

world^{of} tools

HORN'S CUSTOMER MAGAZINE



This month's subject:

**GEAR BOXES FOR
MOTOR RACING AND
FOR HEAVY UTILITY
VEHICLES**

- Teamwork for the best solution – DaimlerChrysler Plant Gaggenau
- Broaching on CNC Lathes, Milling Machines and Machining Centres
- HORN UK – Continuity provides the key to success
- Hard Specialities from Gomaringen





Ladies and Gentlemen,

Improving the economy of manufacturing processes is a regular topic for discussion and a healthy preoccupation within manufacturing industry. However, with an average share of 3 % of the total manufacturing cost, tooling costs do not provide the key to solving the existing problems. Time and effort can be much better spent on monitoring the process and increasing its efficiency to obtain improved productivity.

The emphasis should rather fall on shorter tool setting times and reduced machine down time. With this approach the status of the cutting tool in the process chain of manufacturing shifts from being a "cost overhead" to a "value creator". For this reason the statement "With our products we sell the customer potential to optimise his machining application" is central to our company philosophy. HORN tools are specifically developed with a combination of geometry, coating and substrate that maximises the potential of the machining process. In combination with the correct machining strategy this guarantees the reliability and economic efficiency of the manufacturing process.

Our company's lean management system and the structure of our company enables us to develop specific tooling concepts for your application. Full

control of the manufacturing process from powder to finished, coated insert gives us the capability to perform all important steps of the fabrication of a tool to exacting standards of quality and repeatability. This ensures the ability of individual solutions to generate higher productivity at reduced manufacturing costs.

This, the second edition of our customer magazine "World Of Tools" informs you about these specialities and additional services. After the very positive response to the first issue of the magazine it is our intention to continue to use this medium to develop the relationship with our customers, by making our organisation, its product technology and its employees more familiar.

I wish you an enjoyable and informative read.
Yours Sincerely,

A handwritten signature in black ink that reads "Lothar Horn". The signature is fluid and cursive.

Lothar Horn
Managing Director
Hartmetall-Werkzeugfabrik Paul Horn GmbH,
Tübingen



world^{of} tools

HORN'S CUSTOMER MAGAZINE

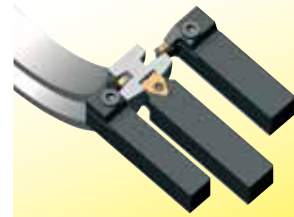
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Masthead: world of tools HORN's customer magazine, twice a year and is sent to customers and interested parties.

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TEAMWORK FOR THE BEST SOLUTION

These people have optimized the manufacturing of the gear rings:

Friedrich Keller,
CNC Organizer
Production Technology/
Daimler Chrysler

Uli Allgaier,
Application Engineer/HORN

Bruno Komorek,
CNC Operator Production/
Daimler Chrysler

Christian Hornung,
CNC Organizer
Production Technology/
Daimler Chrysler

Michale Werte,
Toolmanagement DC
Gaggenau Unit Rastatt/
Daimler Chrysler and

Rudolf J. Nagel,
Sales Engineer/HORN
(from left to right)

Long term cooperation creates application related tooling concepts

At its utility vehicle unit in Gaggenau (production plant Rastatt) Daimler Chrysler AG also produces gear boxes for heavy duty truck applications generating torque up to 2.500 Nm. HORN tools play an important role in the section dedicated to hard turning of rotating parts for the transmission and synchronisation elements needed for these gear boxes

Successful process and tool system change

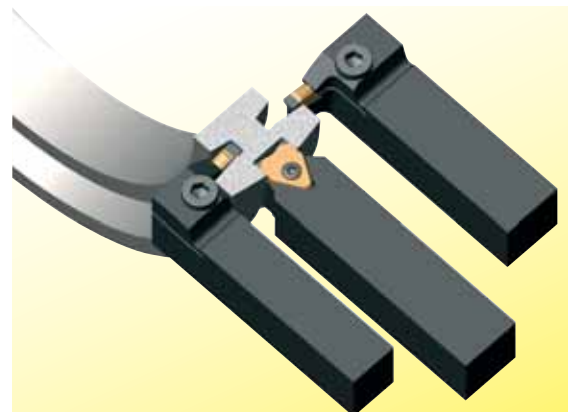
Until the middle of the 1990's six grinding machines were used to produce the tapered faces of the different gear wheels. After this period the process was changed to hard turning with CBN tipped inserts. Unfortunately the concept and the design of the tools allowed only small feed rates, and when quality and dimension issues arose the company sought out a more efficient tooling solution.

