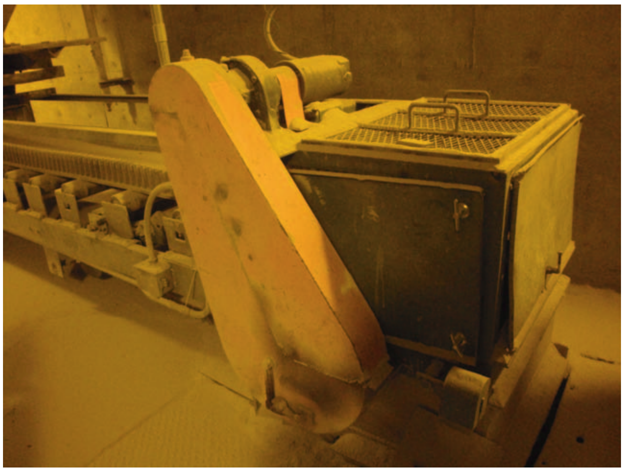

Figure 2. An exposed drive system requires extensive guarding to protect motor, gearbox and personnel.

Figure 3. Three motorised pulleys drive feeder conveyors in the new 'syn gyp' receiving system at Greencastle, Indiana.

such as provided by Rulmeca, significantly increase system reliability, lower maintenance expense, improve personnel safety, save space, and reduce power consumption.

The hermetic seal and oil bath are frequently cited as the key features to improving reliability when comparing motorised pulleys with exposed drive systems in harsh environments where abrasive dust (e.g. high silica content) or corrosive materials (e.g. salt) are present. However, the product's compactness is also mentioned, especially where personnel access is restricted.

Note that motorised pulleys are lighter than exposed drive systems because exposed systems require motors and gearboxes to be protected within separate cast iron or steel enclosures (Figure 2). Internally powered pulleys enclose their motor and gearbox within the pulley shell, eliminating redundant parts. Furthermore, the internal drivetrain acts like a deep beam, resisting deflection in a lightweight package and eliminating the need for a heavy 'through shaft'.

Motorised pulley usage at Buzzi Unicem USA plants

In January 2009, Buzzi Unicem USA requested that JBM Incorporated (JBM) utilise Rulmeca's motorised pulleys in a new raw material receiving hopper project at the company's Pryor plant in Oklahoma. Axel Hernoe, German-born maintenance manager at the Pryor plant, said, "I was well acquainted with motorised pulleys because of my experience with them in the German mining industry in the 1960s, but I was unaware that the technology was available in the United States until late 2008. Our material's high silica content can sometimes cause maintenance problems. Since Rulmeca supports product sales and service from its facility in Wilmington, NC, I decided we should give motorised pulleys a try."

The project included two model 320M 7.5 hp units to drive raw material hopper collector conveyors at a belt speed of 384 ft./min, six hoppers, structure, and feeders – designed, fabricated, and installed by JBM.

The Pryor project was completed within a month of the installation of a new grizzly screen bypass conveyor, which also incorporated a model 320M motorised pulley (10 hp with 300 ft./min belt speed) at Buzzi Unicem USA's Stockertown plant in Pennsylvania, more than 1000 miles from Oklahoma.

Having served Buzzi Unicem USA for 18 years, JBM Incorporated was soon awarded two more conveyor projects. Each project included the design, fabrication and installation of a new synthetic gypsum receiving system. The first was installed at Buzzi's Greencastle, Indiana plant in October 2009 and the other was installed at the company's Festus plant in Missouri in June 2010. Based on previous successful projects, motorised pulleys were recommended to and accepted by Buzzi Unicem USA for use in the two projects. The motorised pulleys "made all aspects of the project simpler and faster, especially because there are no external components to support and guard," noted JBM design engineer, Mike Lane. "Internally powered conveyor drives simplified the entire process," he added.

The Greencastle project included the use of three model 220H motorised pulleys, each at 1 hp with a belt speed of 38 ft./min, as hopper feeder drives (Figure 3).

Each feeder belt conveyor loads a drag chain conveyor that snakes the synthetic gypsum through the existing structure into the primary product flow.

With a similar scope to the Greencastle project, the Festus system included the use of five model 220H, identical to those used at Greencastle. This was a strategic decision to use common components in the two projects so that spare parts can be shared among plants, if necessary.

More motorised pulleys at Pryor, Oklahoma

Having watched the performance of the new 7.5 hp motorised pulleys for eight months, Pryor plant personnel decided to solve additional operational problems, starting with the replacement of a 75 hp exposed drive system on 550 ft. long tunnel reclaim conveyor no. 1 in 2009.

