

GLOBAL SOLUTIONS

COVER STORY

Massive investment in new Gleason technology for P&H Mining Equipment's facilities in the U.S. and China is helping this mining equipment leader keep pace with unprecedented global demand for minerals, materials and oil.



Partnership Pays Off

AT P&H MINING EQUIPMENT



Lower works section showing 'propel' transmissions, which use planetary gear system that now, with Gleason equipment, can be produced in less than half the time it used to take.

Steel prices have soared almost 50% this year and are poised to go even higher. Copper is at \$8,000 a ton – four times what it was just a few years ago. And oil prices have reached a level where it now makes perfect sense to dig up and process billions of barrels of oil from the oil sands of Alberta, Canada.

It's no wonder that a new generation of 'giants' are walking the earth. Most have the name 'P&H' proudly emblazoned on their sides, and they never stop moving, working around the clock on every continent but Antarctica. Some 90% of the world's surface mines are equipped with P&H excavation equipment. The latest, largest generation of P&H electric mining shovels – aptly named the 4100C 'BOSS' – can load the biggest 400 ton capacity hauling truck in just 30 seconds, with just three or four scoops of its enormous dipper. For a mining operation, where nothing these days matters so much as moving the maximum payload at the most minimal cost, P&H electric shovels have never been more valuable – or in demand.



Reducing gear leadtimes by 60%. Headquartered in Milwaukee, WI and in the business since 1884 (now a part of Joy Global Inc.), P&H is no stranger to the ‘booms’ and ‘busts’ that have characterized the global mining industry over the years. So it’s not surprising that, even in the depths of a serious business downturn in the early 2000’s, when shovel orders had dried up like an exhausted vein of gold ore, P&H and its Factory Manager, Walt Wiedmann, were looking ahead, to the next boom. “We went from selling virtually no shovels during the last downturn, to a forecast of 12 shovels a year, to a projected 28 shovels a year today – and we’re poised to go even higher,” says Mr. Wiedmann. “Meeting this demand would have been impossible without the more than \$16 million new equipment investment we’ve made in recent years, partnering with a small group of

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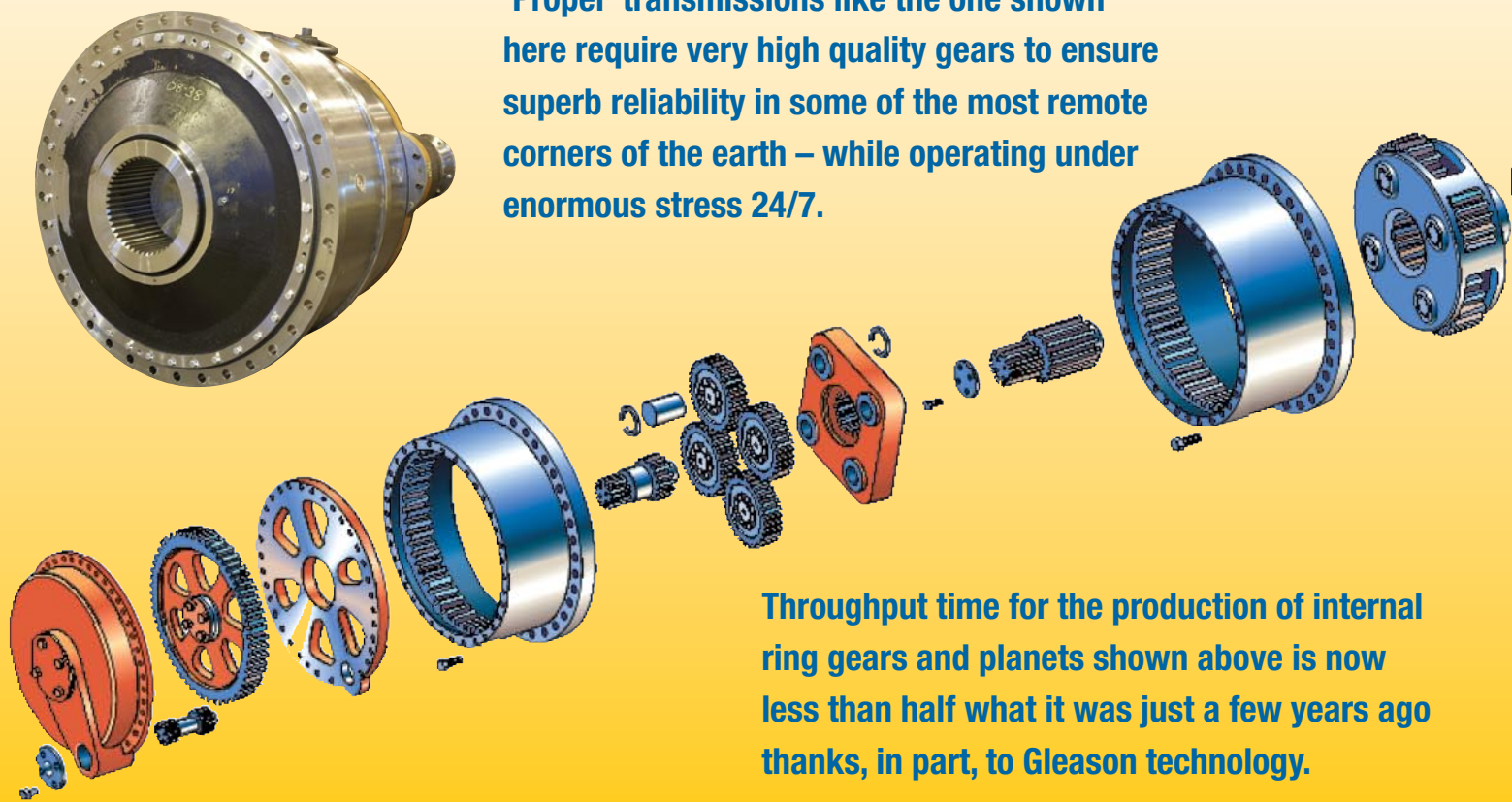
— P&H’s Walt Wiedmann

