

# MY GEAR is Bigger than YOUR GEAR

## Industry Battles it Out for World's Largest Gear Title

Matthew Jaster, Senior Editor

**In 2009, scientists at the Institute of Materials Research and Engineering, Singapore, developed a working molecular-sized gear that could be fully controlled, rotating both clockwise and counter-clockwise.** This was made possible by “nudging” the gear with the probe of a scanning, tunneling microscope. According to the Guinness Book of World Records, it is the smallest working gear in the world.

In an attempt to locate the LARGEST gear in the Guinness Book of World Records, this author fell incredibly short. There's no mention of, for example, some of Rexnord/Falk's mining girth gears or the single-helical SAG mill girth gear from David Brown (England)

delivered in 2008 for a mining operation in Armenia. (A gear that weighed more than 65,000 kilograms [143,300,30 lbs] boasted 362 teeth, 0.75 DP, 863.6 mm face width, 12.4 m OD and a 10.5 m diameter bore). At that time, David Brown had claimed the size record.

Not to take anything away from the engineers and scientists in Singapore, but looking at a molecular gear through a microscope isn't nearly as impressive as seeing a GIGANTIC piece of metal getting the job done in a copper mine or a sugar mill. It's true what they say about engineering and manufacturing: Size does matter.

So why can't an interested engineering geek find any information today on the

world's LARGEST gear and why hasn't anyone talked to Guinness about it?

### Opening a HUGE Can of Worms

The world's largest gear is kind of a sore spot for some manufacturing organizations. It can become a rather contentious subject particularly if you get engineers from competing firms discussing the topic. “This was brought up at a recent SME meeting,” says William Rhody, marketing manager, mill products at Rexnord. “Some companies will downplay the capabilities of their competitors or assume that they have the biggest or the best equipment without doing the research. There's a lot of misinformation out there so it's nice to set the record straight.”



Hofmann Engineering recently shipped a gear boasting an outside diameter of 13.2 meters and weighing 73.5 tonnes.



From a manufacturing standpoint, Rhody believes a debate about the world's largest gear would have to include both the physical size as well as the power. "I can see how several companies could make a case depending on the way you look at it."

In our research, companies in the discussion for world's largest gear would include Rexnord/Falk (United States), P. van der Wegen Gears (The Netherlands), Hofmann Engineering (Australia), CMD/Ferry Capitain (France), FL Smidth (Denmark) and NKMZ (Ukraine). (*Ed.'s Note: These were the companies that responded to inquiries on the subject. If we're missing a company that should be in the discussion, please contact us at publisher@geartechnology.com.*)

Rhody's assertion that various companies debate and discuss their manufacturing capabilities and flex their BIG GEAR muscles is absolutely true. There have been arguments in the past, press releases sent out claiming world records and even trade organizations and magazines attempting to crown a king.

Unfortunately, proving what company has manufactured the largest gear on the planet may be as superfluous as finding out what restaurant serves the world's BEST cup of coffee.

Can **Gear Technology** make the impossible possible?

Before we start debating who should or should not be in the discussion, let's take a moment to acknowledge the impressive engineering knowhow that goes into producing some of the world's largest gears. From our standpoint, it seems as though every couple of years a gear comes along that supports the notion that engineering is truly an inspired art.

"The precision to which large gears are manufactured under controlled conditions is quite extraordinary," says Rhody. "It's something a lot of people don't appreciate until they see one up close and personal."

"It's not easy money," adds Holger Fritz, product manager, mill gearing, at Hofmann Engineering. "If you don't have a temperature-controlled environment, for example, a gear of 10,000 mm

grows 1.15 mm with every 10 degrees Celsius depending on the material. This is significant when you are trying to achieve micron accuracy. With big gear cutting, you need a lot of experience and you always have to keep in touch with new technologies to improve quality levels, cutting times, etc."

Marthe Prunier Ferry, president of Ferry Capitain agrees. "It's a challenge to control the temperature precisely in order to have a good distortion, have a rigid clamping so that there is no vibration and have enough tonnage capacity on the table of the cutting machine.

There is also the matter of the base materials used for high-power gearing.

"With increasing power requirements in mining applications, for example, it is important that materials technology keeps pace with machining technology," adds Ferry (Ferry Capitain can produce cast steel and ductile iron gear materials having a minimum hardness of 340 BHN, whereas the state-of-the-art only 15 years ago was 280 BHN).

The largest gears in operation are utilized in areas like mining, steel, sugar

Ferry Capitain's recently commissioned VBCM16 is capable of turning and cutting gears up to 16 meters in diameter with 1,200 mm face width and 350 tons on the table.



mills and construction applications. "Mining is the biggest market for our operation, but we have manufactured a lot of big gears for the cement and fertilizing industries as well," says Fritz. "We've also made slew gears for satellite dishes."

Many of these gears are large enough to comfortably sit an entire manufacturing staff (See photo on page 47).

### The Big Gear Contenders

Hofmann Engineering shipped a forged steel mill gear recently boasting an outside diameter of **13.2 meters** and weighing **73.5 tonnes**. It will transmit **17,000 kW** when driven by two 9-tonne pinions. The gear is being utilized in an undisclosed copper mine in China.

