Leading Player

Interview with an Innovator

Never Give-Up Attitude Leads to World's First Machine

No gears means no power! From small gears to the big gears of ships and wind power systems, gears come in many sizes, and MHI is leading the world in the field of gear processing. In particular, the world's first internal gear grinding machine (ZI20A) is now firmly in the spotlight; this extraordinary machine accommodates mass production of the difficult finishing process of high-precision ring (internal) gears. Team Manager Yoshikoto Yanase talks about gear grinding machines.

What is a gear grinding machine?

Ring gear and grinding wheel

Mitsubishi internal gear grinding machine ZI20A

It is a machine for grinding the tooth surface of gears by using numerous abrasives attached to a tool. The internal gear grinding machine (ZI20A) mass produces high-precision ring gears at high speed and low cost.

Development of world's first internal gear grinding machine

Q Please tell us about your career since joining MHI.

A I entered MHI in 1997; since then, I have been designing and developing gear machines*1. In 2002, I passed an in-house selection, and travelled to The Ohio State University Mechanical Engineering Laboratory in the U.S. to research reduced gear noise and vibration. Since returning home, I have been developing gear grinding machines and their cutting tools.

Pick Up Innovator ▸▸▸

Profile

Yoshikoto Yanase
Team Manager
Gear Grinding Machine
Gear Machine Designing Section
Engineering Department
Machine Tool Division
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Responsible for the ZE Series of external gear grinding machines and the ZI20A internal gear grinding machine, Yanase has been involved in the development of gear grinding machines since joining MHI in 1997; in 2002 he undertook research at The Ohio State University in the U.S.

Q So you were in charge of developing the internal gear grinding machine, the ZI20A?

A Yes, I was. Previously, in the gear manufacturing flow, heat treatment was applied to most gears after cutting the gear teeth and before final machine assembly, but distortion occurs during heat treatment. So although it was better to grind after heat treatment, it was difficult to grind internal gears, and this was proving to be an obstacle to mass production. The ZI20A was developed and adopted a vitrified CBN wheel*2 that provided a high hardness, and by reviewing grinding speeds and the arrangement and shape of the tool, the high-precision grinding of internal gears after heat treatment was achieved in only 90 seconds. Eventually, tool life was also extended. The ZI20A, the world's first internal gear grinding machine, caused quite a stir and was highly rated at Gear Expo 2009 held in the U.S.

Be patient and look at things from various angles

Q How do you overcome difficult problems?

A By listening closely to customer requests and solving their problems, we improve our technology. I believe the role of engineers is to build a creative relationship with clients. It's very satisfying to solve a problem that the customer has given up on. I find it important to be tenacious and keep coming at the problem from many different angles, basically keep coming up with different hypotheses. Teamwork and trust are also essential; with a good supportive team, you can successfully tackle problems head-on.

Q What was your best experience from going abroad?

A Spending time with overseas researchers and fellow engineers. Thanks to such opportunities, I made many valuable personal contacts and came to see things from a broader viewpoint, which led to raising the level of my work. In addition, although MHI is a top manufacturer of gear machines in Japan, I soon learned that there are outstanding competitors overseas, and this really motivated me to start thinking: "I want MHI to be the world's top manufacturer of gear grinding machines and as an engineer I want to play my part in making that happen."

Q What is most important to succeed in the world market?

A We must be ahead of the pack and keep improving machine performance, but even so, delivering a great machine is not the end. Far more important in terms of customer satisfaction is a first-class after-sales service to directly explain our unique know-how. So it is vital to keep training global staff in Japan for dispatch to local sites.

Promoting gear grinding in support of the global environment

Q How is improvement of gear grinding technology useful for our daily life?

A Along with increasing demands for protection of the global environment, the quietness of vehicles and improvement of fuel efficiency are now being sought after. The ZI20A opens the market for their use in many more passenger cars to give smoother and quieter rides. Also, the spread of high-precision and low-cost internal gears means we're going to see improved efficiency and downsizing of gear components across the board. Soon they're going to be used in large-size vehicles, and in industrial fields other than automobiles, which is great for the environment because of their contribution to reduced noise, high efficiency and better fuel consumption.

Gears are rarely seen by people in everyday life, they are the so-called "unsung heroes"; a sort of hidden low-profile proof of high technology. I never give up; we just keep working towards the perfect mass production system to finish that perfect gear.

*1 **MHI gear machines**
The product range covers all machining processes, from the initial stage of dry-cut hobbing through to finishing. As a manufacturer of gear cutting tools as well, MHI is able to offer a host of comprehensive machine and processing solutions.

*2 **Vitrified CBN wheel**
A cubic boron nitride (CBN) grinding wheel hardened by using a vitric binding material. CBN has a diamond-like crystal structure and is the second hardest material after real diamonds, but has better thermal stability.

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