vendors, and the implementation of eight QRM (Quick Response Manufacturing) cells.”

The QRM methodology was developed in conjunction with University of Wisconsin (Madison) – and with the buy-in of P&H’s union bargaining committee, who recognized that QRM was critical if P&H was to remain competitive and meet increased demand for its products. Simply put, a QRM cell requires that machine operators multi-task, rather than simply dedicating themselves to operating one machine. They’re responsible for scheduling their own work within the cell, performing multiple machining operations, inspecting and even assembling components in some of the cells. In the end, QRM has proven to be considerably more efficient and cost effective than the traditional approach, while greatly reducing leadtimes.



‘Propel’ transmissions like the one shown here require very high quality gears to ensure superb reliability in some of the most remote corners of the earth – while operating under enormous stress 24/7.

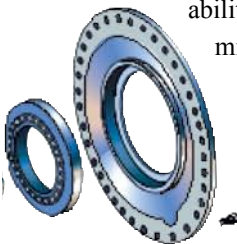


Throughput time for the production of internal ring gears and planets shown above is now less than half what it was just a few years ago thanks, in part, to Gleason technology.

Gleason Profile grinder (left) can finish grind 1 meter planetary gears like these in just over an hour. It used to take 9 hours.

As examples of the power of QRM and new technology working together, Mr. Wiedmann points to the two QRM cells used to rough and finish internal ring gears and planets for the planetary gear systems found in P&H ‘Propel’ and ‘Swing’ transmissions. A shovel like the P&H Model 4100XPB uses two ‘propels’ to distribute power to the enormous tank-like treads that move the vehicle from one place to the next, and two ‘swing’ transmissions to help rotate the upper structure that houses the operator and swings the shovel. Gears for these critical transmissions are all produced at a Gear Roughing Cell and a Gear Finishing Cell, where throughput time is less than half what it was just a few years ago – despite quality requirements that are among the most rigorous of any industry. “We’re routinely finishing induction hardened, and carburized hardened gears up to AGMA 13,” says Mr. Wiedmann. “The high torque stresses placed on these gears, as you might imagine, are significant. Couple this with the need for superb reliability because of the remote and extreme environments our shovels are working in, and you must produce a very high quality gear.”

These gears not only go into new equipment, but are important spare parts components in P&H’s extensive aftermarket business, managed through a worldwide network of P&H ‘MinePro’ Services facilities. MinePro’s service support teams assemble, install and service the equipment around the world. High quality ‘spare and repair’ components such as pinions, shafts and gears factor prominently in MinePro’s ability to keep their customers up and running with minimal scheduled – or unscheduled – downtime.



Four new Gleason machines; cornerstones of the gear cells. Mr. Wiedmann says they selected Gleason as P&H’s partner to provide the latest P 1200 Hobbing/Gashing Machine, P 1200 S Shaping Machine, P 1200 G and P 2000 G Profile

Grinding Machines because the company best fulfilled a host of criteria, including the quality of its equipment, the extent of its in-house manufacturing capabilities, the availability of service and spare parts, and cost and delivery considerations. Results to date bear out their decision.