"This gear is just 1 mm bigger than the gear that we manufactured five years ago for BHP Billiton (an Australian mining and petroleum company)," says Fritz. "We are also quoting on different designs at the moment with dual pinion mills up to **22,000 kW** and dual girth gear mills up to **34,000 kW**. We currently have an order for a mine in North

America for a ball mill gear with a with a **9,000 kW** single pinion drive."

While Fritz doesn't know what gear sizes the competition is supplying to the mining market, he does note that Hofmann boasts one of the biggest gear cutters in the world. "Our biggest machine is a **15,000 mm** machine, followed by **14,000 mm**, followed by an **11,000 mm**. These machines are all hobbing/form cutting machines, but we also have three MAAG machines."

But can Hofmann actually claim the title of world's largest gear? Not so fast, according to the competition.

Rexnord/Falk boasts a **13.5 meter OD SAG mill gear set** at the Los Bronces Copper Mine. "We also have two Detour Lake SAG mill gear sets, at **13.4 meters**," Rhody says. "Additionally, there are five others with diameters between **13 and 13.2 meters**. In terms of mill power, two of these have a total mill power of **24,138 hp**. There are three other ball mill gear sets, with diameters less than **13.1** that have a mill power of **23,132 hp**."

Hans van der Wee, of P. van der Wegen Gears b.v., says the compa-

ny once delivered a **14 meter gear**. "At the moment we have several very big gears on order (to be delivered at the end of this year and the beginning of next year) with an external diameter of a little below 14 meters. These gears are all for the minerals industry."

In fact, P. van der Wegen is currently working on different methods for the manufacture and production of large gears. "At the moment our maximum diameter capability is **16.5 meters**," says van der Wee. "We are currently expanding our capacity and capabilities so that we will be able to produce gears (using the generating method and not, as many others do, the single-indexing method) up to a maximum diameter of **30 meters**, though we have not yet encountered these size gears."

Ferry Capitain has already produced a **13.6 meter diameter girth gear**, according to Ferry, and the company is currently producing a **16 meter diameter girth gear**.

While Ursula Mian, head of marketing and communication at FLSmidth MAAG Gear states that the company is



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limited to about 11.2 meters, she confirms that P. van der Wegen Gears, Ferry Captain and NKMZ are in the discussion. "We know that van der Wegen can today produce up to 14 meters and they are investing soon in a new machining center to produce even larger gears. Novokramatorsky Mashinostritelny Zavod (NKMZ) in Kramatorsk, Ukraine produces up to 15 meters on a new multi-machining center and Ferry Captain can surely produce 14 meters."

So, Ferry Captain at 16 meters takes the crown, right?

Not quite.

**What Makes a Gear a Gear?**

The world's biggest gear saga played out once in back issues of this very magazine when one Peter Mayo, of Toronto, N.S.W., Australia discussed a 92 meter diameter "red mud" tailings thickener in Western Australia. The question was raised whether or not a thickener rack or dragline rack should be even considered gears in the first place or should the name be reserved for gears that rotate ("The Bridges of Cook County

and Other Sagas" *Gear Technology* September/October 1996).

In the very next issue, in an article entitled, "Gears on Film" (*Gear Technology* November/December 1996), the late Eliot K. Buckingham, an authority on the gear industry, stated, "To my

mind, a single gear is a piece of metal with projections on it. A gear is designed to be operated with another gear or gears. You do not design a single gear ..."

In the article, Buckingham approached the biggest gear question the same way. "The largest gear in the world



William Rhody, marketing manager, mill products at Rexnord, believes both physical size and power need to be included in the World's Biggest Gear debate.

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is a cog railroad, since the rail is a rack, which is a segment of a gear of infinite diameter."

Perhaps this argument would best be resolved by getting all the companies together in a room with a potential BIG GEAR customer and let the chips fall where they may (pun intended). For all intents and purposes, it's difficult to argue which gear is the biggest or most powerful because it's essentially going to come down to satisfying a customer's request. If a gear customer has a need for a 35 meter gear, these companies will find a way to manufacture one. It's what they do.

"As the technology improves, companies will be capable of making larger and larger gears and it's going to be impressive to see the results," Rhody adds. "It's fun to imagine how big they might actually get."

In the meantime, talking about it only leads to anger and/or resentment. Someone that sees a press release claim-

ing "World's Largest" immediately scoffs because the record won't stand for very long. In fact, the average *Photoshop* aficionado could "create" the world's largest gear with a few mouse clicks and some minor photo manipulation. Until Guinness sends a representative down to verify one of these mining gears with a notepad and a serious tape measure, all bets are off.

### The Great Cop Out

No one will be named manufacturer of the "World's Biggest Gear" in this article. Instead, it's better to just stand back and admire the handy work of these massive components. If you're hell bent on naming a champion, we suggest a bit of restraint. By the time you've crowned the manufacturer of the world's largest gear, we're confident that some other company will be shipping a bigger one.

Good for the big gear business, ultimately bad for the bragging rights. ⚙️

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