Electrical supervisor, DeWayne Wagnon, said, "The reclaim tunnel conveyor is fed by six belt feeders and has a concave vertical curve, elevating material from beneath the storage pile 138 ft. up to the transfer tower [Figure 4]. It had been causing us production delays for years. If the conveyor was overloaded and tripped the breaker under load, material would have to be shovelled off the belt in order to restart it. On the other hand, when the conveyor was started with an empty belt, it bounced up at least 4 ft. [Figure 5], damaging the belt and the feeder support structure."

Figure 4. The reclaim conveyor no. 1 at the Pryor plant elevates material 138 ft.

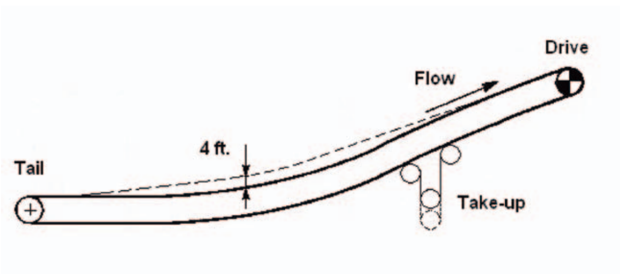

Figure 5. The concave vertical curve with 75 hp head drive 'bounced up' when starting with empty belt, damaging tunnel feeder supports.

Rulmeca engineers suggested replacing the 75 hp head drive with two model 630H motorised pulleys, each at 50 hp, in the head and tail positions. Converting to a dual drive system would not only offer more power but also 360° of belt wrap instead of 180°. Calculations showed that slack side tension could be reduced by 2000 lb, extending belt life significantly. Furthermore, instead of replacing the 30 in. wide 3-ply belt with a 4-ply belt, as originally planned, the dual drive system enabled the plant to continue using the 3-ply belt, even with 33% more drive power.

One of the most significant benefits of the head and tail drive configuration is the complete elimination of belt bounce. Now, the belt remains snugly within the troughing idlers throughout the concave curve, even when started empty. This is because effective belt tension is spread evenly between the head and tail pulleys.

Plant personnel were also surprised at how quickly the two 50 hp motorised pulleys were installed (Figure 6). Weighing just 1850 lb each, the 24 in. dia. motorised pulleys were installed in one shift. Since all components are internal, it was not necessary to spend time aligning motors, gearboxes, couplings, and pulleys.

In head and tail positions, motorised pulleys are controlled and synchronised through the use of two flux vector VFDs. Controlling the motors in this manner ensures load-sharing and provides protective features such as overcurrent protection, ramp up and ramp down, in addition to offering the possibility of changing belt speed if necessary.

The Pryor plant retrofitted several other conveyor drives in 2010, all of which were driven by flux vector variable frequency drives (VFDs). High rock weighfeeder conveyor drives for raw mills no. 1 and no. 2 were each converted to a model 400H (16 in. dia.) motorised pulley at 5.5 hp with a 48 ft./min belt speed to drive the 30 in. wide x 8 ft. long feeder conveyors in the spring and summer (Figure 7). The no. 3 finish mill limestone feeder was converted in autumn last year, using a model 320H (13 in. dia.) motorised pulley at 1.5 hp and 24 ft./min, to drive the 30 in. wide x 11 ft. 3 in. conveyor.

Figure 6. Two 1850 lb motorised pulleys were installed in one shift.

Figure 7. The high rock weigh feeder has a 30 in. wide belt with 4 in. sidewalls and is driven by a 16 in. dia. 5.5 hp motorised pulley at 0.8 – 80 ft./min.

Since amp draw and motorised pulley temperature were carefully monitored during commissioning, these feeders are capable of moving a wide range of material throughput (from less than 1 tph to more than 100 tph). VFDs automatically vary the power supply frequency from 1 Hz to 100 Hz. Since motorised pulleys cool their motors by transferring heat through the pulley shell into the conveyor belt, it was essential to verify that adequate cooling was available through the wide frequency spectrum.

Conclusion

The Buzzi Unicem USA experience is typical. Many international major bulk materials handling facilities have first tested a Rulmeca motorised pulley on a secondary conveyor to verify the product's reliability and maintenance characteristics and then installed the drive on problematic primary conveyors.

Since motorised pulley technology was developed in Germany and Denmark in the 1950s, European plant personnel, in general, are acquainted with the drive's benefits. However, a growing number of companies are adopting the technology in the Americas, Asia, Africa, and elsewhere. As a consequence, the knowledge that motorised pulleys offer an optimal alternative to exposed conveyor drive systems, especially in harsh operating conditions, is now becoming widespread.

When properly applied, motorised pulleys can increase conveyor 'up time', reduce electrical power consumption, improve plant safety, save space, and lower maintenance expense.

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