

CYBER WORLD



Feature

The Automotive Industry and Machine Tools

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2019
No. 58



AUTOMOTIVE INDUSTRY

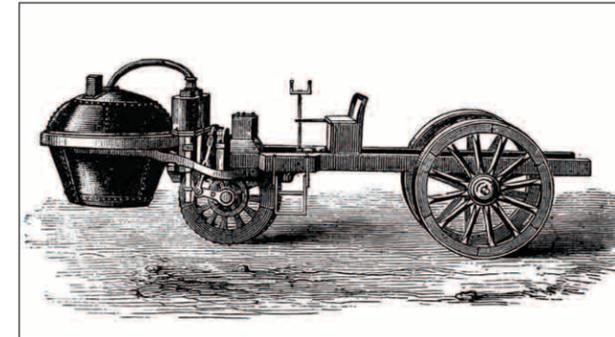
The Automotive Industry and Machine Tools

Automobiles are widely used as highly convenient means of transportation all over the world. The annual car sales in the world will reach the milestone of 100 million units in the near future. Approximately 250 years from the birth of cars, the automotive industry is entering the period of a once-in-a-century innovation.



History of cars

"Cugnot's Steam Wagon", the world's first steam-powered car made in France (1769)

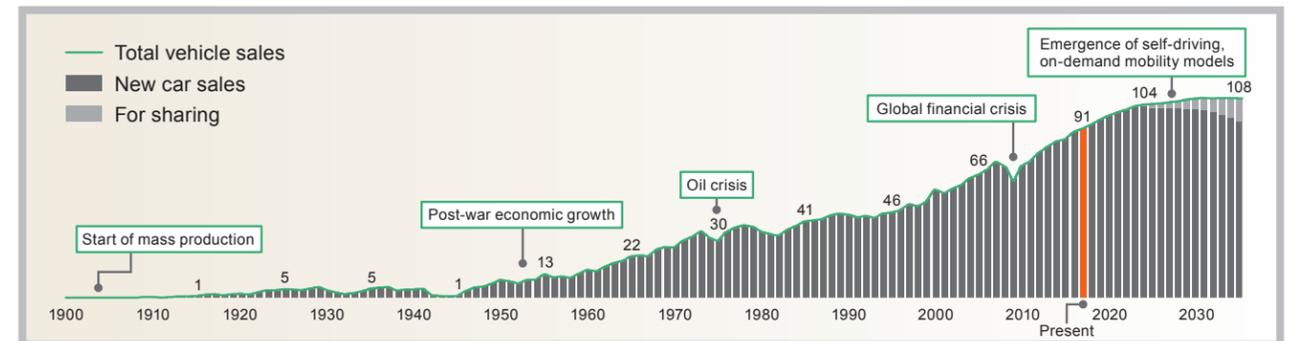


The "Jamais Contente", the electric car that broke the 100km/h (62.13mph) barrier for the first time in the world at a car race (1899)



Photos courtesy of Getty Images

Sales of new cars in the world by year (Unit: million)



Source: Boston Consulting Group

The automotive industry is entering the period of a once-in-a-century innovation

The history of cars started with a steam-powered car born in France in 1769. The type of cars developed following steam-powered cars was actually electric vehicles (EVs). EVs started to be developed in the early 1800s and have a longer history than internal combustion engine vehicles (ICEVs) powered by gasoline, which were born in the late 1800s. The three types of cars, namely steam, electricity and gasoline-powered vehicles, were widespread around 1900. In the United States, the share of EVs was large at that time and it is said that most of the taxis operating in New York City were EVs. Although it was expected that EVs would be more widespread, ICEVs became the mainstream in the 20th century because of the establishment of their superiority in performance and price after the start of mass production of the Ford Model T, which was released in the US in 1908.

