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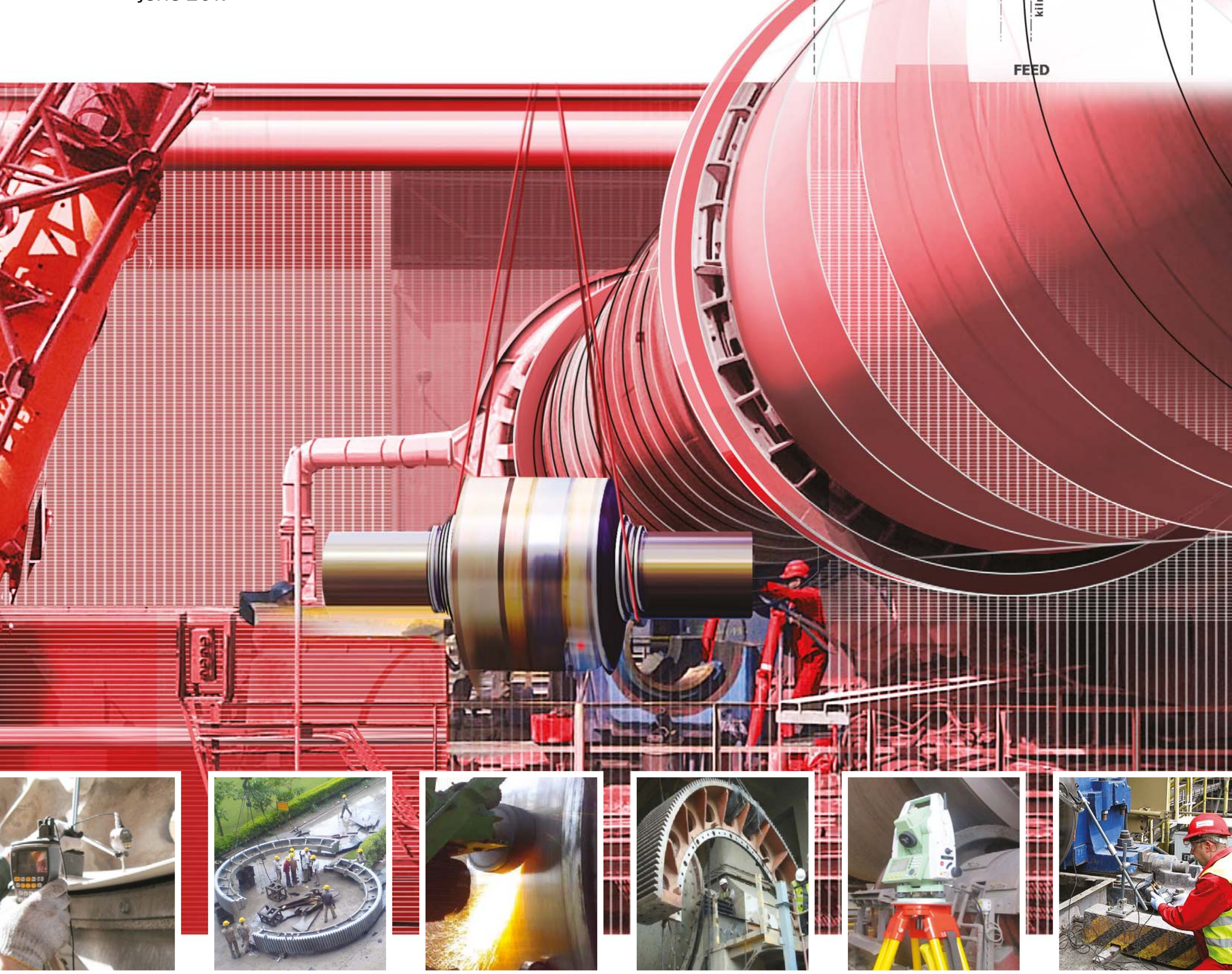
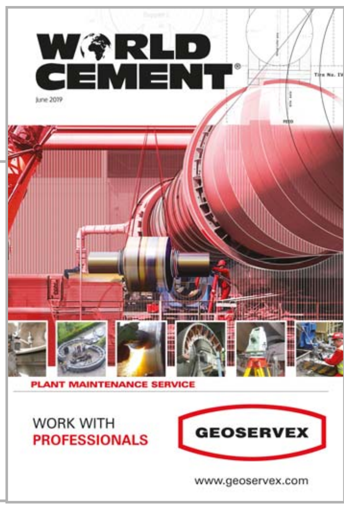
June 2019