HORN sales engineer Rudolf Nagel recommended a solution based on System S229. The base is a solid carbide insert with a brazed CBN tip. The base insert is reusable and the thickness of the CBN tip and the rigidity of the tool system combine to offer extended tool life and the ability to perform grooving operations.

Optimization step by step

Tolerances and surface quality are the parameters considered as having the highest priority on the gear wheels. Initial trials indicated that the HORN solution had excellent potential. Working on a surface quality definition of Rz 1,5 µm to 5 µm it was possible to machine 70-90 components right from the start. From here it was possible to further develop the design of

Tools to machine the gear wheels: H117 (middle) to machine the flanks and grooves on the bottom corner. R229, L229 to machine the tapered surface



the insert with a wiper flat on the side cutting edges. The use of the wiper flats improved the originally achieved surface quality of $Rz = 2,5 \mu\text{m}$ to $Rz = 1,7$ up to $2,0 \mu\text{m}$, whilst simultaneously increasing the tool life to 110 components.

When Daimler Chrysler redesigned the layout of the gear wheels for production by hard turning the surface roughness was indicated with values between $Rz = 0,8$ up to $5 \mu\text{m}$. Further modification of the wiper flat improved surface quality to $Rz = 0,8 \mu\text{m}$ and again the tool life increased by another 10 to 20 percent. At the end of 2004 another design modification of the gear wheels due to a new friction surface on the synchronization rings required a new surface quality of max. $Rz = 3,5 \mu\text{m}$.

Due to the already existing modifications on the insert and the coatings it was no problem to achieve these values and maintain the tool life of approximately 120 components.

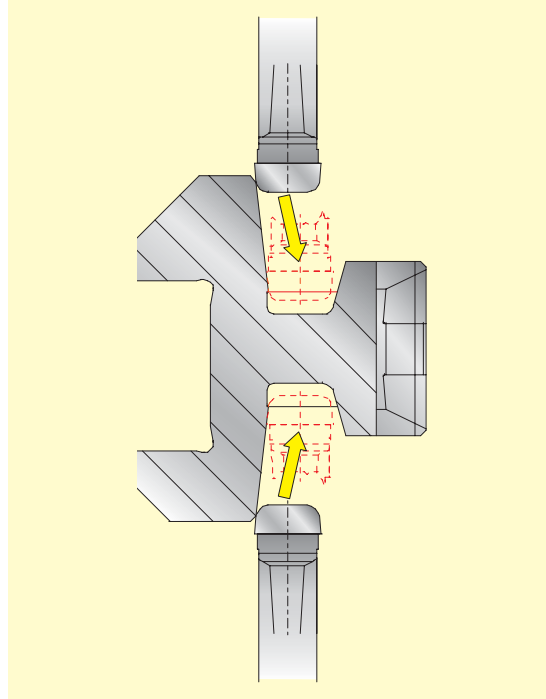
Optimization of Insert Production at the same time

In addition to the optimization of the insert geometry, HORN instituted a number of process improvements aimed at producing the inserts with higher precision. One was the use of a specific diamond grinding wheel with precisely defined dressing cycles and a defined grinding pressure. Also new coatings were considered to reduce the danger of cratering down to a minimum. At the current stage of these trials it is possible to achieve a tool life improvement up to 20 % with the Alcrona-Coating in parallel with increased process stability.

Additional improvements were made to the toolholder and the brazed section of the CBN tipped inserts. The option to re-tip the inserts offers Daimler Chrysler a cost reduction of about 20 % in comparison to the price of a new insert. This also respects parts of the environmental philosophy of this global player and saves resources.