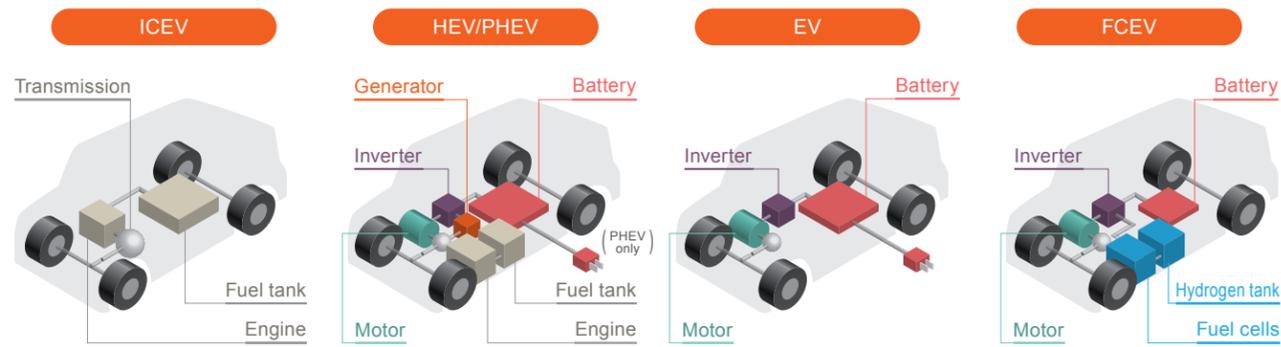
Today, while roughly one century has passed since the rise of ICEVs, the development and dissemination of electric-powered cars including EVs, hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) are accelerating again by, for example, the conclusion of the Paris Agreement as an international

framework for measures to prevent global warming. It is estimated that CO₂ emissions from ICEVs per unit of transport are approximately seven times larger than those from trains. The reduction of CO₂ emissions is thus a major challenge for the automotive industry to continue to develop in a sustainable manner. While electric-powered cars occupy only a few percent among general vehicles at present, it is forecast that their share will grow significantly in the future.

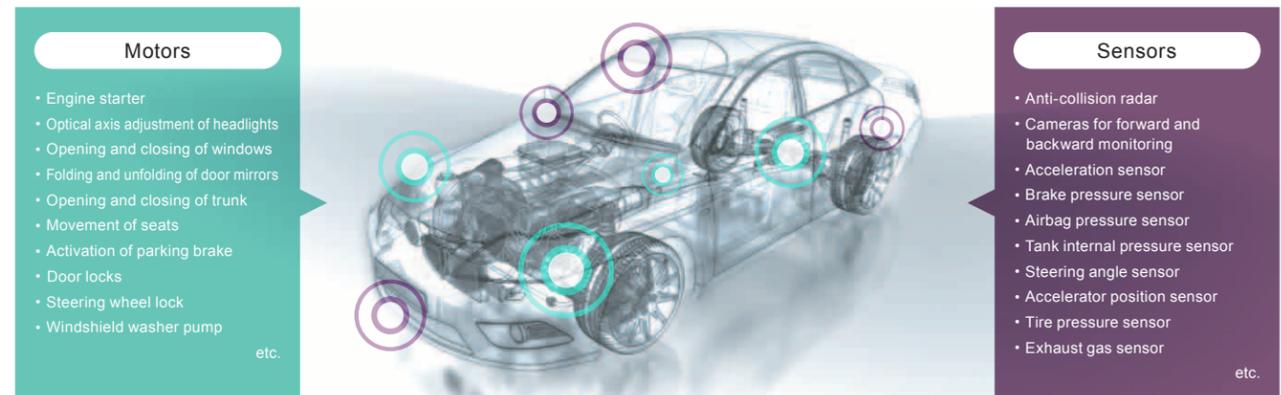
In addition to the shift of the power source from engines to motors, the concept of cars has also been changing in recent years as represented by the term "CASE," which stands for Connected, Autonomous, Shared and Electric. As IT companies have been involved in the development of connected cars and complete autonomous cars along with car manufacturers, the barriers between different industries are disappearing. While the automotive industry is thus entering the period of a once-in-a-century innovation, new demands have also been created due to changes in the needs in the parts industry and the production equipment industry, which support car production.

Technologies related to the electrification of cars

Major types of cars and their structures



Wider use of electrical and electronic components



New manufacturing demands created by the electrification of cars

Electric-powered cars are undergoing a remarkable evolution in terms of their performance. Their driving distance performance is already equivalent to that of gasoline-powered vehicles as the latest EVs can travel more than 500 km (310.68 mi.) on a single electrical charge. On the other hand, it is also said that EVs will be widespread only after the reduction of the production cost and the expansion of the power generation infrastructure. Since it takes much time to solve these challenges, it is forecast that the next few decades will see a "diversification of powertrains" with a mixture of vehicles with various power and drive systems such as EVs, HEVs, PHEVs and FCEVs (Fuel Cell Electric Vehicles), in addition to conventional ICEVs.

