№ 02 2023

world of tools
LOTHAR HORN

DEAR
LADIES AND GENTLEMEN,

It is with deep sadness that we bid farewell to our Managing Director Lothar Horn, who passed away in February. We dedicate this issue of the world of tools to him. As the second generation, he had a decisive influence on the HORN Group. "Standing still is not an option" was his motto. In this spirit, we look forward with gratitude and continue to lead the company with the same values and new approaches.

Through the cooperation between HORN and INDEX, we demonstrate combined expertise in selected processes. With INDEX as a technology partner, we have already been able to implement several processes and thus provide new approaches and solutions for our mutual customers. The focus is on a holistic approach. Precision tools, workholding devices, machines and controls must interact seamlessly in order to generate added value.

EMO Hannover 2023 is one of the trade fair highlights of the year for us. We will show processes, solutions, innovations and live machining on our 580 m² stand. We look forward to speaking with you, our customers and interested parties. Visit us from 18th to 23rd September in Hall 5, Stand A54. Furthermore, in this issue of our world of tools we cover the topic of reaming. In addition to the process, we present a practical production example from the field of vehicle manufacture.

Together with you we look to the future and are pleased to provide you with some insights on the following pages that we hope will be helpful.

Markus Horn and Matthias Rommel, Managing Directors, Paul Horn GmbH

world of tools

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ENTREPRENEURIAL PERSONALITY LOTHAR HORN HAS DIED

The entrepreneur Lothar Horn died on 5th February 2023 at the age of 66 after a long, serious illness. Lothar Horn was the managing director of Paul Horn GmbH in Tübingen. He shaped the HORN Group into an internationally successful manufacturer of precision tools with production sites in England, Italy, the Czech Republic and the USA. There are additional subsidiaries in France, Hungary, China, Mexico, Turkey and Thailand. Today, the company is the largest industrial employer in Tübingen. As Chairman of the VDMA Precision Tools Association, Lothar HORN was the mouthpiece of his industry from 2009 to 2019. Lothar Horn is regarded by many in the sector as a pioneer and visionary. His son Markus Horn, became Managing Director of Paul Horn GmbH in 2018. Markus, third generation, continues to manage the company together with Matthias Rommel, also Managing Director.

Lothar Horn, a technology enthusiast and business economist, joined his parents' company in 1991. Before that, he gained experience in the IT industry and in management consultancies. He became Managing Director on 1st January 1995. In 1999, Lothar Horn created new production and administration facilities as well as a demonstration, research and development centre at the Tübingen headquarters. The new building combined all business processes in one location for the first time, including a coating centre.

In order to further expand its leading position in the world market, another factory was constructed next to the Tübingen headquarters, doubling the production area. Since its completion in 2016, it has been the largest industrial building in use in Tübingen.

Trust in technology and people

"Technology determines costs. This sentence epitomises Lothar Horn's pioneering determination to be successful selling high-precision tools into world markets. The expansion of the production and administration buildings also involved the reorganisation of processes. In addition to production and administration, staff education and customer training took on increasing importance and resource at Paul Horn GmbH under Lothar Horn's direction. The HORN Academy is an investment in people and employees. In addition to training internal and external people, it also offers apprenticeships, dual study programmes, retraining and further education. The facility cooperates with the Chamber of Industry and Commerce and the Baden-Württemberg Cooperative State University (DHBW).

LOTHAR HORN IS REGARDED BY MANY IN HIS INDUSTRY AS A PIONEER AND VISIONARY.

It all depends on having the right people in the company, was Lothar Horn's conviction. He encouraged freedom, trust and a culture that allows mistakes as well as the opportunity to learn from them. People were just as important to Lothar Horn as technology or modern processes. "His appreciation was directed to our customers as well as our employees," says his successor Markus Horn, referring to his father.

Lothar Horn, former Managing Director of Paul Horn GmbH in Tübingen, b.9th December 1956 d.5th February 2023.

"No car drives, no plane flies (...) without precision tools being used."
For ten years, in addition to carrying out his entrepreneurial activities, Lothar Horn was chairman of the Precision Tools Association of the German Engineering Federation (VDMA). In 2019, his role as official representative of the trade organisation came to an end. "No car drives, no plane flies and no artificial joint can be inserted by doctors without precision tools being used," was one of Lothar Horn's central statements. Paul Horn GmbH is an important and visible player in the industry: Hall 10 at the Stuttgart Trade Fair Centre bears its name.

A jury of experts awarded Lothar Horn the Tool and Mould Making Medal of Honour at the Moulding Expo trade fair in Stuttgart in 2021. It honours personalities who, as pioneers and visionaries, have set groundbreaking benchmarks and are role models. The jury said of Lothar Horn: "Even though he directs and manages a really big company in the industry, he has remained true to himself over all these years, close and approachable to everyone. A human being."

Committed to the people of Tübingen
The internationally active company leader Lothar Horn remained loyal to the city of Tübingen. The HORN Group offers jobs and apprenticeships to 950 employees at the headquarters, and 1,500 worldwide, making HORN the largest industrial employer in Tübingen. Lothar Horn was also loyal to the people of the city. Paul Horn GmbH supports social institutions as well as the young people and youth development work of sports clubs, for example. A visible sign of this is the Paul Horn Arena for competitive, amateur and school sports in Tübingen.

Markus Horn together with Matthias Rommel continue to lead the company into the future – with the same values and new approaches.

HORN's headquarters in Tübingen.

ABOUT US

HORN TECHNOLOGY DAYS 2023

For the eighth time, Paul Horn GmbH in Tübingen opened its doors to over 3,000 visitors from 37 countries from 14th to 16th June 2023.

The focus of the event was on processes that result from the optimal interaction of tool, workholding and machine. "Only those who have mastered the machining process can achieve the optimum results with the tool used," says Markus Horn, Managing Director of Paul Horn GmbH.

HORN OPENED ITS DOORS IN TÜBINGEN FOR THE EIGHTH TIME.

With informative and exciting technical presentations on eight different topics, live machining demonstrations, industry-specific exhibition areas and extensive freedom of movement around production areas, visitors had the opportunity to experience HORN with all their senses. 35 co-exhibiting companies rounded off the programme. Exhibits such as several sports cars, a Radical custom bike (motorbike), the Prometheus combustion chamber for an Ariane 6 engine, medical products and watches and jewellery collections left lasting impressions on the visitors and illustrated the diverse areas of application of HORN precision tools.

The special event on the ZykloMed joint project funded by the Federal Ministry of Education and Research (BMBF) was another highlight of the event. The project deals with the production of functionally integrated implants through novel synchronised-cyclical machining processes. The participating partners INDEX, Paul Horn GmbH, Beutter Präzisions-Komponenten GmbH and the wbk Institute for Production Engineering at the Karlsruhe Institute of Technology (KIT) demonstrated their know-how in medical technology by machining a bone pin and a bone screw.

In addition to HORN's two manufacturing plants, which mainly involve insert and holder production, visitors to Horn Hartstoffe GmbH were given an insight into the production of carbide and various shaping processes on state-of-the-art equipment. The precision tool manufacturer is also expanding its capacity in the area of additive manufacturing. The next HORN Technology Days will take place in 2025.

Face-to-face conversation is an essential part of the HORN Technology Days.

Theme-specific exhibition areas rounded off the programme of the HORN Technology Days 2023. The Aerospace area is pictured here.

HORN Family Day 2023

Following the Technology Days, the HORN Family Day took place on Saturday, 17th June 2023 in bright sunshine. From 10:00 am to 4.00 pm, there were numerous attractions and treats for young and old around Plant 2 and in the catering tent.

The employees and their families were able to move freely through Plants 1 and 2 to gain an insight into the daily work and to visit Horn Hartstoffe GmbH on guided tours.

The HORN Family Day has been held every two years since 2011. This event reflects values such as employee loyalty and appreciation, which characterise HORN as a family business. "The people in the company are our foundation," says Markus Horn, Managing Director of Paul Horn GmbH.

PROCESSES

MASTERING PROCESSES WITH HORN AND INDEX

Polygon turning

HORN and INDEX demonstrate their joint technology and solution competence. The focus is on five selected processes: High-speed whirling, skiving, spiral bevel gear cutting, grooving and polygon turning. Nowadays, modern INDEX turning/milling centres, in combination with the correct cycle and the right precision tool, offer improved and new possibilities or approaches to optimally complete virtually any machining task.

POLYGON TURNING

In polygon turning, the challenge is synchronisation of the lathe axes. Synchronisation is playing an increasingly important role in machining. Modern turning machine concepts from INDEX enable such complex processes. Using axial feed, HORN tools offer the possibility of producing non-round contours on lathes. This process facilitates the production of polygonal shapes, for example. The axes of the workpiece and tool are offset from each other and maintained at a specific speed ratio. The process and associated tools are suitable for both external and internal machining. The axis offset, the speed ratio of the workpiece to the tool and the diameter of the cutter define the dimensions of the contour. A tool system for polygon turning is individually adapted to the workpiece contour to be produced.