Successful Teamwork motivates

Michael Werde, tooling manager at the Gaggenau factory, is very satisfied with the achieved production developments. He reports: "Both Teams work with a very high competence and the sense of co-operation. Information exchange was particularly good and because the operators of the different shifts were part of the project the usual shift related abnormalities



The tapered surfaces of the horizontally placed / inside head diameter clamped gear wheels are turned with a tolerance of $\pm 3'$ and with a surface quality of $Rz = 0$ up to $3,5 \mu\text{m}$ with 3 specifically designed tools.

Cutting speed is $vc = 140$ to 180 m/min , Feed rate $f = 0,2 \text{ mm/rev}$. on the tapered faces and $f = 0,08 \text{ mm/rev}$. turning an additional groove (not shown in the sketch)

didn't appear." He and his team were specifically impressed with the flexibility and short reaction times of Paul Horn GmbH.

During the optimisation phase of the project there were many occasions when 20 to 30 inserts were ground during the night and implemented in the production process on the following day.

Significant Time and Cost reduction

A large board in the section "Hard turning of rotating components" informs the employees on the shop floor in the plant in Rastatt of the difference in the old and the new manufacturing process of the gear wheels:

Grinding in 3 set up's

Manufacturing time 4,5 mins.

Hard turning in one set up

Manufacturing time 1,4 mins.

Advantages of Hard turning:

- Reduced manufacturing time
- Improved clamping concept
- Simple swarf evacuation (before grinding dust)

After a period of 4 years Daimler Chrysler in Gaggenau can consistently obtain Rz values of $0,7$ up to $0,9 \mu\text{m}$. These values are consistent during the shifts and have proved repeatable in the long term. Michael Werde finally adds the most convincing argument: "Because of the strong cooperation with HORN we could reduce our tooling costs during the last 4 years by about 50 %."



GEAR SHAFTS FOR MOTOR RACING

Groove milling inserts improve the manufacturing of splines

By introducing a spline machining route based on groove milling using HORN tooling, Maidenhead-based motor sport transmissions specialist Hewland Engineering Ltd has gained significant production benefits. Compared with spline hobbing the milling route is more flexible, easier to set up and allows consolidation of second operations.

Moreover the milling route requires a comparatively inexpensive but highly flexible machining centre (sub £100k) whereas hobbing requires use of a costly (£350k plus) specialised machine.

Hewland Engineering is a famous name in motor sport. During the 1970s and early 1980s its transmissions – often paired with the Cosworth DFV engine – helped to win the majority of Formula One races and numerous other motor sports events. Today the company supplies the whole spectrum of motor sport from clubman, through the likes of Formula 3 and Nascar to sophisticated World Rally Cars, supplying world-wide. Hewland's quest is to develop the lightest and most compact possible transmission consistent with the need to withstand the duty cycle placed upon it. Precision and high standards of finish are needed to achieve these aims. The factory produces around 300 designs of splined shaft with diameter from 20 mm to 35 mm and from 150 mm to 400 mm in

length; batch quantities range from 5 to 30-off. Most have splines running along almost the entire length. Most are machined from a Hewland-specific variety of EN36 which is heat treated to around HRC61 and finish machined in the hard state. Many require a number of additional operations, including cross drilling, identity engraving, machining of key slots and other features.

Operations director David Radley recalls. "Spline milling provided a response to a number of production issues. Firstly we wanted to consolidate the number of machining set ups needed to complete machining of certain shafts. Secondly we needed to produce shafts which exceeded the length capacity of our then existing hobbing machines – though these have subsequently been upgraded. Thirdly we had need to generate splines which finished close to increases in the cross section of the shaft – particularly on pinion shafts. In addition there were quality issues relating to the hobbing facilities that we had at that time." Hewland initially performed trials to test the milling route for spline generation, using high speed steel cutters. This entails mounting the shaft between a horizontal precision indexer/tailstock set up on the table of a vertical machining centre. Machining is

carried out at the 3 o'clock position. Michael Mack, Hewland's senior production engineer added. "Once we had the basics in place we looked to HORN for tooling that would allow us to 'productionise' the process; we already had experience with HORN groove turning tools and felt they were well qualified for this task." All shafts are semi-finish machined but following heat treatment to HRC60 some are machined to a finish while others are ground.

