

# Current and Future Gearmaking Challenges in Workholding

## Quick-change capability and high clamping forces deliver both flexibility and strength

Frank Burke and Michael Larson

**The combination of world-wide pandemic and current and anticipated changes in technology have severely impacted both high-production gear manufacturers and shops producing limited runs of gears. Concerns include the availability of qualified personnel, proper allocation of capital investment, productivity requirements, and market demand.** While these are not unheard of under normal conditions, the present situation has caused a major disruption on virtually all fronts and, as a recent survey of the industry by *Gear Technology* magazine has shown, ([www.geartechnology.com/issues/0121x/Gear-Industry.pdf](http://www.geartechnology.com/issues/0121x/Gear-Industry.pdf)) many in the industry are deeply concerned about the future.

### The Future: Different but Better

Timothy Wachs, president of Hainbuch America Corp., sees a future that will be different but will offer multiple opportunities. “Hainbuch’s long history of involvement with gear manufacturing has given us a perspective that is realistic yet optimistic. Some of the changes that have taken place have been accelerated by the pandemic and will remain. For instance, the use of social media and remote conferencing has become much more commonplace, and many individuals not previously familiar with it now use it on a daily basis. As an international corporation, we can see that this familiarity will translate into a new type of marketing and an increased presence in the world-wide marketplace.

“Individuals involved in design and engineering, as well as management and staff functions, will be able to work remotely, and the ability to involve an overseas pool of talent will increasingly become a reality,” he added.

With regard to the factory floor,

Wachs sees the need for other equipment manufacturers to follow Hainbuch’s lead in the development of equipment that is extremely user-friendly. “One of the greatest challenges faced by industry today is the availability of machinists, operators, and other workers. There are any number of reasons for this, including competition from other industries and businesses and the shortage of technical training that has long been a problem in the American educational system. Although many schools have come around and are now emphasizing STEM (Science, Technology, Engineering, and Math) courses, the full impact of this will not be felt for a number of years. To solve this deficit, some amount of automation may be practical, but that is typically expensive, not just in terms of equipment but in the need for programming skills. The labor shortage is notably difficult because it comes at a time when

American manufacturing has moved from high-volume production to a low-volume, high-mix model.”

Hainbuch has developed a product line that can effectively use robots in changeover operations for different parts, according to Wachs. “More to the point, our equipment is designed to permit fast and accurate change that is easy to complete. The machine operator can be taught how to use our equipment in a matter of hours, and the repeatability can accommodate tolerances at the micron level. I like to say that we are helping to redefine the meaning of ‘skilled labor’ and that we are providing a means for less experienced individuals to start building a successful career in manufacturing,” he said.



MAXXOS Mandrel with hexagonal taper.



'Multi-purpose' mandrel for gear production.

### Technology Drives Product Changes

Wachs sees opportunities in gearmaking's changing product mix as well. "Any number of technological innovations are going to offer new opportunities. From an automotive standpoint, hybrid and electric vehicles (including both cars and trucks) will alter or eliminate the traditional drivetrain but will result in opportunities with the manufacture of smaller high-precision parts. A very big factor will be the advances taking place in drone technology that range from defense applications to package delivery and vehicles capable of vertical takeoff and landing. All of these will require a new generation of gears. At the same time, there will be no shortage of more traditional gear designs," Wachs said.

As the need for new technology increases, a primary concern of manufacturers in every industry is the allocation of capital expenditures. Following the general slowdown caused by the pandemic, as well as gaps in the supply chain, many are planning new investment strategies.