SKIVING

Modern turning/milling centres and multi-spindle automatic lathes from INDEX with coupled and synchronised spindles and process-optimised software enable gear skiving. The associated HORN system includes tools for the highly productive production of internal gears, splines and other internal profiles as well as external gears with interfering edges. The main advantages of skiving in these applications are significantly shorter process times compared to gear broaching, the ability to use optimised turning/milling centres, turning and gear cutting in one clamping and the elimination of undercuts at the end of the gear teeth. In addition, skiving offers more productive and cost-effective production compared to gear shaping and broaching and a cycle time that is four to five times shorter compared to slotting. It also allows the possibility of hard machining of solid gear blanks. The skiving tools are designed for machining medium to large batches. Each tool is individually adapted to the application and the material to be machined, with the different tool interfaces being based on the number of teeth and the module. For the production of defined chamfers for deburring the gears, the technology is available together with the associated production process. The prerequisite for this manufacturing process is a turning/milling centre with coupled axes.

BEVEL GEAR CUTTING

In cooperation with INDEX, HORN offers a solution for milling spiral bevel gears. Thanks to the use of special milling tools and the appropriate machining cycle, even small series can be milled economically. With the new tool system for milling bevel gears, complete machining on turning/milling centres is possible. The user no longer needs special machines to manufacture these gears, as INDEX has developed a bespoke cycle for this type of machining. It allows all functional surfaces to be produced together with the gear teeth in one clamping, enabling high component precision, short throughput times, high process efficiency and fast machining times due to controlled machine cycles. By using a turning/milling centre from INDEX, components with spiral bevel gears can be produced efficiently in small quantities as well as in large batch sizes. This makes the process attractive for medium-sized and small companies that previously bought in gears or had them manufactured externally.

HIGH-SPEED WHIRLING

INDEX and HORN are showing another new process, namely high-speed (HS) whirling. It offers a substantial increase in productivity through turning and whirling in one set-up. In this process, the speed is so high that a turning process can take place simultaneously with whirling if required. The turning tool positioned in front of the whirling tool reduces the volume of material that

Skiving

Bevel gear cutting

High-speed whirling

would otherwise have to be removed by the whirling tool. This enables longer tool life and leads to higher surface quality. The whirling heads used are similar to conventional varieties. Only the inserts differ in geometry. The production of single- and multi-start threads is possible with only one set of inserts. Thread whirling is mostly used in the production of bone screws and worm gears. The whirling head rotates at high speed over the workpiece, which also rotates quickly. The whirling head is set at a special approach angle. Due to the axial feed, the whirling tool cuts the thread. As the demands on the quality of the threads are high, special attention is paid to the precision and surface quality of the whirling tools.

GROOVING

Basically, the grooving process involves a narrow insert that penetrates the workpiece in a radial or axial direction. The art of grooving is, among other things, controlling the chip flow. Ribbon swarf, chip jams or long, stringy swarf must be avoided, as they have a negative impact on process reliability and can lead to tool breakage and marking of shoulders. Depending on the material to be machined and the type of process, HORN has developed different chip breaker geometries that ensure reliable chip control and chip breakage. Another important point for an economical grooving process is sufficient coolant supply. Where in the past cooling was carried out externally using classic flood coolant, today modern tool carriers mostly have an internal coolant supply. This ensures effective cooling of the shear zone between the tool cutting edge and the workpiece. HORN and INDEX offer an ideal technology platform through the combination of precision tool and machine.

Grooving

PROCESSES

PROCESS RELIABILITY AND ECONOMY

"By switching to gear skiving and investing in a turning/milling centre from INDEX, we have achieved maximum process reliability," says Erwin Wagner. Wagner is responsible for tool scheduling at SAM GmbH in Bad Tölz. The company is considered a specialist in the development and production of high-quality components for aircraft construction. For almost 40 years, SAM has relied on precision tools from Paul Horn GmbH for machining challenging components. In addition to tool solutions for groove turning, internal turning and gear broaching, the gear skiving process has now also found its way into production at the Bavarian factory.

SAM is recognised in the aerospace industry as a specialist in the development and production of actuators, as well as other components. The actuators control valves used for temperature regulation and in oxygen, air, fuel and water systems. SAM manufactures single- and double-acting as well as modulating actuators. The dual motorised actuators are used, for example, to shut off fuel flow valves where maximum fail-safety is required. A central component of each actuator is a bronze alloy gear measuring around 60 mm (2.362") in diameter.

"We mainly outsourced production of the gear," says Wagner. The demand for the delicate components is over 20,000 pieces per year. "In order to achieve greater flexibility and independence of supply chains, we decided to implement the production of the gears in-house," explains Herbert Krischkowski, the person responsible for special projects at SAM. To produce the external gear with a module of 0.5, the only process available with our existing machinery was gear broaching with a shaping unit. "For our large quantities, this process would not have been as expedient

The gear assumes a central role as a sun gear that meshes with the planetary gears in the actuator.

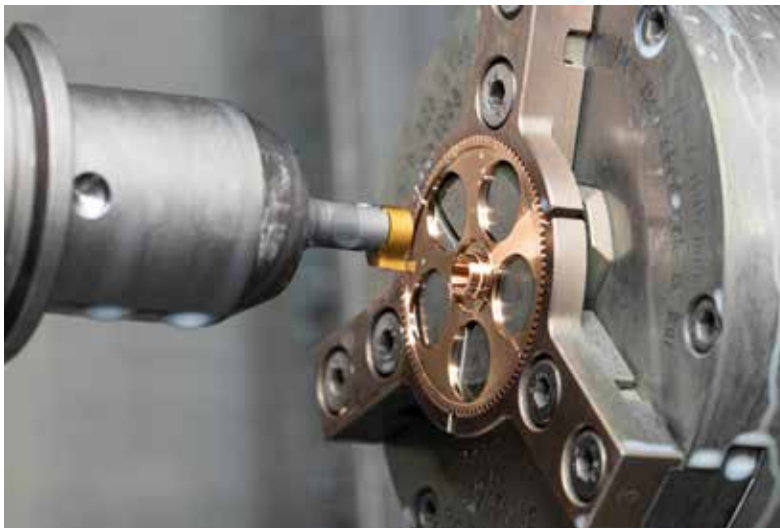
Gear skiving provides a high degree of process reliability, short machining cycles and high quality gear teeth.

as external production. On one hand, the production time would have been too long and on the other, the maintenance costs of a shaping unit would have driven up the cost of the components even further," explains Krischkowski. Wagner adds: "The pusher units have to be serviced at least every six months during continuous operation. Here you are in the mid four-figure region in terms of cost."

Investment in new turning/milling centre

SAM is always receptive to new and more economical technologies. To this end, the decision was made to invest in a new turning/milling centre to produce the gear teeth using the gear skiving process. "We did not have a lathe with a milling spindle in our factory," says Wagner. In the search for a suitable machine, two candidates were quickly shortlisted. "We decided to choose the INDEX G220. The flexibility of the turning-milling centre, the advice and the service from INDEX completely convinced us," says Krischkowski. The Bavarians bought the skiving cycle and the skiving tool with the machine. The tool design was carried out by HORN's original equipment department and Michael Götze, the sales representative responsible for SAM.

The decision to invest in a new machine with HORN skiving tools quickly turned out to be the right one. "We now save several euros per component by producing them in-house," says Krischkowski. The skiving tool is not of monobloc design, but a replaceable head system with a high-precision interface. In the process, the gear teeth are produced with four tool strokes. These are divided into three roughing strokes and one finishing stroke with a reduced feed rate. The cycle time for gear skiving is around 20 seconds. In addition to the short production time, those responsible were particularly impressed by the quality of the gear teeth. "We had our measurement results validated by an external service provider. He was amazed at the precision and said that he normally produces his master gauges to that level of quality," Wagner explains, jokingly.



Turning an axial groove with the Mini system.

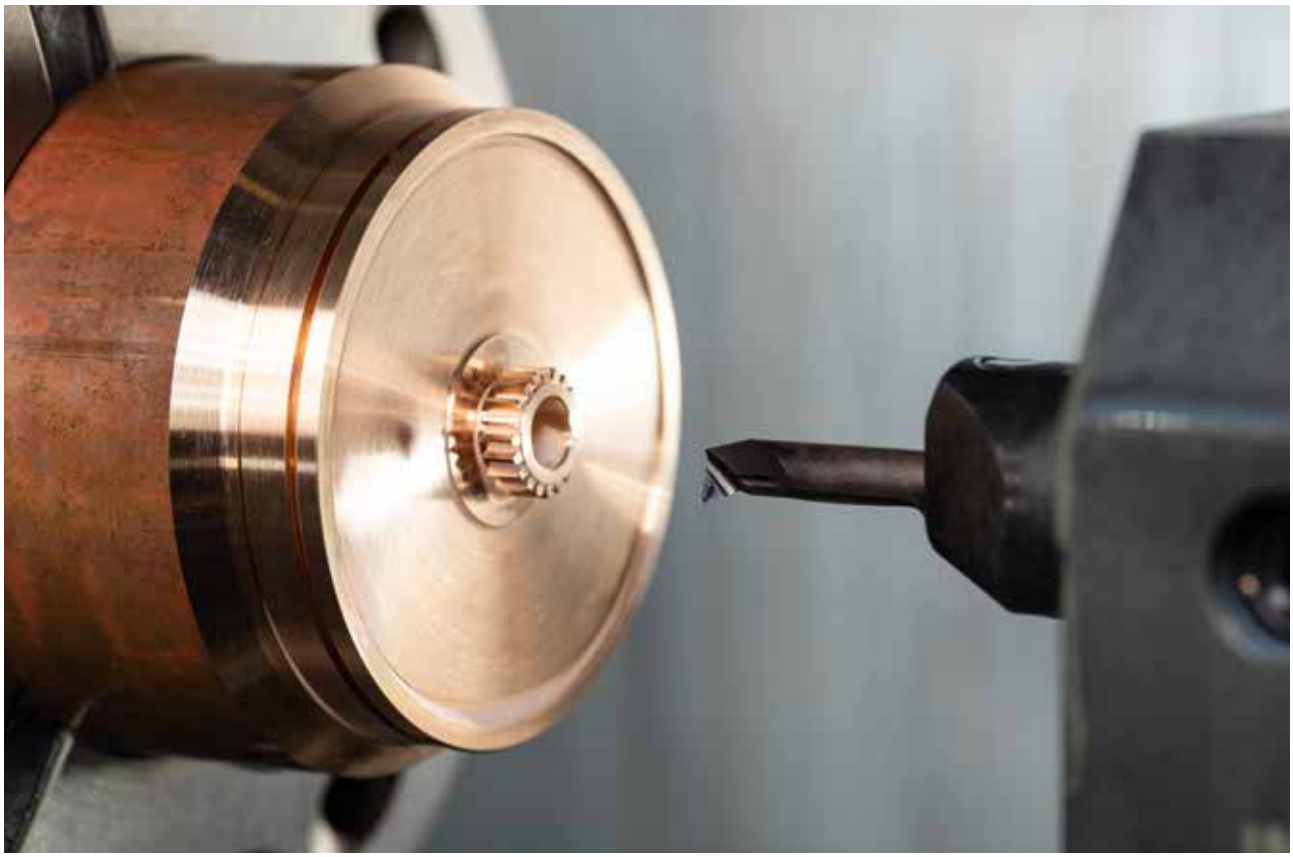
A CENTRAL COMPONENT IS A BRONZE GEAR.