New strategy, new tools

The solution developed with HORN uses a Type 380 inserted cutter body with three Type 314 inserts for roughing/semi finishing. Roughing is carried out in a single pass at 400 m/min with 2 mm depth of cut at around 1000 mm/min feed rate; this reduces to 350 mm/min on the ramp entry and exit. The two passe semi finish cycle uses much reduced depth of cut at 3000 mm/min feed using a form tool based on the HORN Type M313 insert. This finalises the basic form of the spline walls and a concave radius on the leading edge to profiles a 'hump' on the bottom of the spline groove. This prevents the grinding wheel (used to finish the spline walls on some components) from bogging down in the bottom corners and causing wheel burn. The tool is set on the machine using a laser probe to ensure that the edge radius is exactly centred prior to machining.

"We expected to need specially coated inserts but in fact we've been able to use standard TiN coated 314 inserts, with Futura coating on the form tool." Mr Mack remarked. "Compared with hobbing, at the time we introduced the groove milling route we reduced machining cycle on comparable compo-

nents from 30 minutes to ten minutes, including an on-machine deburring cycle. Moreover all of the second operation work is completed in the same set-up. It proved to be highly accurate; pitch accuracy, straightness, form and surface finish are all well within our limits."

For finish machining after heat treatment to HRC60, HORN supplies an extreme coated version of the type M313 form tool. It differs dimensionally from the semi-finish derivative as it conforms exactly to the finished profile of the spline groove. Cutting data is 100 m/min surface speed with 300 mm/min feed in one pass.

Successful spline manufacturing

"The HORN tooling performs extremely well." Mr Mack remarked. "It exhibits very good tool life even though we ask a lot of it." Mr Radley added. "Overall the milling route provided us with a great deal of flexibility on spline production, virtually eliminating design constraints with regard to proximity of splines to 'obstructions' such as pinions or flanges." The route has also improved the production economics on smaller batches of challenging components. Although Hewland does not formally cost its production against the value of the machine or tooling, being able to consolidate a high proportion of the machining operations for these components onto a relatively low cost machine using proprietary tooling must have a positive effect on the bottom line.

Mr Radley concluded. "The HORN tooling has assisted us in achieving well engineered machining solutions that improve our flexibility and delivery performance, helping us to offer more competitive solutions to our customers."

Primary shaft with inserts type 313. The profile on the cutting edge of the insert complies with the profile of the spline.



Primary shaft with milling cutters type 380 and indexable inserts type 314 to produce the spline profile on the right handside of the shaft.



Milling a groove in the shift fork with an insert type 328 is the next project.





BROACHING ON CNC LATHES, MILLING MACHINES AND MACHINING CENTRES

Special Profile Inserts
Type Supermini® 105,
110 and S117.

Complete Manufacturing in one set up

Manufacturing of smaller batches of components with keyways or splined shafts with straight flanks is rarely economical if you have to use or invest in process limited or dedicated machines. Often the necessary reaming, hobbing, broaching and electrical or chemical erosion operations are performed by subcontractors.

This interrupts the flow of the in-house manufacturing process and affects delivery schedules, pricing calculations. It can also affect the precision of the products. HORN therefore recommends its proven tooling systems for broaching as an alternative approach.

Requirements for the Lathe

Keyways compliant with DIN 138 or 6885 can be broached on almost all available CNC Lathes. Perhaps surprisingly the cutting forces of this operation are much lower than the forces which appear during threading or tapping. If there are non-standard requirements for the width or the size of the keyway a programmable Y-Axis can make it possible to produce the keyway in overlapping cutting steps. Where several keyway slots have to be broached on a shaft or bore it is also an advantage to have a

programmable C-axis to guarantee angular positioning accuracy.