"We have found that a significant number of Hainbuch customers, including those involved with gear manufacturing, have employed two different but effective means of conserving capital. On the one hand, by equipping older legacy machines with Hainbuch precision workholding systems, they have been able to achieve results comparable to what a new machine could deliver at a fraction of the cost. In fact, I recently

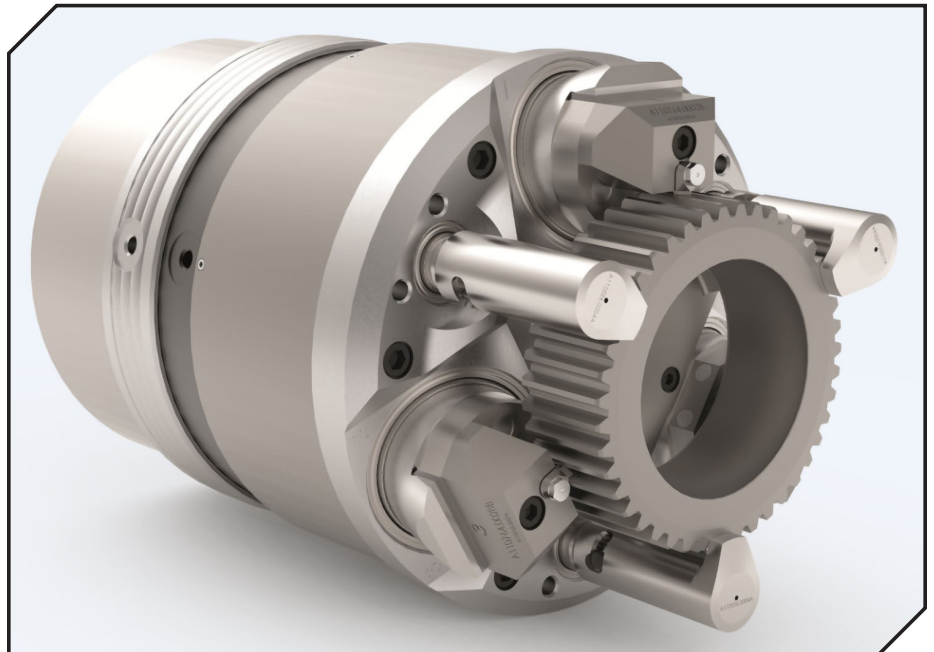
visited a plant that had equipped a number of 70-year-old lathes with Hainbuch systems and were cutting gears to desired tolerances. Admittedly, this is the exception, but it's a vivid demonstration of what precision workholding can do. Other customers have purchased less expensive machines and equipped them with our systems so that they perform to the standards of much more costly units," Wachs said.

"It is pleasantly ironic that the primary factors in gear cutting are rigidity and clearance, typically difficult to achieve. We have been able to deliver those

results in a system that is easy to use, reduces setup time, and offers unlimited flexibility," he added.

### LEGO-Based Innovation

Dean Winkel, Hainbuch manufacturing representative serving eastern Canada, cites specific Hainbuch product advantages. "Although we regularly work with customers in developing special products for unique applications, one of our main objectives is the development of standard products that can be used in most situations. A primary example of this is our G211 mandrel, which we refer to as the 'multi-purpose mandrel.' The original design is very short and rounded out with a wide base, but it is also available in a longer and thinner version. On a hobbing machine, it is extremely versatile and can be used for multiple sized gears by simply changing the clamping bushings or substituting regular bushings with a set specially



One of a kind, specially designed and manufactured for a customer in the aerospace industry, this gear chuck positions the part in microns. Changeover from one diameter to the other is accomplished with less than 3 microns variance.

ground to specific diameters.”

The mandrel itself alternates sturdy metal construction with specially formulated vulcanized material and provides high clamping torque without marring the part. The vulcanized bushings also give a great amount of stroke and feature more room for easy loading. It is far superior to traditional mandrels that are, in effect, slotted cylinders placed on a shaft and subject to breakage. G211 vulcanized strips are not brittle and, therefore, avoid breakage.

Winkel said that Hainbuch offers special sizes for smaller bore gears including the T213, which extends from  $\frac{5}{8}$  to  $\frac{3}{4}$  inch, and the Micro Mandrel for bores as small as 8 mm.

“Hainbuch’s large diameter collet chucks deliver accuracy and stability in the production of ring gears. They’re available in a wide range of sizes and are easily and quickly changed with minimal setup time,” Winkel said.

“We term our approach ‘LEGO based innovation’ in that our family of products is designed to be truly modular and

capable of multiple applications. Our customers frequently contact us to tell us how they’ve adaptable our standard products to special situations to derive greater flexibility at less cost,” Winkel added.