The HORN gear skiving system includes tools of cylindrical or conical shape for modules from 0.5 to 2. The solid carbide monobloc variant is available with a diameter of up to 20 mm (0.787") and in a slim design. They are used for small modules and small components, preferably when a slim shaft is required due to the risk of collision. The grades and coatings matched to the application produce high surface quality on the workpiece. For tool diameters over 20 mm (0.787"), skiving tools with an interchangeable head system are used. The precise interface allows the cutting head to be easily changed in the machine without removing the holder. The carbide holder ensures high rigidity, wear resistance and precision. For larger modules, HORN relies on the use of a tool holder with indexable inserts. Especially with the WSR tool type, HORN offers the option of placing the internal coolant supply in front of or behind the insert. This means that, depending on the application, blind holes, through holes or stepped holes can be machined with appropriate cooling.

Other HORN systems in use

Other HORN systems are used for the bronze gear. For example, an insert of type S117 takes over the broaching of external teeth on the face of the component. "Here, the use of gear skiving was not possible because the required clearance at the end of the teeth was absent. So we chose the gear broaching process using a special tool" explains HORN field representative Michael Götze. In the process, the tip diameter and the undercut at the end of the gear are pre-turned. The undercut provides clearance for the broaching tool. The broaching insert is precision-ground to a special shape and has two teeth. The first tooth serves as a pre-cutter and the profile of the second tooth is the same as the nominal profile of the required gear. In use, the tool broaches one finished tooth at a time in axial movements with an infeed of 0.1 mm (0.004") per stroke. Then the main spindle indexes by

OTHER HORN SYSTEMS ARE ALSO USED IN THE PRODUCTION OF THE BRONZE GEAR.



Boring the inside of the central hole with a HORN Supermini.

A successful cooperation: Michael Götze talking to Herbert Krischkowski, the setter Andreas Neumann, and Erwin Wagner in front of the new INDEX G220.

one tooth and the broaching process starts again until all the gear teeth are machined. The time to produce the gear teeth is about one minute.

SAM also relies on the HORN tool portfolio for complex turning operations. Two different Mini tools are used in producing the gear. The first tool, with a cutting width of one millimetre (0.039"), turns the undercut on the small gear teeth. The second Mini turns an axial groove on the back of the component. "A special feature of the groove is the tight tolerance fit across only two millimetres (0.079"). The tool has to provide high precision and process reliability," says Wagner. A Supermini tool is used for boring the inside of the central hole.

SAM ALSO RELIES ON THE HORN TOOL PORTFOLIO FOR COMPLEX TURNING OPERATIONS.

Engineers at SAM have been taking advantage of tool solutions from HORN for around 40 years. "The project using our new turning/milling centre was a complete success. The joint implementation by INDEX and HORN convinced us. The tool solutions from HORN and the service that is always provided have shown us again why we have been relying on tools from Tübingen for decades," says Wagner.

SAM GmbH

The company was founded in 1974 as Sitec-Präzisionstechnik GmbH by Franz Sichart. It became part of the Westland Helicopters Group in mid-1978 and was acquired by Singapore Aerospace Manufacturing (SAM) in 2001. Having grown steadily over the course of more than 40 years, the company has always offered its business partners around the world a high level of stability, quality and flexibility. The product range includes not only actuators and valves, but also complete assemblies for hydraulic applications and flight controls for various types of aircraft.

PROCESSES

HIGH SPEED PRODUCTION OF A PRECISE BONE SCREW

Sports injuries, car accidents or mishaps at home – bone fractures can occur suddenly and unexpectedly. Not infrequently, they are so severe that surgery on the fracture is unavoidable. Depending on the injury, the treating surgeon decides between wires, screwed plates or long bone screws to fix the fracture. Few patients know that bone screws in particular are high-tech medical products. The company hg medical from Raisting in Upper Bavaria is considered one of the leading subcontract manufacturers of these special screws. To produce them, hg medical relies on Swiss-type lathes from Traub and whirling tools from Paul Horn GmbH. In addition to conventional whirling, hg medical uses the high-speed whirling process.

Skull, spine or femur. There is an enormous variety of different screw types for fixing bone fragments. Not all bones are the same. The surgeon selects the appropriate screw depending on the nature of the bone, such as hardness, porosity or bone marrow. In addition to self-locking screws with tapered threads or variable pitches, screws with a through hole are also used, through which bone cement can be injected for stabilisation.

Conventional whirling

"The problem with the conventional whirling process is that the whirling and pre-turning of the diameter must always be done in individual steps. The inserts in the whirling head are not designed to cut the sometimes larger outer diameters of the raw material," says Sebastian Schmid, process developer at hg medical. As a result, the whirling attachment has to be repositioned several times in the threads, depending on the length of the bone screw. This results in so-called entry marks on the surface. Although these are biologically harmless, they could result in a weakness, leading to breakage at that point of the screw if too much stress is placed on it. Furthermore, a flawless surface is desirable as a quality feature of every implant.

Continuous cut

A significant step in the further development of the whirling process is high-speed whirling. The advance was developed through a cooperation between the machine manufacturer INDEX/Traub, hg medical,

THERE IS AN ENORMOUS VARIETY OF DIFFERENT SCREW VARIANTS FOR FIXING BONE FRAGMENTS.

HORN and a university. In this process, the speed is so high that turning can take place at the same time as whirling. The turning tool positioned in front of the whirling tool reduces the volume of material that would otherwise have to be removed by the whirling tool. The whirling heads used are similar to conventional types: Only the inserts differ in their geometry. The production of single- and multi-start threads is possible with only one set of inserts. The advantage over conventional whirling is, on one hand, a cycle time reduction of up to 30 per cent and, on the other, higher quality of the workpiece. "The time advantage always depends on the application and geometry of

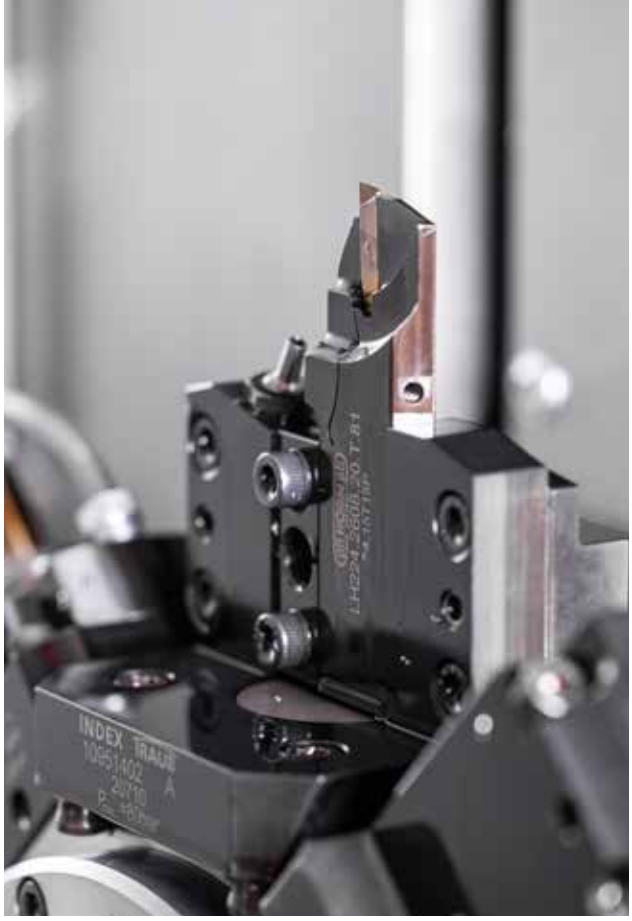
The carbide grade IG35 is used for machining titanium alloys.