Recent automobiles have been electrified in various areas to improve comfort and safety. In some models, a car is equipped

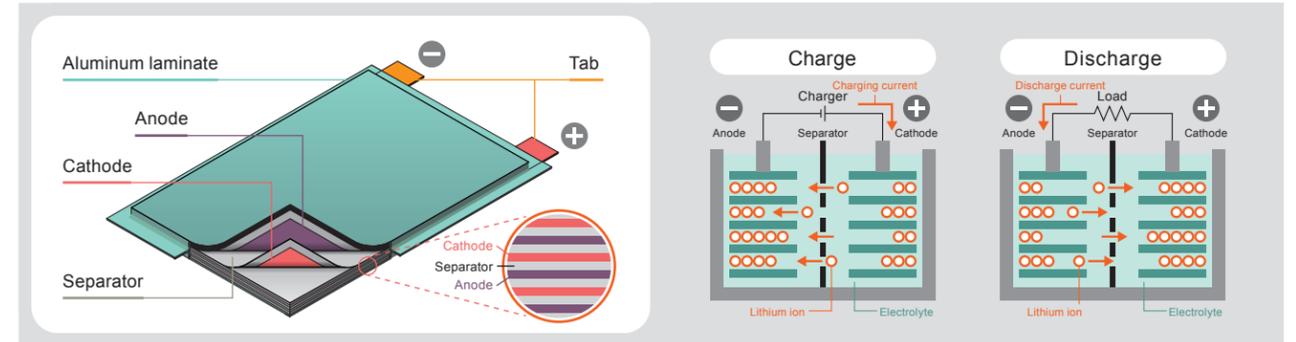
with more than 100 motors. Dozens of kinds of sensors are also used for cameras, radars, etc. It is expected that the percentage of electronic parts among all automotive components will continue to rise.

With ongoing diversification of powertrains and increases in use of electronic parts, the demand for various equipment that produce batteries, motors, semiconductors and other components is growing. The infrastructure industry surrounding automobiles is also experiencing changes caused by increases in the number of EVs and the capacity of batteries, such as the construction of new ultra-fast charging stations.

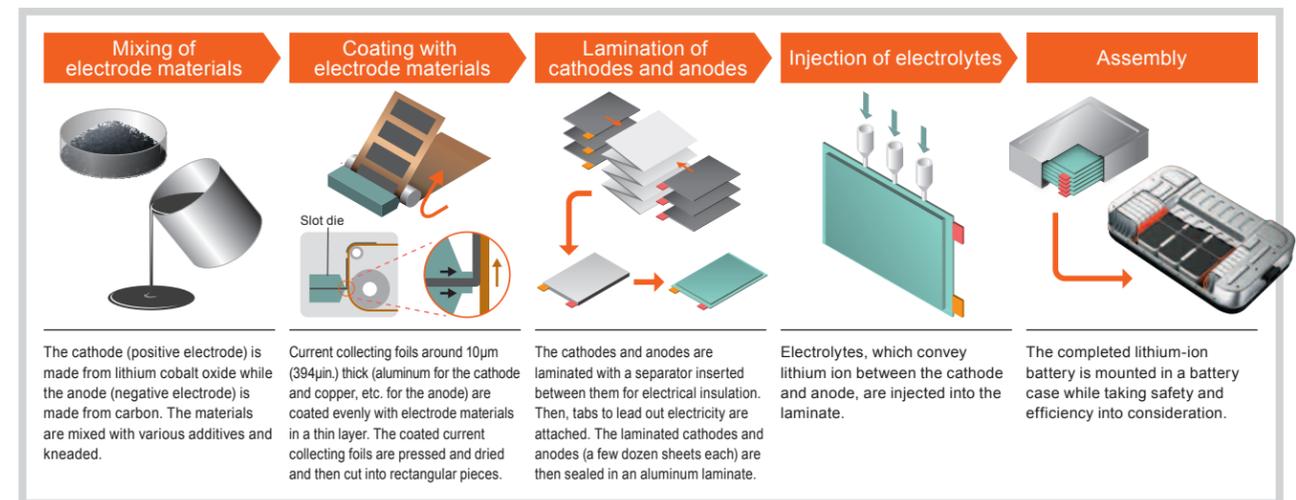
Lithium-ion battery production process

Among a wide range of manufacturing equipment related to automotive components, the demand for battery manufacturing machinery is anticipated to grow significantly in the future.

Structure of a lithium-ion battery (laminated type)



Lithium-ion battery (laminated type) production process



While lead storage batteries, nickel-hydrogen batteries, etc. are used in conventional automobiles, lithium-ion batteries (LiB) have been used by EVs in recent years. The dissemination of LiB is promoted with an increase in the capacity and decrease in the price and it is estimated that the demand for LiB in the automotive industry will be approximately doubled in the next five years. The reinforcement of the production line is in progress around the world.