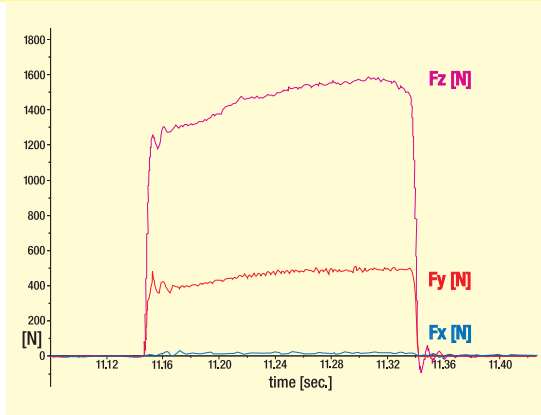
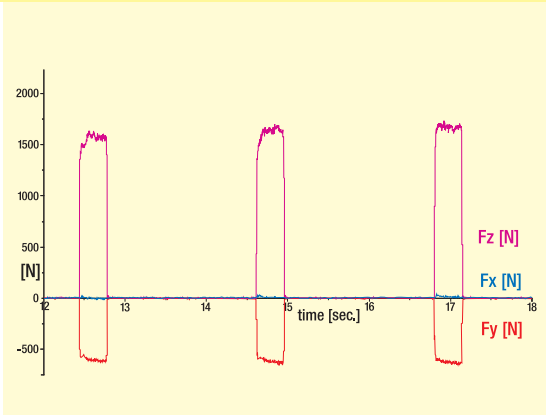
Standard and Special Tools

For the production of keyways three different types of inserts 105, 110 and S117 are available in the tolerance classes C11, P9 and JS9. These inserts enable broaching of keyways up to 12mm wide without horizontal adjustment.

The toolholders have shank diameters of 20, 25 and 32mm and can be mounted in all directions on the turret in the machine. Upon request the toolholders can be supplied with a full range of connections including VDI, Capto or HSK.

For keyways within bores down to 6 mm diameter the tool system type SB105 is ideal. Maximum broaching length on keyways up to 3 mm width is 12mm whilst on 4 mm keyways it is possible to broach up to 15mm length.

For longer keyways within bores from 10 mm diameter the system 110 has been developed. On insert widths of 4 or 5mm, keyway lengths of 25 or 40mm are possible. For keyway widths above 5mm the system S 117 is recommended. It enables broaching of keyway lengths of 40 to 75mm with inserts between



Picture left:
Cutting forces over 3 strokes in the linear and force directions Fx, Fy and Fz measured on a milling machine.

Picture right:
Cutting force development during one stroke with a cutting width of 8mm, depth of cut 0,05mm, cutting speed 10m/min.

5mm up to 12mm width. Wider keyways can be generated by moving the turret on the Y-Axis. For involute or special tooth profiles, Torx profile and 3-,4-,6 and 8-edged profile special inserts can be supplied. It is thus possible to manufacture almost all keyways or special profiles including those requiring a sloping bottom to the keyway.

Cutting data

For broaching on CNC Lathes there is a linear relation between depth per stroke and feed rate. As a result, with increasing tensile strength of the material the feed rate as well as the depth per stroke decrease. For example, on a steel 1.7225 (42CrMo4, tensile strength 1.000 N/mm²) the basic data is defined as 0,035mm/stroke and a feed rate of 3.500 mm/min. On mild steel 1.0178 (SMnPb28) it is possible to start the broaching application with 0,08mm/stroke and a feed rate of 8.000 mm/min. The picture in the top right corner shows the cutting data development on material 1.2767 / tensile strength 850 N/mm². For calculating the cutting forces the formula $F_c = w \cdot z h (1 - m_c) \cdot K_c 1.1 \cdot K_{sw} \cdot K_s$ can be used. The parameters are define as: F_c ...Cutting Force in N, w ...cutting width in mm, z ... depth / stroke, m_c ...leading exponent, $K_c 1.1$ specific cutting force, K_{sw} and K_s correction parameters for top rake versions and processes.