High-speed whirling enables continuous cutting through concurrent turning.

the screw. We see a great benefit in the elimination of entry marks, since with high-speed whirling the inserts are in a continuous cut," explains Schmid.

Theoretically, high-speed whirling also has the advantage of increasing the service life of the inserts. This is due to the lower volume of material to be removed by whirling, due to the previous turning operation. "This would be an advantage, for example, when whirling short-chipping materials. However, we process almost 100 per cent long-chipping titanium alloys. When whirling titanium at high speed, the whirling head serves as a chip breaker for the long swarf generated by the simultaneous turning operation," explains Schmid. It diminishes the advantage of the longer tool life in this case. On average, tool life is similar to that achieved with conventional whirling. "We turn or change the inserts in the whirling head in a specific order. The quality of the bone screws is always higher than the maximum service life that has been specified," says Schmid.

The kinematics of the Swiss-type turning machine allow effective and simultaneous machining with two, three or four tools.



hg medical also relies on tool systems from HORN for grooving.

High manufacturing precision

Bone screws are subject to strict criteria for manufacturing quality. "The production tolerances, especially for the diameter of the thread, are very tight depending on the screw," says Schmid. Furthermore, a complete absence of burrs must be guaranteed during production. Any burr, no matter how small, poses a potential danger for causing a failure in service. "To achieve the required high quality and specification, the whirling tools and inserts must be manufactured very precisely. A major focus is on axial and radial run-out. The level of accuracy is crucial, especially in the transition between two different threads, or when restarting", explains HORN field service representative, Stefan Benz. HORN grinds the inserts to length tolerances of less than 0.002 mm (0.079 mil). In addition, the insert seats in the whirling head are manufactured with high precision. Another quality feature is the profile of the ground inserts. Defined inner radii of r = 0.025 mm (0.984 mil) with tolerances of +/- 0.005 mm (0.197 mil) are not uncommon in precision grinding of the indexable inserts. For the inserts, HORN whirling tools mainly use the three-edged indexable type S302 variety or the two-edged type S274 insert. All whirling tools are special designs to suit customer requirements.

hg medical

hg medical is a leading contract manufacturer of orthopaedic implants for the lower and upper extremities and the spine. The company's customers develop products that improve the quality of life for many patients around the world. With its technical know-how, the company implements the requirements of its customers.

HORN tool systems have been performing reliably in hg medical's factory for around ten years. In addition to thread whirling tools, the company also relies on grooving and boring systems from HORN: "We sometimes have very difficult tasks during new whirling projects. Luckily, we have a hotline to HORN's design department to discuss each application and develop a tooling solution," Schmid explains and continues: "As a supplier, we offer our customers the highest flexibility and speed and we expect the same from our suppliers and partners. With HORN, we have a tool partner at our side which offers this service and is always available for us."

ANY BURRS, NO MATTER HOW SMALL, POSE A POTENTIAL RISK OF SUBSEQUENT FAILURE.

Machine for high-speed whirling

The design of the TRAUB TNL20 sliding-headstock automatic lathe has been consistently adapted to the requirements of the user. The kinematics of the Swiss-type turning machine allow effective and simultaneous machining with two, three or four tools. The generously sized, vertically orientated working area provides the necessary degrees of freedom as well as very high process reliability. The automatic sliding-headstock lathe achieves a decisive productivity advantage with its high dynamics. The newly developed machine bed made of grey cast iron forms the basis for vibration-damping properties. The high rigidity and thermal stability also ensure optimum workpiece quality during Swiss-type turning and conventional turning.

Stefan Benz in conversation with Sebastian Schmid.

PROCESSES

SWABIAN PRECISION TRILOGY

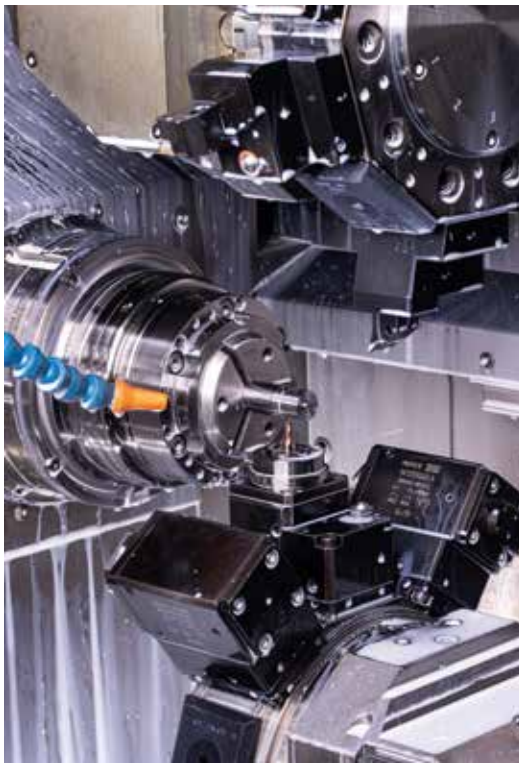
Precision tools, accurate lathes and a deep understanding of how to use the two to achieve micron precision. This describes the cooperation between Paul Horn GmbH, the machine manufacturer INDEX and the contract manufacturer of precision turned parts, RICH Praezision. "The proximity of all three companies to one another and the long partnership between us can be described as a success story," says Wolfang Rich. He and his brother Gottfried manage the company RICH Praezision as third-generation directors. RICH Praezision has relied on tool systems from HORN since the 1980s. The company is a customer of, as well as a supplier to, the Tübingen-based tool manufacturer.

THE COMPANY PRODUCES THE BODY OF THE PRECISION INTERFACE FOR THE HORN SX TOOL SYSTEM.

It all began on 3rd March 1949 with Wilhelm Rich, the grandfather of the current managing directors. In 1986 and 1990 respectively, the current managing partners Wolfgang and Gottfried Rich joined the company. Today, RICH Praezision employs more than 40 people. The brothers have always specialised in the production of precision turned parts and complex workpieces and sub-assembly is becoming increasingly important. Under the motto "We start where others stop", the company manufactures workpieces for numerous industries. Specialities include, for example, components for gearboxes, high-quality electrical appliances, hydraulics and pneumatics as well as refrigeration technology.

Interface for precision tools

RICH Praezision has been a supplier to HORN for several years. The company produces the body of the precision interface for the HORN tool system SX, a further development of the 42X family. The cutting head is connected to the contact surface of



Milling of the key surfaces with the HORN system DS.

For internal grooving, RICH relies on solutions from the Supermini tool family.

the tool body via a stable, robust, yet highly accurate thread. This interface brings several advantages: High stability due to the generously sized mounting thread, excellent support due to the large contact surface and precise changeover accuracy to within microns, which is always in the middle of the tolerance band. Furthermore, changing the head is simple and user-friendly. The interchangeable head system is mainly used for milling tools that are brazed to the tool steel body.

"Manufacturing the tool holders was initially a great challenge. HORN's demands for precision are very high," explains RICH production manager Wolfram Stiefel. RICH manufactures several tens of thousands of parts in numerous variants for HORN every year. Stiefel also relies on HORN tools for producing the HORN component. Critical features for machining are, on one hand, the mounting thread and, on the other, several very closely toleranced fits. In addition, there is a further focus on the concentricity and axial run-out of the various contact surfaces.

High precision thread milling

The HORN circular interpolation milling system or the solid carbide DC milling system are used for milling the internal thread, depending on the diameter of the SX body. The inserts are precision

For grooving, RICH Praezision relies on the modular grooving system with the S100 insert.

ground to cut the special thread profile. The threads are milled using several infeeds. "The thread is checked using a plug gauge, which HORN provided us with," says Stiefel. Another tool type, a 306 circular milling cutter, is used to mill an internal recess. Stiefel chose milling for this because the process is more stable than turning in view of the unfavourable length/diameter ratio in the product series. "The circular interpolation milling system with interchangeable head, or as a monobloc version, can be adapted precisely for such milling tasks," says HORN field service representative, Frank Blocher.