The production of LiB is automated with various dedicated machines and the total length of the production line can be up to a few hundred meters (500ft. - 1000ft.). The production process broadly consists of the five steps of (1) mixing of electrode materials, (2) coating with electrode materials, (3) lamination of cathodes and anodes, (4) injection of electrolytes and (5) assembly, which takes place in this order. In the process, coating with electrode materials is especially important and has a decisive influence on the quality of LiB. Uniform coating with electrode materials is essential for the stable performance of the battery

and the precision of the coating tool called a slot die, which is included in the coater, is significant. Since the coating thickness needs to be adjusted at the micron (0.00004 in.) level, slot dies are produced with high precision using machine tools. While the production of LiB has increased in various parts of the world, efforts to commercialize the next-generation batteries are also in progress. Among them, the all-solid-state battery is extremely safe and can be charged in a short time, a fraction of the time for LiB. Its early commercialization is anticipated to substantially accelerate the dissemination of electric-powered cars.

While the automotive industry is thus entering a revolutionary period, production demands in the parts and industrial equipment industries, which support car production, have become more diversified than ever.

Mazak's machine tools that support the automotive industry

Piston Differential case Knuckle Brake disk CV joint

Exhaust manifold Crankshaft Transmission case Inverter case Motor housing

FF-5000/40 (Gantry robot, multiple machine integration)

IVS-300M

UN-600/30V
UN-600/30H

SQR-250M

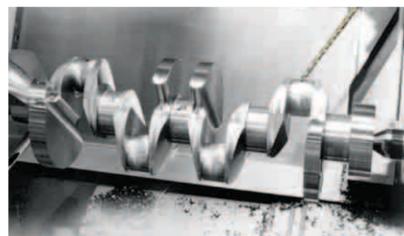
VARIAXIS i-700T

INTEGREX i-450H ST

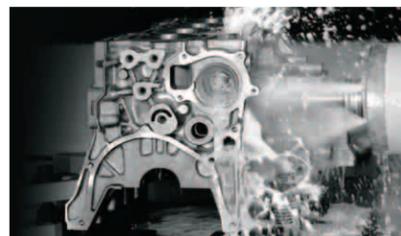
HCN-4000

MULTIPLEX W-200Y (Gantry robot system)

To maintain efficiency, reliability and safety, high precision is required in the machining of each automotive component. In addition, to respond to the ongoing diversification of production demands in the automotive industry, production systems with increased flexibility are required. Mazak contributes to the high-precision machining of automobile components and production equipment with an extensive product lineup together with automation systems by providing turnkey solutions covering the steps from project planning to the start of operation. Along with the proposal of machine tools, peripheral equipment and fixtures that meet production demands, we provide machining expertise accumulated over many years to help improve efficiency in customers' production facilities.



Crankshaft machining by INTEGREX



Cylinder block machining by FF



Brake disk machining by IVS

The automotive industry has also conducted research on machining with Additive Manufacturing (AM) and Friction Stir Welding (FSW) in recent years. Mazak has developed Hybrid multi-tasking machines that integrate metal-cutting machine tools with these machining technologies. We are making proposals incorporating them for meeting various machining demands in a more efficient manner in the automotive industry. For example, the VARIAXIS j-600/5X AM features AM to increase the efficiency of mold repairing while the VTC-530/20 FSW with FSW can be utilized to integrate processes such as machining cooling plates used in automotive inverter units.

Repair of tire molds by AM

WIRE ARC

VARIAXIS j-600/5X AM

Metal wire is melted by an arc discharge head and deposited on the base material by a NC program.

Welding of cooling panels by FSW

FRICITION STIR WELDING

VTC-530/20 FSW

The tip of the spinning tool is pressed on the material to generate frictional heat and stir to join the softened material.

Preparing for the mobility revolution



As represented by car sharing and ride sharing, the concept of cars is changing from ownership to sharing. Car manufacturers promote the examination of new business models to provide transportation services, in addition to their conventional business to supply cars. For example, they are actively developing ultra-compact cars for short-distance transportation, which will be basically used for sharing.

A new mobility society where people can move in a more comfortable and efficient manner is arriving. The keys to this realization are a further evolution of cars and innovation of their production technology. Mazak will continue to contribute to the development of the automotive industry through the supply of high-quality and high-efficiency machine tools.



01

Customer Report 01

Pursuit of "High Tech with a Heart"

Japan TACHI SEISAKUSHO MFG Co., Ltd.

