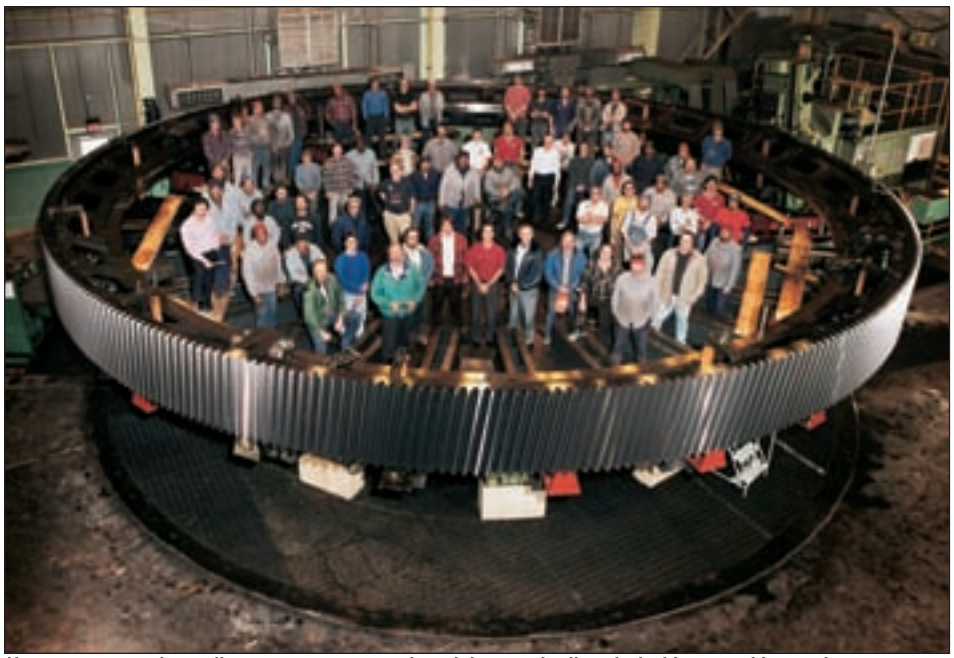
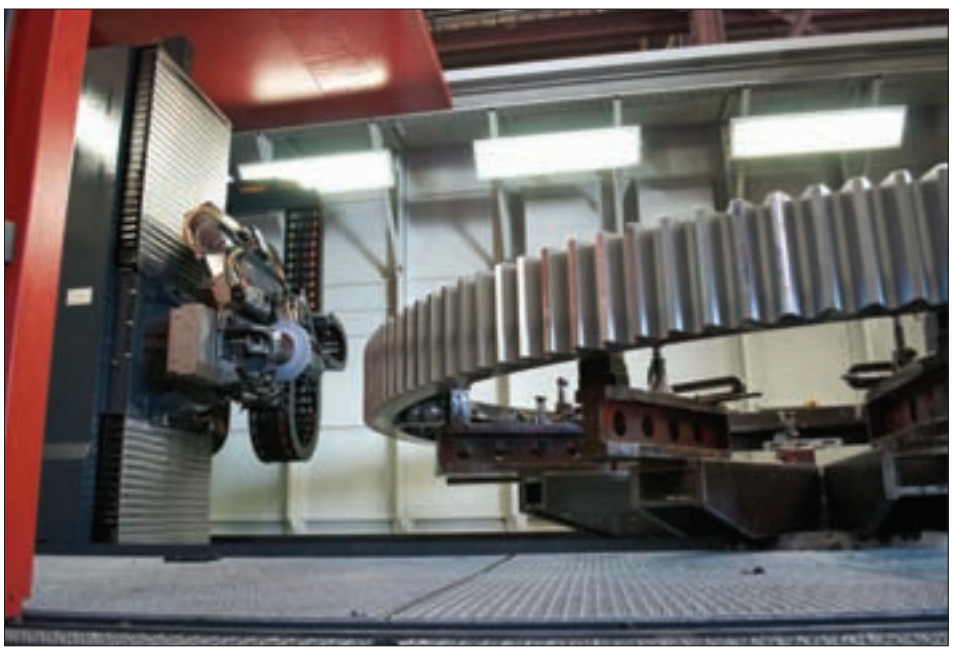
BIG Gears

HIGH STANDARDS, HIGH PROFITS

Jack McGuinn, Senior Editor



Huge gears such as these are common in mining and other industries requiring extreme power. Photo/Rexnord.



Photo/HMC.

Natural resources—minerals, coal, oil, agricultural products, etc.—are the blessings that Mother Earth confers upon the nations of the world. But it takes unnaturally large gears to extract them. Whether it's draglines and conveyors for the mining industry, or roughing stands and finishing stands for steel production, the equipment used in these endeavors all employ very large gears.

But what, exactly, constitutes a big gear? It depends which manufacturer you're talking to. For some shops, a 60-inch diameter gear would be considered large. For others, gears seven feet and

more in diameter are common. But one thing that all of these companies would agree on is that it is a very good time to be in the big gear market.