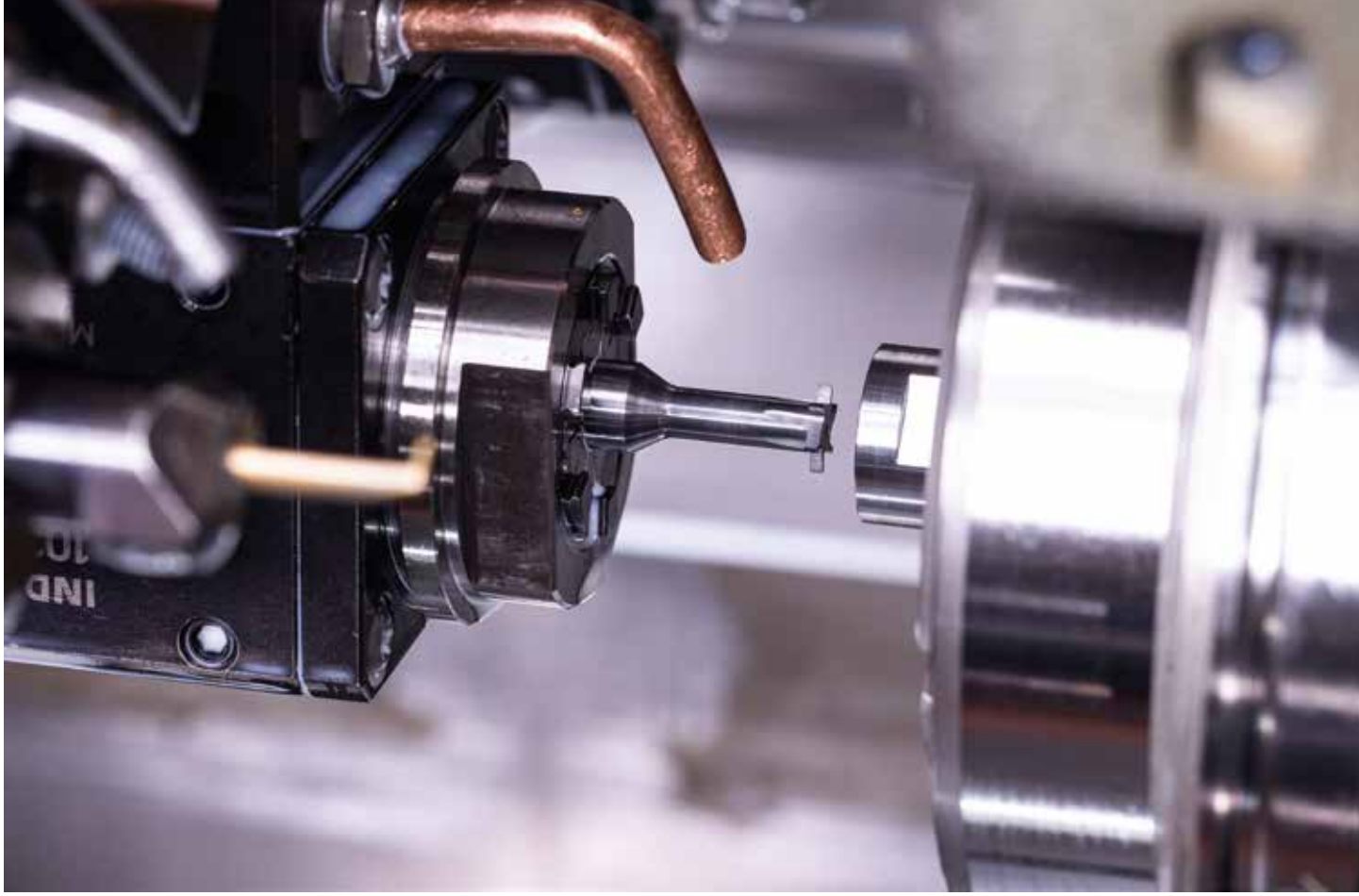
The circular interpolation milling system from HORN offers the user a number of advantages: It is fast, reliable and achieves good surface finish. The tool, which is guided on a helical path, plunges into the material at an angle that may be either steep or very shallow. This makes it possible, for example, to produce threads in reproducibly high quality. Compared to machining with indexable inserts for larger diameters, or with solid carbide cutters for smaller diameters, circular milling is generally more economical. Circular milling cutters have a wide range of applications. They machine steel, special steels, titanium, aluminium and special alloys. The precision tools are particularly suitable for groove milling, helical milling, thread milling, T-slot milling, profile milling and gear milling. However, they are also ideal for special applications such as the milling of sealing grooves or in connecting rod machining.

THE CIRCULAR INTERPOLATION MILLING SYSTEM IS FAST, RELIABLE AND ACHIEVES GOOD SURFACE FINISH.

HORN turning tools

Other HORN systems are used for turning operations on the component. For boring small diameter holes, RICH always uses the Mini and Supermini systems. In addition to the precision thread, a taper and a further fit are used for centring the interface with

The RICH management team relies on HORN and INDEX: Production Manager Wolfram Stiefel and the two Managing Directors Wolfgang and Gottfried Rich.



Groove milling with the solid carbide circular interpolation milling system DC.

micron precision. Turning of the taper and the fit is done by a Supermini type 105. "The turning of the very close-tolerance fit is a stable process. However, due to the series production, the fit is finished with a reamer," explains Wolfgang Rich.

FOR PROGRAMMING, RICH USES THE AVAILABILITY OF THE INDEX VIRTUAL MACHINE.

The component comes off the INDEX C100 automatic lathe finish machined. "The versatility, stability and adaptability of the machines from INDEX impressed us. The proximity of INDEX to Esslingen is also important. If we have a problem, someone from the service department is on site immediately, or we simply pick up the spare parts ourselves," says Gottfried Rich. For programming, RICH uses the virtual machine from INDEX. The machine operators create the programs themselves at several programming stations.

Generous working area

The INDEX C100 and INDEX C200 production lathes open up new possibilities for the rapid production of parts turned from bar. Despite their compact footprint, the INDEX C100 and the INDEX C200 twin- or triple-turret machines offer a generous working area for the complete machining of complex workpieces. The INDEX SingleSlide guide system ensures high dynamics with good vibration damping. This has a positive effect on workpiece quality and tool life, while at the same time reducing cycle times.

PREVIEW

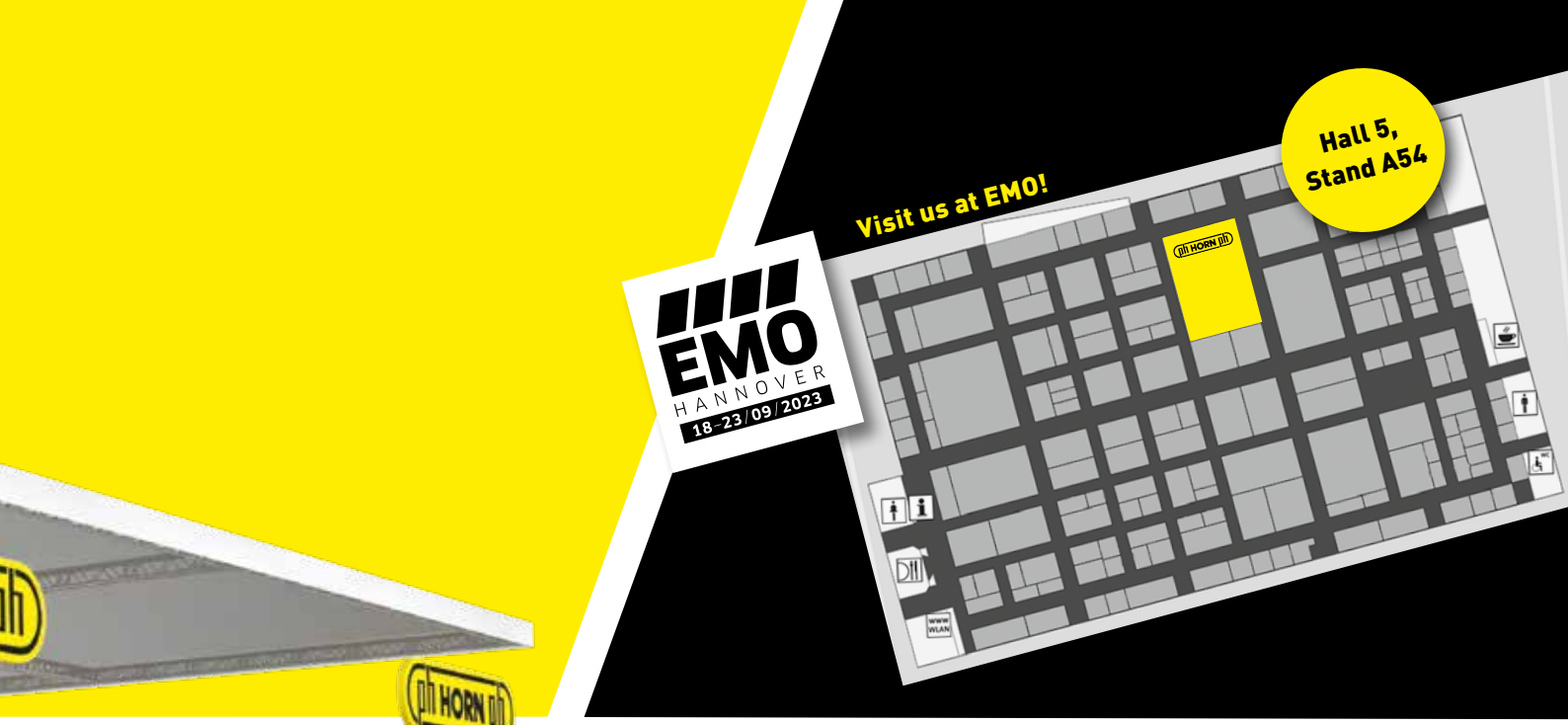
INNOVATE MANUFACTURING – THE NEW EMO HANNOVER

Innovate Manufacturing – that is the claim and promise of the new EMO Hannover – 365 days a year. Because EMO Hannover is more than just a trade fair: It is the starting point for innovation, important discussions and new business partnerships. That is why the show continues to evolve into a globally relevant business platform that facilitates surprising encounters outside of trade fair hours, drives companies forward, promotes effective networking and offers a complete overview of production technologies.

The global economy is in a state of flux. It is characterised by not only technical but also social developments and changes. This creates volatility and greater complexity for entrepreneurial activity. Production technology creates solutions for these current and future challenges. Production processes are becoming more efficient and sustainable, workflows more flexible, and new value-added strategies and business models are emerging. As a central enabler for technical innovation within the entire production chain, the manufacturing industry is at the centre of a digital transformation.