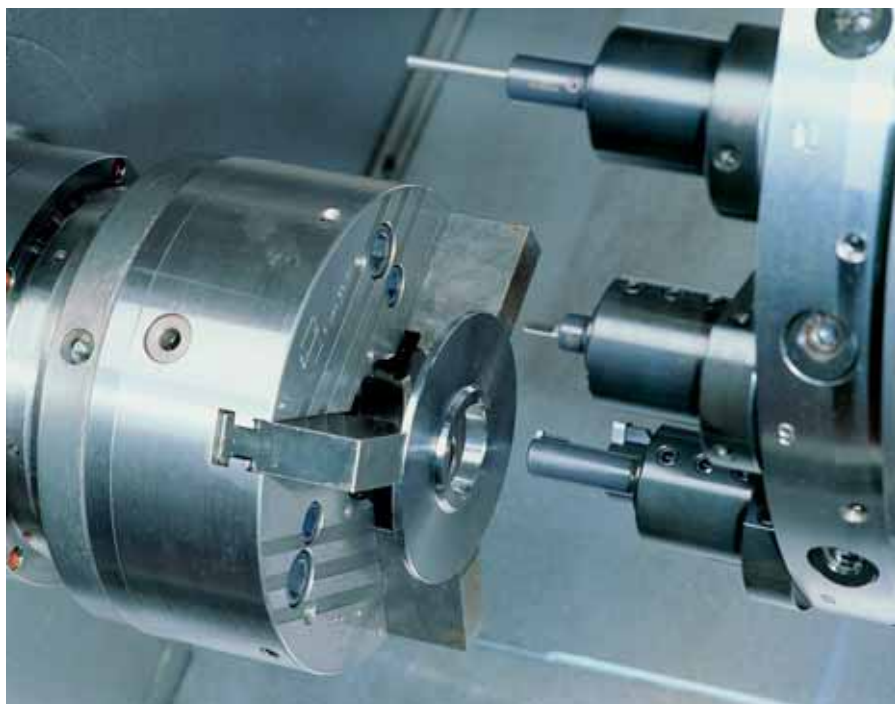
Broaching on Milling Machines and Machining Centres

In similar fashion to the lathe application it is also possible to produce linear keyways economically on milling machines and machining centres. A key requirement here is that the working spindle can be secured and locked against rotation during the broaching operation. Splines with a defined pitch can be produced by rotating the C-Axis while broaching.

Recommendations for successful broaching

To obtain a precise keyway a relief section at the end of the keyway is necessary. It is also important to lift the tool on the return stroke by appr. 0,7mm from the bottom of the keyway or even better to exit the keyway completely to allow chippings to be flushed out by the coolant. For collision free entry the tool has to be adjusted for a shaft diameter of 15mm considering 0,2mm security space on the corner rads at a final dimension of 13,95mm in the X-Axis (adjusting tables are available also for other diameters). Plentiful, well directed coolant improves the quality of the surfaces of the keyway and also increases the effective life of the cutting inserts. Furthermore, performing the broaching operation upside down improves evacuation of swarf from the keyway.

Broaching of a keyway according DIN 138 in the body of a disk milling cutter in one set up. Just one example of the economical use of broaching tools on CNC Lathes.



Retrospective

EMO Stand
in Hannover



EMO Hannover 2005

International approach top class, Business expectations significantly exceeded, Exhibitors and and Visitors highly satisfied! This conclusion was the headline of the VDW-General commission office final report regarding EMO, central meeting point of the world for Metal machining equipment in Hannover. Lothar Horn confirms this evaluation: "It was the best EMO show we've ever had. In view of the number of visitors, new contacts and the enquiries it was far beyond our expectations. A lot of customers were interested in themes such as cost reduction in manufacturing, increased flexibility and new machining processes. With our new products and system extensions we were able to present the answers to these requests

as well as offer an important factor for the final process decisions.

Our news at EMO:

- DS System of high precision Solid Carbide Endmills with cutting diameters from 0,2mm up to 12mm
- Parting Off System for TRAUB TNX 65
- New toolholders for Swiss Lathes with increased depth of cut
- MINI and Supermini® inserts CBN tipped for internal hardturning applications of bores from Ø 3mm
- 10 P MINI insert based grooving inserts for depth of cuts up to 3mm

The next EMO will again take place in Hannover from 12.-19. September 2007



EuroMold and turnTec from 30.11.-03.12.2005 in Frankfurt

HORN was present at both, the EuroMold Show (Mould & Die manufacturing, Design and Product Development) and the turnTec Show (Turned parts, Turning and Milling Technology).

Lothar Horn reports: "Both exhibitions met our expectations in terms of the visitor frequency.

This was our third attendance at the EuroMold Show and the fourth at turnTec and we definitely measure the increased interest in our products."