“Where a typical 1 meter diameter planetary gear might have taken nine hours to finish grind using one of our older gear generating grinding machines, it now takes just 1.20 hours to finish grind the teeth on our Gleason Profile Form Grinder,” says Mr. Wiedmann. “Sure, profile form grinding is inherently a much faster process, because the grinding wheel is dressed to the finish geometry of the tooth and you need far fewer passes to finish grind the gear teeth. But the Gleason machines also have



Internal ring gears that used to take some 22 hours to internal shape now require just 4.5 hours, on this Gleason P 1200 S Shaping Machine.

a host of features that further reduce cycle times, leadtime, and improve quality and throughput.”

For example, Mr. Wiedmann points out that his new Gleason grinders can ‘power dress’ the grinding wheels right on the machine, a process that takes just 30 minutes versus up to four hours required without power dressing. He also likes the fact that the Gleason grinders have an on-board inspection capability right on the machine as well, so that the operators can quickly inspect the first piece of a lot, and print an inspection chart that shows lead, profile, tip relief, and tooth spacing, which ultimately determines the AGMA/DIN quality level achieved. “Now there is no need to let the machine sit idle while we go through the time-consuming and expensive process of measuring gears in the gear lab for ‘first-piece’ inspections or during runoffs,” explains Mr. Wiedmann. “We can grind, inspect, adjust the program, grind and finish the gear right on the machine in a fraction of the time it used to take. The on-board inspection works so well, and is so accurate, that we’ve validated it against a high precision gear inspection machine and used the process to create master gears used later on to verify that our gear grinders are holding the accuracy our engineering dept. requires.”

The time it takes to produce internal ring gears (up to 2 meters in diameter) used in both the ‘swing’ and ‘propel’ planetary gear systems has been greatly reduced as well. In fact, the ring gear used in the ‘propel’ transmission now requires just 4.5 hours to internal shape, versus some 22 hours previously, thanks to the use of a new Gleason P 1200 S Internal Gear Shaping Machine. “The ring gear for the ‘propel’ is designed with a much larger face width, that used to require gashing on an older internal gashing machine, and then finishing on an older shaping machine,” says Mr. Wiedmann. “Now we use the new Gleason Hobber/Gasher with an internal head and the new



Faster and more flexible, this Gleason Hobber uses indexable-insert, air-cooled cutter to perform gashing dry.

two of six new Gleason Hobber/Gashers, Internal Shapers and Profile Form Grinders, some even larger than those used at the Milwaukee facility, have already been installed. But if you think Mr. Wiedmann is worried about the challenges of integrating such advanced equipment into an emerging market like China, you'd be wrong. "Yes, starting from scratch in China with a 'clean sheet', or a new partner, would have been a difficult proposition, but we are employing the same Gleason equipment, the same Siemens 840D CNC control (with programs and functions in Chinese), and the same QRM philosophy there that's worked well here," says Mr. Wiedmann. "The fact that Gleason already is so firmly entrenched in China and has a Tianjin service center in place right around the corner is also instrumental in the timeline required for installation, runoff and the training process required.

"The bottom line really, both in Milwaukee and China, is partnering with a company like Gleason that offers advanced technology that can reduce the required skill level of the operator. Their machines reduce the necessity for a 'journeyman skill level' operator with years of hands-on gearing experience, and instead take that out of the operator's hands and build it into the machine. The results are evident in Milwaukee, and we expect China to be equally as productive."



Six more Gleason machines are poised to start production at P&H's new Tianjin, China facility, giving the company still more capacity to meet unprecedented global demand.

Gleason internal shaper to finish the internal gear teeth in far less time."

In addition, the Gleason shaper was purchased with a head with an extended stroke length that enables P&H to produce critical 660 mm (26 in.) internal splines on a number of parts that couldn't be produced in-house previously on the older internal machines.

In the Gear Roughing Cell, P&H has installed a Gleason P 1200 Hobbing Machine that provides a degree of speed and flexibility that simply didn't exist before, according to Mr. Wiedmann. "With the new machine, we can hob or gash additional families of parts that we were unable to do in-house on the older machines, such as larger pinions," says Mr. Wiedmann. "We are also gashing dry, by using a special indexable-insert, air-cooled cutter with replaceable carbide inserts, allowing us to take advantage of the higher feeds and speeds that are possible on the Gleason machine."

China Expansion: what works in Milwaukee will work in Tianjin. Today, you'll most likely find Mr. Wiedmann in his role as Project Manager, Capacities Expansion/China, at P&H's new 108,000 sq. ft. plant strategically located in the coastal city of Tianjin, China, just a few hours east of Beijing. The new facility, when fully operational later this year, will give the company still more capacity to meet the surge in global demand for P&H shovels and aftermarket components. The first

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