"The first thing I did was to change the skylights because everyone wants to work in a bright place where it is comfortable." Ms. Machiko Tachi, the president of TACHI SEISAKUSHO MFG Co., Ltd., looked back at the job she did first after assuming the post. She proceeds with the beautification of the company. At the same time, the president actively promotes the introduction of cutting-edge machines and equipment. The beautification and the introduction of equipment have a common purpose of providing products of higher quality to customers. This idea is represented by the company's principle "High Tech with a Heart."



Aichi, Japan



02



03



04

- 01. Two VARIAXIS with MPP have been installed for high-mix, low-volume
- 02. The two systems with a total of 36 pallets have realized 24-hour full operation
- 03. Equipped with 240 tool magazines to meet the requirements of a large number of workpieces
- 04. Ms. Machiko Tachi, President (center, front row), Ms. Kiyoe Tachi, Executive Vice President (second from right), and employees

COMPANY PROFILE



TACHI SEISAKUSHO MFG Co., Ltd.

President : Machiko Tachi
 Head Office : 47-1 Nagahori, Nishitanaka, Kiyosu, Aichi
 Number of employees : 96

www.tachi-net.co.jp

TACHI

Customer Report 01

Japan TACHI SEISAKUSHO MFG Co., Ltd.

TACHI SHOKAI, the predecessor of TACHI SEISAKUSHO MFG, was founded in Nagoya in 1946. The company was incorporated in 1967 and the head office was relocated to Kiyosu, a suburb of Nagoya. Its two principal businesses are currently the manufacturing of parts and the unit assembly of industrial machines. In the part manufacturing business, the company has strong expertise in the machining of complex aluminum parts, which is highly regarded in the industrial machinery, elevator and automotive industries.



Voices of the employees are also reflected in capital investments in production site

employees are certified as skilled workers through a government program. All of these initiatives represent the policy of the company to value the power of human resources.

Aggressive investments in technologies as well as human resources

TACHI SEISAKUSHO MFG started to use Mazak machines in 1969. Now, a total of 14 Mazak machines are working actively to support the machining of complex parts, which is an area of specialty for the company. "We have complete confidence in not only the machines but also the prompt after-sales service," stated Ms. Tachi, in her comment about their relationship with Mazak. The technical strength of the company is underpinned by bold capital investments and effective use to accumulate expertise. Recently, TACHI SEISAKUSHO MFG introduced the VARIAXIS i series with MPP, a compact multi-pallet stoker system, to enhance its production capability two years in a row from 2017. Ms. Tachi herself saw the MPP at JIMTOF in 2016 and decided to purchase it on the spot. "I respect the opinions of the production staff when selecting a machine. I do not hesitate to purchase an option if necessary." She was able to make the decision instantly because she listens to the voices of employees every day.

MPP dramatically increased the machine utilization rate

Ms. Tachi decided to introduce the MPP

▶ Aluminum products machined with high precision to be used in industrial machines



because they had trouble meeting the demand for increases in production at that time. The objective of the introduction was to establish a completely unmanned operation for machining various types of workpieces. As intended initially, the MPP is fully operated every day to play an important role. The machine utilization rate dramatically rose after the introduction in 2017. A total of 50 kinds of workpieces are machined with the two units continuously around the clock 5 days a week. The operating time per unit reached up to 520 hours in a month and the working hours of the operators have decreased by 40%. The introduction of the MPP also had an effect on unit assembly, which is the other principal business of the company. With the improvement of efficiency in parts machining, the unit production volume has increased by more than 80%.



Machining of complex parts with multi-tasking machines is the strength of the company

TACHI SEISAKUSHO MFG is seeking to diversify its parts machining business for further growth. "We aim at the area of hard-to-cut materials. I hope that we can effectively add to the techniques we have accumulated through the machining of aluminum and stainless steel." Ms. Tachi talked about the future outlook of the company including its future plan of capital investments. The future of the "High Tech with a Heart" company is obviously very bright.



Customer Report 02

Business growth through satisfied customers and employees

🇯🇵 Japan Nakanotec Co., Ltd.

With the creed "We are valuable because we meet impossible demands of customers," Nakanotec Co., Ltd. ambitiously tries to meet requests for the machining of complex parts that other companies are reluctant to accept. The company, which is located in Amagasaki, Hyogo, takes an attitude to do the jobs that usually seem to be impossible, which has led to the establishment of strong relations of trust with customers. Nakanotec also actively promotes the improvement of the working environment in its plant to ensure that employees can work in an energetic and comfortable manner. Based on the technical abilities developed since the days of the former president, it takes measures to satisfy both customers and employees with an aim to further expand the business.