"Right now, I can make this statement with high confidence—I have got probably an 18-month backlog," says Nick Sudzum, general manager and chief operating officer of B&R Machine and Gear, in Sharon, Tennessee.

At Vancouver Gear Works, in Richmond, British Columbia—same story.

"Right now is a very good time with what's going on in mining," says Jim Mantei, general manager. "We've never been as good as we are right now, and as far as we see, it's all going to continue well into next year. Being a jobbing-related shop traditionally, we don't usually see business much more than a month or two out, and we're six months into next year."

And at Princeton, Indiana's HMC and Milwaukee's Falk-Rexnord, there's more of the same—up to a point.

"I think it's about as strong as I've ever seen it," says HMC's John Schnarr, sales manager.

"We had a great run here with metals like copper and also gold going from $400 to $800 an ounce," says Craig Danecki, vice president, global gearing for Rexnord. "Iron ore took off like crazy, and we had a real good run on all that. But back in September-October we began to see a softening in those areas. Most people we talked with didn't think (the slowdown) was going to be anything significant or long term, but now people are questioning that, and there's the bank issues. People being able to get access to cash for all these big projects—you're talking about some pretty big capital investments."

Aside from any slowdown in mining, the only drawback in all of this prosperity has more to do with the availability of material and the large machines needed to produce, test and inspect outsized gearing. Given that lead times for machines and materials can be more than a year, a start-up company entering the large gear market would

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probably need years, not months—and a lot of money—to get up and running.

"I wish I had another couple large machines, but there's none on the market," says Sudzum. "If you buy a new machine, you're looking at three to four years delivery. That's my understanding, anyway. There are a couple companies out there retrofitting older pieces of equipment with CNC controls and such—I just don't believe in that. It's like Gleason Works designed a machine, and now here comes along a guy who's going to put controllers on it, doing away with the gear trains and such. I don't know the longevity of them. The factory didn't build them that way, and here we're going to put this servo motor in to replace the entire gear train. Essentially, I don't think the machine is going to last as long as it would if you kept it all original."

The most consistent bottleneck in the supply chain is bearings. Whether for a behemoth wind turbine or mill equipment for processing sugar cane, the bearings needed for that equipment are in short supply. Indeed, a central reason for the long lead times on new machines is that they, too, require high-quality bearings. In short, if the bearings specified for a certain design are out of stock, waits of a year or longer are not uncommon.

"Some of our machines—CNCs, hobbers, grinders—they use large bearings, and a lot of times the lead time for the machines is pushed back purely based on the availability of bearings," says John Belton, business and development manager at Vancouver. "Typically, bearings have the longest lead time on any project.

"I think it's because they're building bigger machines now; they're running faster, and so, things have become more sophisticated. They have to, quite possibly, build new machines to build the bearings."

"Bearings have been the biggest issue," agrees Cal Tanck, Rexnord marketing manager. "(A certain bearings supplier) has been the poorest regarding their commitment dates, and it hurts us especially when it's a week or two before the order and we're getting ready to box it up and we're just waiting for the bearings and—bang—it's another three months."

And although Rexnord is not in the wind turbine market—they prefer to concentrate on their industrial customers—Danecki believes that the booming market is in part to blame for the bearings shortage and, to some extent, steel as well.

"There was a pretty significant impact on all of this from the wind

Photo/Vancouver Gear Works.

market," he says. "The wind market really bit into capacity out there."

B&R Gear and HMC are two other gear manufacturers that have opted out of the wind turbine market and concentrated on what they do best.

"We would enter that market, but right now it's saturated with manufacturers trying to get in it, and it's very, very competitive," says B&R's Sudzum. "But we're seeing that it has loosened up some in the jobbing area. Several shops have become nothing but wind power, and that's opened up the market for shops like ourselves to be introduced to people that we've never done business with before in general replacement gearing."

But when it comes to steel availability, much depends on which steel has been specified by the design engineer. And that has been a problem of sorts for a company like Vancouver Gear, which uses both foreign and domestic steel in its large gears.

"What we're finding is that a lot of these gear box designs are coming from Europe, so they've used materials readily available in Europe, and we don't have those available to us in North America," says Mantei. "We work with their engineers to see if there's a material that's close enough that we can use, maybe a 40 C 40 or a 40 C 20, etc. In some cases they say no, all their engineering has been based on these specific materials, so we then have to source those materials from Europe."

Large gears also require large pinions. Photo/Vancouver Gear Works.

Conversely, steel is not a problem for B&R Gear. That's because they use only U.S.-manufactured material. "In fact, a lot of our customers insist on—and we don't stock—anything but U.S.-manufactured, U.S.-certified, SAE grades," says Sudzum.

Ditto for Rexnord. They in fact have their own steel alloy foundry, where they produce much of the steel for their ring gears.