As the world's leading trade fair for production technology, EMO is not only part of this process – it plays a decisive role in shaping it and actively promotes it. The exhibitors' products and services now extend far beyond metalworking. They represent the entire value chain of production and integrate the flow of information from the product idea to its realisation. These technologies interconnect to address all central issues: precision tools, software, machine and process, measuring technology, control technology and automation – because the customer's problem can only be solved by comprehensive, holistic concepts. Networking, data sourcing and data analysis are increasingly becoming a central component of a solution and are the special focus of exhibitors and visitors alike. The new EMO Hannover will address this in a special way. It expands the range of products and services at EMO Hannover with a clear focus on the digital factory, from the shop floor to the control level and technology platform.

The HORN trade fair stand is located in Hall 5, Stand A54
Visitors can experience innovations, processes, solutions and live machining in an area of around 580 square metres (6,243 square feet). HORN precision tools are in use on two machines under power. The new trade fair concept is both production- and product-related, which puts even more focus on the tools and demonstrates their performance.



Artist's impression of the HORN exhibition stand for EMO 2023.

A trade fair highlight is the new milling cutter programme for stainless steels.

The range of products and services at EMO Hannover covers the entire spectrum of state-of-the-art production technology. Machine tools and manufacturing systems, precision tools, automated material flow, production and management software, digital platforms and value-added services as well as industrial electronics and accessories – at EMO, exhibitors present the full spectrum of manufacturing technology for modern, future-proof production. The trade fair thus provides a comprehensive and well-founded insight into the status quo and trends in production technology – and beyond. Because in addition to professional training, the focus of the trade fair is on industry-wide and cross-industry inspiration, exchange between international professionals and the expansion of one's own professional network.

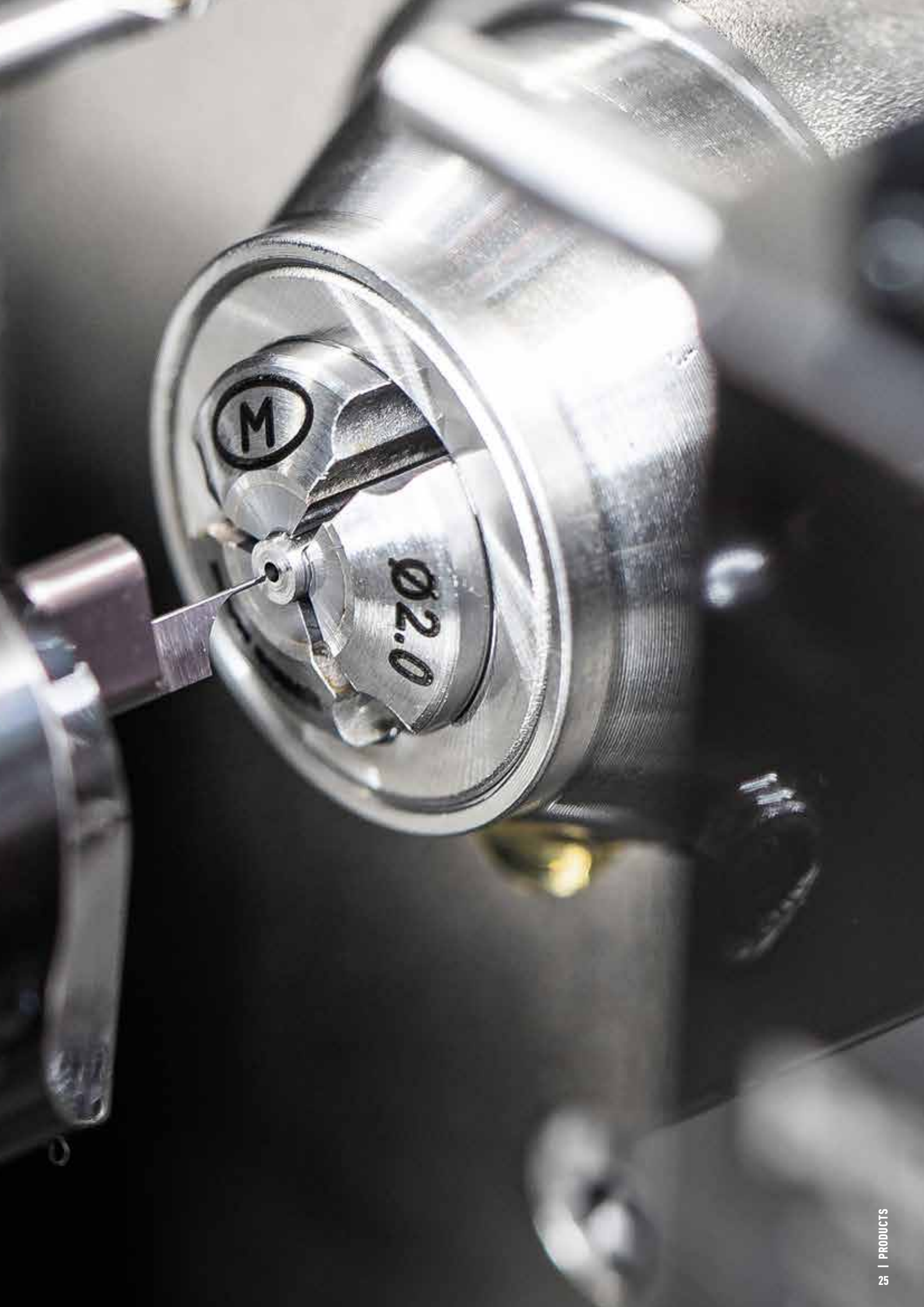
Come to Hannover and visit HORN in Hall 5, Stand A54 – we look forward to seeing you.

THE RANGE OF PRODUCTS AT EMO HANNOVER COVERS THE ENTIRE SPECTRUM OF STATE-OF-THE-ART PRODUCTION TECHNOLOGY.

PRODUCTS

EMO 2023

In 1989, HORN launched the technically superior Supermini System at the world's largest metalworking trade show, EMO in Hannover Germany. With considerable technical development, it became possible to successfully manufacture precision internal grooving tools for bores up to 5 mm (0.197") in diameter. The Supermini system was born and over time became one of HORN's most successful products. In addition, the Supermini system was the first precision tool to benefit from HORN's own in-house coatings. Now EMO Hannover 2023 will see HORN present yet another innovative extension to the Supermini system, Ultra-Fine Machining.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SUPERFINISHING OF BORES

Superfinishing of bores
HORN has added a variant with a precision-ground rake face to the Supermini system especially for ultra-fine machining of bores. Due to precision grinding of the cutting edge, it is free from notches when magnified approximately 200 times. The tool system can be used from an inside diameter of 0.3 mm (0.012"). The sharp insert geometry enables process reliability even with very small infeed and cutting feed rates. The specially developed coating is suitable for stainless steels, non-ferrous metals and other metallic materials.

The insert of the Supermini Type 105 system requires only one tool carrier for well over 1,000 insert variants. This applies equally to left-hand and right-hand versions. The carbide inserts are available in coated and uncoated versions in different grades for every application including hard machining up to 66 HRC. The patented droplet shape of the cross-section has a vibration-damping effect and delivers excellent repeatability when changing the insert. Internal coolant supply to the insert increases tool life, enhances cutting performance and improves chip removal. HORN offers the tools with elements for face clamping. This allows, for example, the insert to be changed easily without having to remove the holder.

HORN OFFERS THE TOOLS WITH ELEMENTS FOR FACE CLAMPING.

PRODUCTS

ADJUSTABLE DAMPED BORING BAR

Adjustable damped boring bar

Long tool overhangs can cause a turning tool to oscillate when boring internal geometries. In addition to the resulting chatter marks on the surface, these vibrations also lead to a significant reduction in tool life. For unfavourable length/diameter ratios, the experienced machinist relies on vibration-damping boring bars, which enable low-vibration machining but which can still vibrate during certain machining operations. Paul Horn GmbH has addressed this problem and is presenting a boring bar at EMO in Hannover that can be adjusted to the vibration amplitudes that occur. Precise adjustment of the damping element in the boring bar enables a vibration-free grooving process. This results in better surface quality without chatter marks and a significant increase in tool life.

The exact adjustment of the damper, made of a carbide rod supported in O-rings, is made from the outside by means of a screw. Adjustment is achieved by fine-tuning the pre-tension of the O-rings. This allows the boring bar to be precisely set according to the vibration occurring in each application. As standard, HORN offers the tools from stock in the length/diameter ratios 5 x diameter and 8 x diameter. Higher ratios are possible as special tools. For the grooving processes, HORN offers the S224 double-edged grooving system. The HORN cassette system BK 224 ensures a stable interface between the boring bar and the inserts. To further increase process reliability, the boring bars are equipped with an internal coolant supply.

THE BORING BAR CAN BE ADJUSTED TO DAMP THE VIBRATION AMPLITUDES ACTUALLY OCCURING.

HIGH PERFORMANCE IN STAINLESS STEELS

High performance in stainless steels

HORN has developed a new, solid carbide milling cutter range especially for machining stainless steels. The tools are for milling stainless materials in the the food, chemical and pharmaceutical industries as well as the precision engineering and watchmaking industries. In addition, due to their geometry and good chip formation, the milling tools are suitable for machining numerous other materials. Due to the precise combination of the substrate, the macro and micro geometry as well as the IG3 coating, the milling system exhibits high performance and long tool life. The coating in particular offers high temperature resistance for machining steels alloyed with chrome, nickel and molybdenum.