01. The competitiveness of the company is supported by the INTEGREGX j-200
 02. The Itami Plant has rows of Mazak machines - 18 in total
 03. Pump-related parts machined with high precision
 04. Mr. Takayuki Nakano, President (center, second row), and employees

COMPANY PROFILE



Nakanotec Co., Ltd.

President : Takayuki Nakano
 Head Office : 10-151 Minami-hatsushima-cho, Amagasaki, Hyogo
 Itami Plant : 9-83 Morimoto, Itami, Hyogo
 Number of employees : 20
 www.nakanotec.co.jp



Customer Report 02
 🇯🇵 Japan Nakanotec Co., Ltd.

Nakanotec was established in Osaka in 1974. Its Head Office Plant was relocated to Amagasaki in 2004 and a new plant was constructed in Itami, Hyogo in 2018. At present, the Head Office Plant engages in laser processing and the Itami Plant is in charge of machining. In the machining business, the company is strong in the machining of long shafts and complex parts and receives orders from the diesel engine, industrial measuring equipment, pump and various other sectors of industry. In particular, its achievements in the machining of pump-related parts are remarkable and the leading pump manufacturers place great confidence in the ability of the company to respond to almost impossible demands.

the higher efficiency of the plant. The operation status of each machine is visualized and constantly checked to establish a system to respond flexibly to urgent orders. Nakanotec also continues to make capital investments for the improvement of production efficiency. In line with this approach, the company has introduced a total of 18 Mazak machines.



The production control system is actively used to promote the efficient operation in Itami Plant

also be used for special machining such as machining of square parts from round material. The production lead time for machining of square parts for measuring equipment has been reduced by 25% in comparison with vertical machining centers."

The design also helps improve the working environment

Mr. Nakano also praises the unique design of Mazak machines. "Actually, I have been interested in their exterior design that is not shared by other companies since the introduction of the first machine. The unique color combination and design provide a sense of unity to the plant and also help improve the work environment, motivate employees and enhance our corporate brand. In addition, the design based on ergonomics, as well as the CNC system with a touch screen that is easy to operate, is accepted by young staff." In fact, many young employees at the Itami Plant handle these machine tools with a smile.

Mazak machines support the company's business model

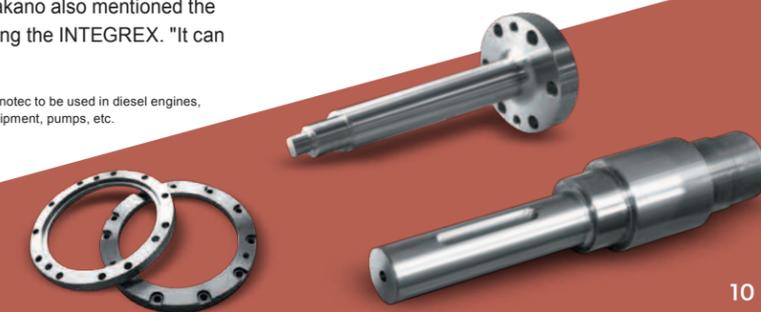
Nakanotec met Mazak machines for the first time in 1995. "While I was comparing products of several companies, I saw a Mazak CNC turning center smoothly handling deep hole drilling of 50 mm (2 in.) in diameter with a U drill and had a sense that it would be useful," said Mr. Nakano. Since then, the company has actively introduced CNC multi-tasking machines manufactured by Mazak. To integrate the processes for shaft work, a multi-tasking model was selected without hesitation. "I chose it to establish a system that can accept difficult jobs to machine long shafts that our competition would be reluctant to accept." Nakanotec introduced the INTEGREGX multi-tasking machine in 2003 for full-scale entry into the machining of complex parts. "It is more favorable than conventional machines in all aspects including set-up time and number of processes." Mr. Nakano also mentioned the effects of introducing the INTEGREGX. "It can



Complex parts are machined from copper and various other materials

Now that ideal plant have been set up, the next target for Mr. Nakano is to expand the shaft machining business. "The number of companies that can handle long shaft work has been decreasing in the industry recently. There are many opportunities in this area." In addition to the target of expanding the business, he mentioned that the establishment of a cleaner work environment for employees is another major target. By realizing satisfied customers and employees at the same time, the company will create a new image of "iron works."

▶ Parts machined by Nakanotec to be used in diesel engines, industrial measuring equipment, pumps, etc.