Aside from the exorbitant cost of the machinery needed to produce big gears, heat treating is another component of the equation. Many companies making big gears do their own, and in fact—like Rexnord and Vancouver Gear—do commercial heat treating as well in order to defray costs and provide capital for reinvestment. HMC,

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on the other hand, chooses to outsource heat treating. HMC's Schnarr gives an example that illustrates the complexity of heat treating big gears, and perhaps a reason why some companies choose to outsource rather than own the process.

"Essentially, the biggest challenge you have with heat treating large gears is distortion that's inherent with heating large masses of steel," he says. "And that calculation, a certain amount can be anticipated and expected, but there are always surprises. So what you end up doing is roughing a gear to a specific size and then, depending upon the depth of the heat treating, you have to allow—because you're going to bring that gear back—for the fact that you're going to finish cut it or grind it.

"So if you want to end up, say, with an eighth, and you anticipate that you're going to have another eighth of distortion, you have to go in and say, 'OK, we want a depth of a quarter because we anticipate an eighth of an inch distortion, which we're going to have to clean up when we bring (the gear) back."

If there is one trend in the big-gear industry that stands out in our conversation with these four companies, it is the higher AGMA/quality standards that customers are insisting upon. And it's a trend that has not been seen before in the industry. Designer-specified AGMA standards of 12 to 15 are common and have been a bit of a game-changer for many companies.

"The biggest difference for us is that the quality level has increased substantially," says Vancouver's Mantei. "Today the requirements are up there at AGMA 14 and 15 levels for wind generation, and with that, it's one thing to claim (high AGMA standards); it's another thing to back it up. The new machines come with onboard inspection and the new-generation machines can certainly hit those levels relatively easily—certainly much easier than the old machines. With the old machines, we were lucky if we could produce a quality 11 or 12. Today, we're able to do 14-15 much easier than we could produce a 12 in the past."

And because Vancouver is a player in the wind generation industry, the quality challenges are even more daunting.

"It's not just the quality level, but the actual gear geometry of the gears for the wind industry," says Vancouver's Delton. "We've seen some double-helical gears where they have different helix angles. It's quite challenging."

"We are seeing higher AGMA requirements," agrees Schnarr, "and that's where we've focused our capabilities on in being able to provide the absolute highest quality on large gears. It comes down to value. When you run the calculations, higher AGMA standards mean better service and accuracy, and extended life of the product."

Says Danecki, echoing that sentiment, "Our markets aren't interested in product that they have to replace in three to five years," he says. "They're

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And at B&R, "Everybody is looking for a higher-quality gear size—AGMA 11 and 12—which is customer driven," says Sudzum. "Engineers are sitting down at computers and crunching numbers and so forth, and they're deciding that a smooth finish—the fillet being a nice mirror finish blended into the root, so on and so forth—means that their longevity and strength factors increase."

And speaking of trends, Sudzum addresses another one affecting his company.

"I am seeing less and less large corporations keeping spare parts in their storage departments," he says. "They'd rather wait for that breakdown situation to happen and pay more money for somebody to produce that set of gears in a timely fashion, as opposed to putting the money out now and putting (the parts) on their shelf for five years.

"I'm old-school; I'd rather have the parts on my shelf. If I make one set of gears for, let's say, a Model 26 Gleason, I'm going to make five sets because I've got seven machines. It's easier for me to do that. Eventually, I know we're going to use it—it might be 10 years from now, it might not be in my lifetime—but somebody will use them."

Revisiting the supply chain issue, other components common to big gearing that are in short supply are castings and forgings. Depending on the shop, some use relatively few while companies like Rexnord use quite a lot. It basically depends upon application and manufacturing requirements. The lack of their ready availability can be a problem if you don't plan ahead.

"Sometimes the forgings become a problem," says Mantei. "For some of our repeat business, we know what it is, and we have some forgings on-hand. So we're able to turn around a five-, six-foot-span gear in about three to four weeks."

"There are real difficulties still in getting castings," says Schnarr. "There's limited sourcing for large castings in North America—about a year lead time—they're backlogged. Sometimes they have problems doing their patterns and initial pours, and they end up scrapping and starting over. We're inclined to use more forge-fabricated than designs that have castings. But some still call for that." Because Rexnord uses a good deal of forgings, their wait time is not as extreme, as they have preferred suppliers who fill the demand.

"We deal with four to five forge shops, and we move that around quite a bit," says Danecki.

As for B&R, "Some of the larger gears, you pretty much have to have a casting made for it because the original was a cast form," says Sudzum. "If we can't make just a ring gear, and it's made integral through the hub, then a casting is required. Casting lead times I have found—even for a quote—for a pattern charge and a casting, sometimes we'll send it out to four or five different casting facilities, and we're looking

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at seven-eight weeks just to get a response."

And to what does Sudzum attribute the long wait?

"The old-time pattern makers? They don't exist anymore."

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Heat treating is a crucial component in the manufacture of large gears and pinions. Photo/Rexnord.