Of key interest for visitors was our chess figure ma-

chined on the milling centre installed on our stand. The figure was machined in 6 steps with Toroid- and Ballnose endmills from a solid aluminium block.

Our news at EuroMold:

- DS System of high precision Solid Carbide Endmills for metals and plastics
- DM System with cutting edge diameter 8mm
- DMX System with cutting diameter 10mm with multi flute milling heads for steel and copper

Chess figure of an Egyptian King, produced at EuroMold

Outlook

Exhibitions 2006

Involvement in more than 30 exhibitions world-wide will make 2006 the most intensive exhibition year in the history of the Paul Horn organisation. Around half of our international exhibits are being planned and organized from our local subsidiaries and distribution partners rather than by the parent company.

International key shows for HORN are

- BIEMH, Bilbao (E) 06.-11.03.06
- SIMODEC, La Roche s/Foron (F) 07.-11.03.06
- MACH, Birmingham (GB) 15.-19.05.06
- IMTS, Chicago (USA) 06.-13.09.06

- BIMU, Milano (I) 05.-10.10.06
- JIMTOF, Tokyo (JP) 01.-08.11.06
- PRODEX, Basel (CH) 14.-18.11.06

Significantly, 2006 will mark the debut for HORN at trade shows in Belgium and India. However we are also participating in trade shows in the Netherlands, Sweden, Finland, Denmark, Czech Republic, Romania, Poland, Portugal, Italy, China, Turkey, Austria and others.

Domestic Exhibitions:

- Metav, Munich 04.-07.04.06
- Metav, Düsseldorf 20.-24.04.06
- AMB, Stuttgart 19.-23.09.06
- EuroMold, Frankfurt 27.11.-02.12.06

Introducing:

Horst Tetzlaff, Sales Manager OEM Office

The development and design of tooling concepts for grooving applications for the OEM's of Turning and Milling Centres as well as Special Machines is the core business of our OEM Office. "Faster, better, more economical" are the key requirements which are often in conflict. Increased customer expectations, the globalization of markets and shorter product life spans require always shorter development and manufacturing periods - considering also the reduction of costs. The solutions are customer and application specific tooling concepts.

It is important to have a wide range of experience and knowledge about metal cutting applications, tool design requirements, machining processes and process combinations to cover these key responsibilities.

Horst Tetzlaff whose background is as a mechanical technician, had already gained a wide experience in the sales and application business when he joined the sales office of Paul Horn in 1985. He always finds with his very specific approach a way between the technical extremes and the cost efficient solutions. As highly competent individual he builds the link between our most important OEM customers and the design and production section but it is not always very easy to arrive at a solution which is appropriate for both parties.

Beside his responsibility for the OEM Office he is also responsible for the technical sales in the region of southern Germany. His main responsibility and that of his team is to work on applications and troubleshooting procedures which often appear for the very first time. But the solutions for it will offer the end user in general a highly cost effective and efficient tool package. No matter whether the tool packages are required by the OEM or the end user, the Team has a high level of responsibility because the specification may vary or change during the design process. It is therefore very important to react quickly and flexibly to the changed parameters. The developed concepts also need to be efficient, cost effective and transparent in terms of the internal manufacturing processes. In addition the developed concepts need to be proved and comply with the promised



performance and cutting conditions. These are the key parameters to secure long term economical and quality advantage for the end user.

Another aspect is that the experience gained during the projects for different customers and industries plays an important role in ongoing development of our standard tool range. Recommendations from the OEM Office have led to various new designs on our insert geometries, and identified the need for new coatings. These recommendations have been discussed and in co-operation with the other departments it was possible to standardize the design or coatings with a successful introduction to the market.

The Team of the „OEM Office“.
From left to right:
Horst Tetzlaff,
Manager OEM Office

Joachim Hornung,
Technical Sales Engineer
Southern Germany and
Vice Manager Technical Office

Andreas Laiss,
Technical Sales Engineer
Southern Germany

Caroline Ricco,
Internal Sales &
Administration

Hartmut Raach,
Internal Sales &
Administration,
Technical Support

Volker Dahle-Schröder,
Technical Sales Engineer
Northern Germany



HORN UK – CONTINUITY PROVIDES THE KEY TO SUCCESS

After ten years serving the British and Irish market HORN UK has gained an excellent reputation and is considered to be the technological leader for all types of grooving tool.