MAZAK PEOPLE

Mazak Corporation Marketing and Analytics Manager

 **Mr. Matthew Bain**

Creating 'actionable insights' through analytics

Yamazaki Mazak operates many bases in Japan and other countries for various functions such as production, sales and before and after-sales service and support. MAZAK PEOPLE introduces employees who are active at the forefront of group companies. This issue features Mr. Matthew Bain, who works in Sales and Marketing Department at Mazak Corporation (MC). He always keeps himself open to new ideas as a marketer.

PROFILE » Mr. Matthew Bain

Mr. Bain joined MC in 2006. He has been engaged in sales and marketing ever since he joined MC, taking advantage of his educational background in marketing. He was promoted to Marketing and Analytics Manager in 2018.

—What is your current job?

I am responsible for daily marketing activities. To create and execute our strategic marketing initiatives, with the direction set by the Mazak management team, I help develop and manage both print and digital advertisements, website contents, email campaigns, pre and post event promotional activities as well as analyze and report on latest market trends. I also oversee Mazak's CRM efforts.

—What data do you research for marketing and promotion activities?

Since machine tools are industrial products, it is essential to get a sense of the overall direction of economy. We track macroeconomic indicators such as Purchasing Manager's Index (PMI), Gross Domestic Product (GDP), currency exchange rates, domestic machine tools orders and other major industrial indicators. The US market is comprised of many geographic subsets. Understanding these sets and the differences between them is critical to success in the US market. We also closely monitor market share results using a machine tool order survey administered by the Association for Manufacturing Technology (AMT). This data is vital in assessing Mazak Corporation's performance in the highly competitive North American market.

—What do you value in analyzing data?

With the expansion of digital technologies, we can easily collect various data points. However, when data is not used properly and understood, it can result in "noise." You can be overrun with data and numbers if you don't have a sound strategy on the use of data. Therefore, we are always mindful of identifying which data is important and valued, and which metrics are adequate to eliminate the noise for analysis.

—Today, MC actively use Social Media.

In recent years, Social Media such as FaceBook, You Tube, Instagram and Twitter have become an essential part of our marketing strategy. Machine tool users also actively collect information on products and services through them. Social media is an excellent tool to disseminate information on products and events to a large audience. We can track



Data and analytics sharing is indispensable in strategic sales and marketing

effectiveness of marketing activities through comments and traffic on social media; for example, if we see a certain topic generate many views or "likes" when know that is a topic the general audience is interested in.

—What is the strength of MC in the US market?

I believe the breadth of our products and the longevity of our company are strengths. The geographic size of the US is huge and the number of different businesses is spread out. To meet various customer requirements, Yamazaki Mazak manufactures and sells a wide variety of machine tools.

We also have a distinct advantage in the longevity of the company. While Yamazaki Mazak Group is celebrating its 100th anniversary in business this year, MC also has been in business for more than 50 years in the US. Our history in itself is a strength and gives customers a sense of security and trust that we can and will support them into the future.

—What do you value in your job?

I really enjoy helping people first and foremost. I believe the purpose of marketing at a corporate level is to provide our sales team with a strategic advantage in their sales activities. On the data side, MC management relies on data and analysis we provide. I value being able to play a role in decisions our leadership makes.

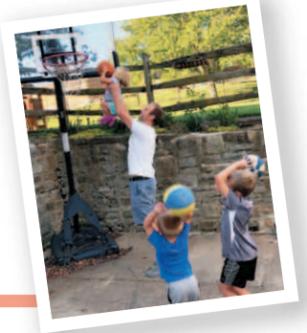
I also value the opportunity to learn and keep up with the latest advances in the market. The machine tool market is constantly changing, new technologies are always being developed. When these new technologies come to market, the way we position our products may be different than how we've done it in the past. In recent years, as social media springs up, the method of marketing is significantly changing.

My job is to stay ahead of the latest market in response to changing landscape. I am always looking to learn and grow with broad perspective in order to quickly respond to changing market conditions.

"I am proud to work for MC and fully appreciate working here." said Mr. Bain about his thoughts. His respect and attitude towards his job will not only lead to his own growth, but also help to grow the overall company.

How he spends his days off

My days off are centered around my family. I have 3 young children, 7 and 3 year old boys and 1 year old girl. I enjoy coaching my sons in basketball, soccer and golf and even play a little bit myself when I find the time. I always encourage my kids to be active and get outside to play. I also closely follow local sports teams including the Cincinnati Reds professional baseball team, the Cincinnati Bengals professional football team and especially the University of Kentucky Wildcats basketball team, where I attended undergraduate school.