HORN offers the solid carbide milling tools from stock in two types. The DSHPR variant is suitable as both a finishing and a roughing tool. The geometry is also adapted for trochoidal machining and plunging. The DSR type, with its very sharp cutting edge geometry and short design, is suitable for very small parts and unstable clamping conditions, such as in the medical and watchmaking industries. In the DSHPR line, all tools are available with four teeth and in diameters from 2 mm (0.079") to 20 mm (0.787"). The DSR variant HORN offers with three teeth in diameters from 1 mm (0.039") to 10 mm (0.394").

THE DSHPR VARIANT IS SUITABLE AS BOTH A FINISHING AND A ROUGHING TOOL.

GROOVE AND CUT-OFF MILLING SYSTEM M475

Groove and cut-off milling system M475
HORN introduced a new-generation groove and cut-off milling system in 2022. The tool system enables economical, highly productive milling performance. To round off the milling system for narrower grooves, HORN is expanding it to include smaller inserts with a cutting width of 3 mm (0.118") and 4 mm (0.157"). The precision-ground, indexable insert offers four usable cutting edges, each with two left and two right inserts, so the user no longer needs to fix different inserts onto the cutter body. HORN offers the positive-cutting indexable inserts with a round chip breaker in the carbide grade RC4G, which enables high cutting performance during milling. The special surface treatment of the cutter body offers a high level of protection against abrasion by chips.

The bodies of the M475 system are available from stock as side milling cutters, shell milling cutters and screw-in milling cutters. The shell and screw-in milling cutter variants are equipped with an internal coolant supply. HORN offers the side milling cutters in diameters from 80 mm (3.150") to 200 mm (7.874"). The cut-off and grooving widths are optionally 3 mm (0.118"), 4 mm (0.157"), 5 mm (0.197"), 6 mm (0.236") and 8 mm (0.315"). As shell milling cutters, the tools are available in diameters from 63 mm (2.480") to 200 mm (7.874"). The groove widths are the same as for the side milling cutter variant. The screw-in milling cutters are stocked with a cutting width of 5 mm (0.197") and diameters from 40 mm (1.579") to 63 mm (2.480"). The effective number of teeth (zeff) of all the variants depends on the diameter. For example, it is zeff = 2 for the 40 mm (1.579") diameter shell mill and zeff = 13 for the 200 mm (7.874") side milling cutter. The large number of effective inserts also contributes to the economical efficiency of the new M475 milling system.

THE SHELL AND SCREW-IN MILLING CUTTER VARIANTS ARE EQUIPPED WITH AN INTERNAL COOLANT SUPPLY.

NEW HIGH-PERFORMANCE GRADE FOR THREAD WHIRLING

New high-performance grade for thread whirling

SG3P – that is the name of the newly developed high-performance grade offering the user new possibilities in terms of performance and tool life when whirling medical screws. The new carbide grade from HORN also enables shorter cycle times for thread production thanks to higher cutting values, including when processing materials that are difficult to machine. In addition, the combination of an ultra-fine grain carbide powder and the high-temperature resistant coating results in high process reliability and better component quality. The carbide grade is available for all standard HORN thread whirling systems. Furthermore, in-house coating enables fast delivery times.

THE CARBIDE GRADE IS AVAILABLE FOR ALL STANDARD HORN THREAD WHIRLING SYSTEMS.

The production of bone screws must necessarily be carried out using a metalcutting process, as the material for this type of screw must not be compressed, as is the case with thread rolling, for example. Titanium in particular, which is mainly used in the human body because of its high biocompatibility, tends to burn if the material is compressed too much. As a machining process, thread whirling has been established for many years. The whirling process has been known since 1942 and was not subject to any significant further development for a long time. Conventional thread whirling is a process that is mainly used on Swiss-type lathes to manufacture bone screws, but also on a larger scale for the production of threaded spindles. In the process, the rapidly-rotating whirling head is positioned eccentrically to the workpiece axis in front of the guide bush of the sliding- headstock lathe and the slowly rotating workpiece is guided into the whirling head with an axial feed movement.

GEAR MILLING IN RECORD TIME

Gear milling in record time
With its tool configurator (HTC – HORN Tool Configurator), HORN offers the possibility of supplying gear milling cutters in a short lead time. HORN focuses on its own circular milling system. After the customer's enquiry, the HTC system offers the possibility of automatically generating a tool drawing for all gear profiles up to module 3. This shortens the design phase. The system enables quotations to be generated within one working day. Quotations with technical drawings are available the next working day. With the Greenline process, HORN offers delivery within five working days. The number of pieces is limited to a batch size of 50 and approval of the drawing by the customer is a prerequisite.

The circular interpolation milling system from HORN offers the user a number of process advantages: It is fast, reliable and achieves good surface finish. The tool, which is guided on a helical path, plunges into the material at an angle that may be either steep or very shallow. This makes it possible, for example, to produce threads in reproducibly high quality. Compared to machining with indexable inserts for larger diameters, or with solid carbide cutters for smaller diameters, circular milling is generally more economical. Circular milling cutters have a wide range of applications. They machine steel, special steels, titanium, aluminium and special alloys. The precision tools are particularly suitable for groove milling, helical milling, thread milling, T-slot milling, profile milling and gear milling. However, they are also ideal for special applications such as the milling of sealing grooves or in connecting rod machining.

THE CIRCULAR INTERPOLATION MILLING SYSTEM IS FAST, RELIABLE AND ACHIEVES GOOD SURFACE FINISH.

ZYKLOMED

COMBINED EXPERTISE FOR THE MEDICAL INDUSTRY

Functionally integrated implants through novel synchronised machining processes – ZykloMed

With the joint project funded by the Federal Ministry of Education and Research (BMBF), the participating partners INDEX, Paul Horn GmbH, Beutter Präzisions-Komponenten GmbH and the wbk Institute for Production Engineering at the Karlsruhe Institute of Technology (KIT) are demonstrating their expertise in the medical industry. Using new and modern manufacturing processes, the partners have tackled the challenges for economical machining of implants having multifunctional as well as non-round bionic designs. The focus was on the three manufacturing processes of eccentric turning, polygon turning and high speed whirl milling (turn whirl milling).

Modern medical implants for orthopaedics, traumatology and dental technology are characterised by rigorous demands on strength, biocompatibility and bionic-optimised geometry. The geometry of an implant is adapted to the bone and tissue. In the process, the functional surfaces of the implants are given an increasingly sophisticated design in order to facilitate their attachment in the body and make them less invasive for the patient. The new designs of implants drive up manufacturing costs because the surfaces are no longer circular or square. They have more curved surfaces and functional elements with continuous transitions in a very small space. In particular, the need for several manufacturing steps on different machines causes costs to rise significantly. For example, precise handling for exact reclamping of a workpiece represents a considerable cost factor. Therefore, despite the high level of functional integration, an efficient process route is needed for economical production.

Novel processes

The novel manufacturing processes of eccentric turning, polygon turning and high speed whirl milling (turn whirl milling) are all based on the same kinematic principle of multiple synchronised rotating axes. While this principle is well known, its application to non-circular and curved shapes is highly demanding. At the same time, the practical implementation must meet the high quality requirements of the medical industry.

The project partners researched and developed novel manufacturing procedures along the entire process and supply chain, from the machines and control technology to the tool design to prototype and pre-series production. The manufacturing processes were simulated and designed based on known methods with the same mathematical principles in order to determine the requirements for tool and machine. The tests were divided into equivalence tests under laboratory conditions as well as pre-series tests in laboratory and near-application environments. The engineers focused on both machine and tool technology for the development and design of the individual processes. In eccentric turning, a rotating non-circular tool is guided along a rotating workpiece under positional coupling. The speeds are brought into a certain ratio to each other. The out-of-round shape is thus reproduced on the component within certain limits. The process offers highly productive production of eccentric outer contours. The rotation of the tool reduces the thermal load at the cutting edge, which ensures long tool life. The process also enables the production of tapered profiles.

Polygon turning is a process for producing non-circular external and internal contours with the shape of a hypotrochoid. Like rotary eccentric turning, the process offers the possibility of producing non-circular contours on lathes. In the process, the parallel axes of the workpiece and the tool are offset from each other by an

Left: High speed whirl milling (turn whirl milling) is a highly productive process for manufacturing bone screw threads.
Middle: Eccentric turning enables highly productive manufacture of non-round external contours.
Right: Polygon turning offers the possibility of producing non-round contours on lathes.

axial distance and are brought into a specific speed ratio under positional coupling. The axial distance, the speed ratio of the workpiece to the tool and the cutting diameter of the inserts define the dimension of the contour. A tool system for polygon turning is individually adapted to the contour of the workpiece to be produced.

High speed whirl milling (turn whirl milling) is a highly productive process for producing threads for bone screws. One or two circular milling cutters are set at a certain angle to the workpiece. The directions of rotation of the cutters and the workpiece can be the same or opposite. The speed ratio of the workpiece to the two cutters depends on the number of threads and the number of cutter inserts. For the first time, high speed whirl milling (turn whirl milling) can also be used to economically produce threads with a true variable pitch by dynamically changing the thread profile.

Tests close to series production successful

With successful tests in a near-series production environment, the partners of the ZykloMed project have come a big step closer to the goal of the research project, the economical production of implants of multifunctional and non-round bionic design. The engineers proved that the synchronised manufacturing processes enable the cost-effective manufacture of modern implants. In addition to the production of new component geometries, the processes also offer optimisation potential for the economical production of existing implants, as well as possible applications beyond the medical industry.