Peter Mueller, director of strategic sales for Hainbuch, works out of the corporate headquarters in Marbach, Germany, where he has access to the engineering and R&D departments. He notes the evolution of demand in the gear manufacturing industry. “In the past, the majority of our sales were to customers in the automotive sector. Today, the largest growth comes from aerospace and defense.”

Thanks to Hainbuch’s innovative design, customers have the ability to machine a larger range of gear sizes on the same mandrel. “The vulcanization process is really the ‘heart of Hainbuch,’” said Mueller. “In developing material, we’ve tested it for resistance to oils, heat, and virtually any other hostile condition that could possibly affect the mandrel.”

One of Hainbuch’s latest innovations is

the MAXXOS mandrel, which was introduced in 2019.

“The MAXXOS uses a unique hexagonal design for strong clamping power in the 18 mm to 100 mm range. The run-out accuracy extends from 0.01 mm/0.007 mm possible to an accuracy of  $\leq 0.002$  mm by special order. The hexagonal pyramid shape allows maximum machining capacity with less vibration and thereby less tool wear. And, like all Hainbuch products, setup time is fast and easy,” Mueller said.

### The Evolution Continues

“As customer demands change, it’s our goal to provide them with high precision and maximum flexibility in an efficient and affordable package. As the gearmaking industry emerges from a very difficult time, Hainbuch continues to provide technology and the support necessary to move toward a brighter future,” Wachs said. ⚙️

[www.hainbuchamerica.com](http://www.hainbuchamerica.com)

## MAXXOS Line Resists Extreme Cutting Forces

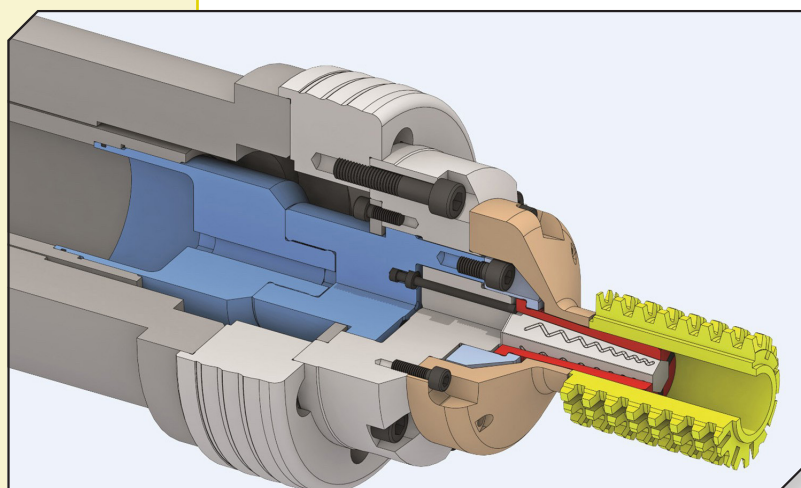
For ID workholding, Hainbuch’s Mando product line is well-known for its rigidity, parallel expansion clamping, and its unrivaled clamping forces. However, in exceptional cases when a clamping length is minimal, or extreme torque is generated by cutting forces, special design features are required.

In this case, a customer needed an internal clamping chuck that would maintain its functional integrity under severe cutting forces.

By integrating a hexagonal cross-section to the Mando’s clamping cone, the bushing is unable to begin slipping on the Mando column—where slippage first appears. To generate more radial clamping force, a shallower clamping angle was also incorporated. Although this slightly lessens the radial stroke, it greatly enhances the force generated to the workpiece.

The MAXXOS line, of which this is an example, was added to Hainbuch’s Mando family for more demanding machining forces. Where necessary, the Hainbuch design team can add additional features to accomplish virtually any ID workholding challenge. Learn more here: ⚙️

[www.hainbuch.com/en/products/mandrels/mandrel-maxxos/](http://www.hainbuch.com/en/products/mandrels/mandrel-maxxos/)



For Related Articles Search

workholding

at [www.geartechnology.com](http://www.geartechnology.com)