News & Topics Introduction of new products

Laser processing machine that improves cutting productivity of small-diameter pipes "FT-150 FIBER"



High-speed laser processing machine exclusively for small-diameter pipes

FT-150 FIBER

We released a new laser processing machine, the FT-150 FIBER, which improves the productivity of cutting small-diameter pipes of 150 mm (5.9 in.) or less in diameter to be used as structural members for construction, furniture, vehicle frames, etc. The model was exhibited for the first time at Metal Forming-TOKYO 2019, which was held at the Tokyo Big Sight exhibition center, and attracted considerable attention.

Its newly developed bundle loader stores a large amount of pipe material and automatically loads them into the machine one by one to enable continuous operation over extended periods of time. Equipped with a high-precision laser head, the machine can cut large volumes of pipe material with unsurpassed productivity. A wide range of functions are optionally available, such as seam detection to automatically position a workpiece, an internal spatter guard to prevent adhesion of spatter to the opposite inner surface of pipes during laser cutting and thermal drilling to cut holes with frictional heat and cutting threads with a form tap. With these functions, the FT-150 FIBER will perform high quality laser pipe cutting with high productivity.

Workpiece diameter	(round pipe) $\Phi 20 \text{ mm} \sim \Phi 152.4 \text{ mm}$ ($\Phi 0.79" \sim \Phi 6.0"$) (square pipe) $20 \text{ mm} \times 20 \text{ mm} \sim 125 \text{ mm} \times 125 \text{ mm}$ ($0.79" \times 0.79" \sim 4.92" \times 4.92"$)
Max. loading material length	6,500 mm / 8,000 mm (255.91" / 314.96") Option
Max. unloading material	3,000 mm / 4,500 mm (118.11" / 177.17") Option
Resonator	3.0 kW



FT-150 FIBER was introduced at Metal Forming-TOKYO 2019

The Yamazaki Mazak Museum of Art was opened in April 2010 in Aoi Higashi-ku, the heart of Nagoya in order to contribute to the creation of a rich regional community through art appreciation and, consequently, to the beauty and culture of Japan and the world. The museum possesses and exhibits paintings showing the course of 300 years of French art spanning from the 18th to the 20th centuries collected by museum founder and first museum director Teruyuki Yamazaki (1928 - 2011), as well as Art Nouveau glasswork, furniture, and more. We look forward to seeing you at the museum.



Collection Showcase 1
THE YAMAZAKI MAZAK MUSEUM OF ART

MONET, Claude “The Port of Amsterdam”

Monet was born in Paris but his family moved to Le Havre, a port town in Normandy at the mouth of the Seine, and spent his youth in France’s greatest port. The young Monet took painting lessons from Eugene Boudin, a painter in Le Havre, on the shore of the English Channel. Due to this, views of rivers and the ocean were part of his primary experience. Since Monet was fond of landscapes containing water, he chose to live in natural settings near the Seine outside of Paris. He also traveled to seek landscapes he wanted to paint on the shores of Normandy or, later, the coast of the Mediterranean, as well as along the Seine. This work was done on a visit to the Netherlands. It was painted rapidly and demonstrates the Impressionist technique of capturing light by laying down different colors near each other on the canvas with separate brushstrokes. The dark reflections of the ships provide effective accents against the subtle play of color. This was done in 1874, the year of the First Impressionist Exhibition in Paris.



MONET, Claude [1840-1926]
“The Port of Amsterdam” 1874 Oil on canvas



Collection Showcase 2
THE YAMAZAKI MAZAK MUSEUM OF ART

**GALLÉ, Émile
“Etched cameo table lamp
with morning glory design”**

This electric table lamp with a morning glory motif is one of the largest pieces of glassware manufactured in the period around Gallé’s death. Transparent glass with blue mottling (salissure) is partially overlaid with yellow and pinkish orange glass. This is covered with another layer of transparent glass and a layer of blue, which is carved to create relief designs of morning glory flowers and vines. Both positive and negative relief carving are carried out in the leaves. An acid treatment creates a matte finish on the undecorated areas and the lamp shade. There is a scarab relief at the tip of the bronze fitting on which the shade rests. Because of the cost-effectiveness of acid etching, this technique was used to decorate most of the glassware produced in large numbers of Gallé’s late period and after his death. This piece is unusually large with a height of 924mm (36in). The complex forms of the twisting and clinging morning glory vines are etched with marvelous skill.

GALLÉ, Émile [1846-1904] “Etched cameo table lamp with morning glory design” c.1904