ON THE COVER

Geoservex is the leader in comprehensive kiln inspections, offering a service that combines the latest surveying solutions with state-of-the-art software, in order to optimise the geometry and mechanics of rotary kilns. Geoservex promotes a comprehensive approach, with kiln alignment, adjustment, and balancing as the most preventive maintenance tools. Now, Geoservex has implemented new services: turnkey repairs and replacements, resurfacing of rollers and tyres, supervision and troubleshooting, ball mill services, and drive gear services.

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CANNON CONTROL

Mike Moody, Martin Engineering, discusses how a moving conveyor belt can generate power for air cannons to control accumulation.

Ash Grove Cement is the fifth largest producer in the US, shipping 8.3 million t of portland and masonry cements from eight plants nationwide. Founded in 1882, the firm currently has 2700 employees, operating 27 cement terminals and two deepwater import terminals, as well as extensive ready-mixed operations and a major quarry operation in British Columbia. In 2018, the company was purchased by CRH plc, the largest building materials company in North America and the second largest worldwide.

The plant in Louisville, Nebraska, began production in 1929, with new kilns added in 1973 and 1980, as well as an administration building in 2009. Today, the facility produces approximately 1.1 million tpy. In order to maintain production levels, efficient material movement via conveyor is critical. It comes as no surprise that the issue is especially acute when running wet raw material at the quarry. Over time, operations personnel noted accumulation in specific locations that threatened to slow material movement – particularly at transfer points – and which required manual intervention on a near-constant basis.

"Basically, a plant utility person would have to be stationed at the transfer point at all times, operating an air lance to prevent material from plugging the chutes," explained Quentin Vandal, Ash Grove Quarry Superintendent. "The approach required a staff member to poke and prod the accumulation for an entire shift, to maintain the flow of raw material and keep pace with our production needs."

Vandal recognised that air lancing was not a sustainable solution and that the temporary fix was affecting overall efficiency, raising costs, and taking a valuable employee away from more productive tasks. The plant had used air cannons in other locations at the facility to maintain material flow and prevent blockages. But the situation on Conveyor 102 was unique, in that no power was readily available to run the devices. Vandal turned to conveyor

The Ash Grove Cement plant in Louisville, Nebraska, produces approximately 1.1 million tpy.

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The load is carried by the generator's large support shaft, which is rigidly mounted to the idler support structure.

experts at Martin Engineering to review the issues and come up with a solution.

The first step was installing the company's air cannon designs at key locations throughout the transfer point. One was located at the head of the conveyor, with two others at the tail. "The cannons did a good job of breaking loose the accumulation, but because they were connected to the plant's air supply without electrical power, the units had to be fired manually," explained Cory Goldbeck, Territory Manager at Martin Engineering. "So when plant personnel noticed a reduction in material flow, they would walk to the conveyor and trigger the cannons. This was not a permanent solution because, at times, the firing was a little too late and that would require another round of air lancing."

Tapping into kinetic energy

To address the lack of readily available power, Martin Engineering technicians installed the company's Roll Generator System, a unique design that uses the energy of the moving conveyor to generate electricity. "A conveyor is driven by a multi-kilowatt motor, and this power is readily available system-wide in the form of the moving belt," Goldbeck continued. "The motors driving the belts are typically sized with a considerable power safety factor to account for parasitic loads, such as rolls with damaged bearings, tracking devices, sealing systems, belt cleaners, and material changes due to different moisture levels and variable loads."