The project participants at the final presentation of the BMBF joint project (from right to left): Dr.-Ing. Volker Sellmeier/ INDEX-Werke GmbH & Co. KG Hahn & Tessky, Andreas Kanz/ Paul Horn GmbH, Dr.-Ing. Wolf-Dieter Kiessling/BEUTTER Präzisions-Komponenten GmbH & Co.KG, Tassilo Arndt/Institute for Production Engineering at the Karlsruhe Institute of Technology (KIT).

GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

The joint project ZykloMed is funded by the Federal Ministry of Education and Research (BMBF).

MASTERING PROCESSES: HIGH PERFORMANCE REAMING

Tight bore tolerances, high surface quality and almost perfect cylindricity. Boring with reaming tools is often the last machining step in the production of precise components. In addition to the features mentioned, other properties play an important role in the production of close tolerance bores. Reaming tools are usually used for this purpose. In addition to the well-known HSS reamers, special high-performance reaming systems are increasingly proving their worth in modern production. With the DR reaming system, Paul Horn GmbH offers its own product portfolio for the economical finishing of bores.

TIGHT BORE TOLERANCES, HIGH SURFACE QUALITY AND ALMOST PERFECT CYLINDRICITY.

As with other tool systems, high-performance reaming systems are also subject to demanding requirements. In addition to high process reliability, long tool life and low tool costs, modern reaming tools must fulfil further criteria. These include, among other things, the modularity of the tools. While machining with an HSS reamer is partially limited in this respect, modern reaming systems can be improved by replaceable heads with carbide inserts, modular tool lengths and various adjustment options. These include, for example, micron-accurate adjustment of concentricity and run-out. Precise concentricity of the reaming inserts is the path to success. In practice, this should be within 5 µm (0.197 mil).

The newly developed DR large reaming system covers a diameter range from 140 mm (5.512") to 200.2 mm (7.882").

The high-performance DR reaming system from HORN has a modular design and can be used for diameters from 7.6 mm (0.299") to 200.2 (7.882") mm.

Chip control

In addition to the precise grinding of the carbide insert, the appropriate tool geometry for the machining operation also plays an important role in economical reaming. Therefore, two insert orientations or side rake angles are used for reliable chip removal. Straight-insert reaming cutters are suitable for machining blind holes. Chip flow is in the opposite direction to the machining direction. Left-hand helical inserts are designed for reaming through holes only. In this case, the direction of chip flow and machining is the same.

Controlling chip breaking is an important aspect of successful boring. In deep bores, with low coolant pressure or dry machining, helical or ribbon swarf can occur. As with drilling with twist drills, the chips can be broken by briefly lifting the reamer. It is important to program as few interruptions as possible, but as many as necessary, as retractions can reduce the service life of the cutting edges. The lifting of the tool is hardly noticeable in the appearance of the machined surface.

Reaming large diameters

With the newly developed DR-Large reaming system, HORN has extended its expertise in boring. The tool offers easy handling and high precision thanks to the proven technology of the DR tool family. The large number of cutting edges enables high cutting values and consequent time and cost savings in machining. The user achieves great flexibility thanks to the modular design and the solid carbide inserts of the tool system. There is no need for tool adjustment when changing the cutter head. The versatile and powerful interchangeable reamer system covers bore diameters from 140 mm (5.512") to 200.2 mm (7.882"). HORN offers servicing for simple and fast reconditioning of worn heads.

Basically, reaming is a very economical machining process. Compared to turning or milling bores to tight tolerances, reaming is many times faster and can significantly reduce unit costs. HORN has developed a high level of know-how for economical boring and has a powerful tool system in its range with the modular, high-performance DR reaming system. It covers bore diameters from 7.6 mm (0.299") to 200.2 mm (7.882"). All variants are equipped with internal coolant supply directly to each cutting edge. The insert interface offers high changeover accuracy within a few µm (tenths of a mil) and enables quick and uncomplicated insert exchange.

WE HAVE SAVED A LOT OF TIME DUE TO THE CHANGEOVER.

REAMING FOR RESCUE

"Quality that saves lives" is the motto of SYSTEM STROBEL GmbH & Co KG from Aalen-Wasseralfingen. The company develops and produces emergency ambulances, rescue vehicles and patient transport vehicles for rescue services and aid organisations all over the world. With a high level of vertical integration, SYSTEM STROBEL produces a large proportion of the components and assemblies itself. In the machining department headed by group leader Marcus Wittek, they rely on tools from the Tübingen tool specialist HORN. The HORN DR small reaming system is used for the production of components for the Mitteneinzug stretcher developed by SYSTEM STROBEL.

The mechanical components of SYSTEM STROBEL's patient support require a high degree of manufacturing precision.

Josef Strobel founded the company in 1938 as a paint and body shop. The current managing director Thomas Strobel took over the company in 1982. At the beginning of the 1980s, he helped a rescue organisation to optimise the interior fittings of its ambulances. This was the impetus for the foundation of SYSTEM STROBEL. In 1985, the first ambulance was built. The first stretcher table followed in 1986. From then on, Thomas Strobel developed the company into one of the largest manufacturers of ambulances in Europe. The company builds between 350 and 400 vehicles a year according to whatever the respective organisation wants. The company's top priorities are always the functionality, ergonomics and quality of the vehicles. The first ambulance built by SYSTEM STROBEL is still in service today.

High level of vertical integration

"We have a very high level of vertical integration. We develop and build as much as possible ourselves," says Wittek. SYSTEM STROBEL purchases the chassis from well-known manufacturers. The construction of cases from aluminium sandwich panels is carried out in the

The HORN DR small reaming system in use at SYSTEM STROBEL.

factory. Even the extruded aluminium edge profiles for holding the sandwich panels together are in-house developments. In addition, aerodynamic signal lights (blue light), electric running boards and many other parts are made in-house. The interior fitting of the furniture is done by the company's own joinery department. SYSTEM STROBEL also puts a lot of know-how into the development of stretcher tables. They are used to support the stretcher on which the person being rescued lies. The patient support is air-cushioned and can be tilted and moved sideways in different directions. The stretcher must also be able to fold flat for ergonomic loading of the vehicles.

THOMAS STROBEL DEVELOPED THE COMPANY INTO ONE OF THE LARGEST MANUFACTURERS OF RESCUE VEHICLES IN EUROPE.

The system requires mechanical components and assemblies. This is where Wittek's department comes into play. With several CNC machining centres, he and his team produce all the metal parts that are machined at SYSTEM STROBEL. The optimisation of machining operations is under constant scrutiny. One issue was the reaming of bores. "We have some components that are cast or extruded. It is important that the bores are of exactly the right size so that the components of the stretcher do not jam when they are moved," says Wittek.

Changeover to the HORN reaming system

Wittek now uses the DR small reaming system from HORN to ream the bores. Before the changeover, the bores were milled or drilled and then reamed with an HSS reamer. "The process, cycle time and accuracy no longer satisfied us. New developments in stretchers with even finer mechanical and electrical components made it necessary to rethink the reaming process. For technical advice, Wittek contacted Stephan Weiß, the HORN field representative responsible for SYSTEM STROBEL: "We have already solved numerous problems with our high-performance reaming system. The machining requirement at SYSTEM STROBEL was a clear case for the DR small reaming system."

"WE HAVE ALREADY SOLVED NUMEROUS PROBLEMS WITH OUR HIGH-PERFORMANCE REAMING SYSTEM."

The diameters of the four system sizes range from 7.600 mm (0.299") to 13.100 mm (0.516"). It enables quick and uncomplicated changing of the inserts in the machine with high repeatability. The flexibility in the choice of grades, inserts and shank systems covers a wide range of applications. The DR small significantly reduces the machining cost per hole, increases productivity and reduces handling thanks to the exchange system that elimi-

The high level of vertical integration and many special requests from customer organisations require flexibility in series production at SYSTEM STROBEL.

The diameters of the four system sizes range from 7.600 mm (0.299") to 13.100 mm (0.516"). It enables quick and uncomplicated exchange of the reaming inserts in the machine with excellent repeatability.

nates the need for regrinding. The precise interface between the shank and the head enables high power transmission, with a changeover precision of less than 5 µm (0.197 mil). The interchangeable inserts are fixed in place by a central clamping screw. Steel or carbide shanks are available in through hole or blind hole versions. They differ essentially in the type of internal coolant supply.

The internal coolant supply is also an important point in the application at SYSTEM STROBEL. "We machine a lot of aluminium components. When reaming deep holes in aluminium, good cooling is the key to success," says Wittek. The reaming of the bores is now done at a cutting feed rate of v_f = 6 m/min (19.7 ft/min). The machining cycle has been reduced by two thirds. The performance of the system has convinced Wittek: "We have saved a lot of time after switching to the new system. Furthermore, we are also impressed by the tool performance as well as the quality of the reamed bores." Wittek cannot yet give any information on the exact tool life. The tool used has machined 2,000 bores so far – without any signs of wear.

HORN reaming systems

Reaming is a very economical machining process. Compared to machining of bores to tight tolerances, reaming is many times faster and can significantly reduce the unit costs. HORN has developed a high level of know-how for economical boring and has a productive tool system in its range with the modular, high-performance DR reaming system. It covers hole diameters from 7.6 mm (0.299") to 200.2 mm (7.882"). All variants are equipped with internal coolant supply directly to each cutting edge. The interface of the cutting inserts offers high changeover accuracy in the range of a few µm (tenths of a mil) and enables quick, uncomplicated exchange of the inserts.

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