Martin Engineering's product engineers developed the design, which uses a magnetic coupling attached to the end of an existing roller. The outside diameter of the generator matches the diameter of the roll, but places the generator outside the material path to avoid the heavy loads and fugitive material that tended to damage previous design attempts. The generator is held in a fixed position by the roll support system, but it is not normally required to bear any of the material load. The system generates enough energy to power the air cannons, allowing operations personnel to schedule automatic firing and prevent the accumulation that had been creating flow problems. Together, the components created a turnkey solution that requires no human intervention.

The conveyor roll loads are carried by the large support shaft in the generator, which does not rotate and is rigidly mounted to the idler support structure. The generator forms a lightweight unit that does not affect the existing roll in any way, except to be magnetically engaged and draw a small amount of mechanical power in order to generate the electrical energy. The generator is sealed from fugitive material and forms an integral unit independent of the conveyor roller. All components to 'condition' the power to a steady 24 VDC are enclosed in a protective cabinet.

The anatomy of an air cannon

The air cannons are a positive-acting internal valve design, developed specifically to deliver the most direct air path and maximum force output, with minimal air consumption. By producing more power from less air than most existing designs, the Martin Engineering air cannons can employ a smaller reservoir, giving a reduced footprint and allowing them fit into tighter spaces.

During the firing sequence, a solenoid valve sends a signal to the exhaust valve, causing it to actuate and release the pressure holding the piston. The piston is instantly forced back by the air pressure stored in the tank, and the blast of air is then directed through the nozzle and into the target area. Refill time in this application is less than 30 sec., and the current schedule has the cannons firing once every 2 min.

To eliminate the risk of unintentional firing due to drops in air supply pressure, the cannon's valve requires a positive signal from the solenoid in the form of an air pulse to trigger discharge. Engineered to fire only when the belt is running and loaded, the system eliminates wasted air from firing when there is no cargo on the belt or when the conveyor is idle.

The specially-designed valve allows the control solenoid to be positioned as far as 200 ft (60 m) from the tank, keeping critical components away from harsh service environments. The lack of heat exposure reduces the impact on the equipment itself, increasing the life of the valves and the tank. Locating the tanks in a safe, easily accessible area means that workers can inspect the equipment more often and perform service on a single cannon without downtime.

The design was developed for simplified maintenance, as the complete valve assembly can be easily removed by a single worker, working from one side of the tank. A technician simply detaches the air and solenoid connections, removes the eight bolts from the valve assembly and slides it out for inspection and maintenance. It can be replaced within minutes to keep operations running, and there is no need to remove the tank from service. The units are covered under warranty for a minimum of 200 000 firings.

Conclusion

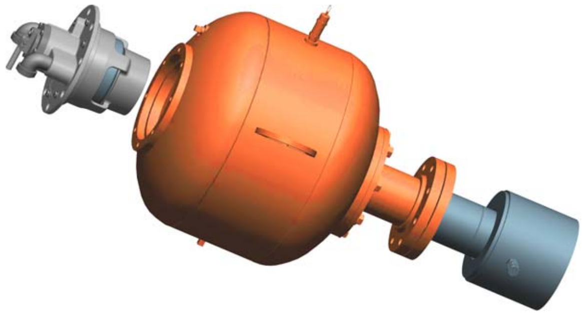
The air cannons are reported to be functioning as designed, significantly reducing the need for air lancing and preventing the buildup of material that was affecting production. "The process experiences less downtime associated with wet material plugging the chutes, feeders, and storage bins," said Vandal. "Operators are able to stay on task, performing inspections instead of investing labour in time-intensive air lancing during operations. The ability to generate the necessary power right at the point where it was needed was a key element in the solution."

Vandal added that several variables can be factored into cost savings, some of which are difficult to quantify. But being able to meet production demands as planned allows for the more productive use of time and helps to ensure completion of other essential tasks. He estimates the payback period to be between 1 and 1.5 years, adding, "The solution is worth its weight in gold."

"Although it can be difficult to quantify, the most valuable payback is improved safety," Vandal concluded. "With this automated system, we have dramatically diminished the risk of potential injury, reducing personnel exposure to unnecessary safety concerns associated with air lancing." ■

About the author

Mike Moody is Business Development Manager at Martin Engineering.



The Martin Engineering air cannons employ a unique valve design that can be serviced quickly and safely.