Foundation under difficult circumstances

As with the foundation of HORN France, establishment of HORN UK came about due to the fact that the existing distribution partner was underperforming on our behalf. Even in 1994 the UK was a key export market along with France and Italy. As a consequence Paul Horn GmbH felt obligated to protect its interest in the UK market for the long term. In December 1994 we elected to cover the UK market with own sales facility and personnel. After some negotiation with the former distributor, an acceptable agreement was reached that opened the door to commencement of sales activities as HORN UK. Finding suitable premises proved surprisingly difficult – the original choice fell through one day before we intended to move into the unit. So within 24hrs we had to find a new location and we were able to secure a new space in New Milton, Hampshire. HORN UK finally opened for business in March 1995.

Growth and Pilot Project

A compact, highly efficient structure allowed HORN

UK to achieve a good sales performance in a relatively short time. This justified recruitment of additional personnel, particularly for outside sales. Very soon, with the additional personnel and the improving image and awareness of the HORN brand in the market, sales volume grew rapidly. The general and financial situation of the company became very strong, vindicating the initial decision to establish HORN UK. In addition, the English management began to make a case for developing a small manufacturing capability at New Milton. The rationale for this was to establish HORN UK not just as a sales and distribution unit, but also as a manufacturer; this, it was argued, would offer the possibility of improved customer service, particularly on special tools. The strategy held some appeal for Paul Horn GmbH. Contrary to the “Go East” manufacturing mentality that already existed in 1996, we were keen to show the market that it remains possible to produce competitively priced cutting tools economically in traditional manufacturing areas. Our experience has shown that this was and still is the case.

By the end of 1996 HORN UK was able to produce inserts on a small shop floor area embracing two



Picture top left:
Building HORN UK

Picture top right:
Production

product types: Production of standard inserts of Type 217, Production of special inserts in small quantities for the UK market. To support this it was necessary to employ highly skilled machine operators and make a modest investment in manufacturing equipment. The success of the venture laid the foundation of subsequent UK manufacturing developments.

Extensions and Implementation of SAP

Continued successful growth of the business necessitated a move into new premises in 1999 in Ringwood, Hampshire. This remains the current location of HORN UK. Starting from 1st January 2004 HORN UK was also connected to the company-wide SAP System. In September 2004 an additional extension to the building was completed. This step brought the available floor space for commercial, training and manufacturing activities up to 1200 m2. The extension made it possible to add 8 machines on the shop floor to produce all standard MINI inserts in the UK now. The manufacturing side of the project was perfectly executed from the maintenance department in Tübingen, where the entire system was assembled and pre-commissioned prior to shipment and installation. Today, HORN UK employs approximately

40 people in all and has total sales volume of more than € 7.5 million. We are already a market leading company in the UK for grooving tools. This has been achieved against a background of the metal cutting market in the UK reducing by almost 17% over the last four years. Contraction of the market has partly been attributable to production transfers to Asia and Eastern Europe by OEMs. This has led to closure of major manufacturing sites and reduced the volume of work available to subcontract suppliers, some of whom have been forced to cease trading.

In spite of these negative influences, HORN UK has been able to continuously grow its sales volume as well as its share in the market. Its success can be explained in terms of the appeal of the product to forward thinking manufacturing companies who value the high performance and consequent cost benefits of the tooling. The aerospace sector and others employing exotic materials have been highly receptive, while HORN UK's capability to develop and supply high performance special tooling has brought it a large number of satisfied customers. As mentioned in the beginning, continuity is the key to the success and because of that HORN is correctly entitled to carry the expression also in the UK and Ireland to be the "Leaders in Grooving Technology".

From left to right:
Mike Green,
National Sales Manager
HORN UK.

Vince Lodge,
Production Manager
HORN UK

Tony Butterworth,
Technical Manager





HARD SPECIALITIES FROM GOMARINGEN

Just a small selection
of special inserts
produced in Gomaringen

Our manufacturing facility for tipped tools

Approximately 15 mins. by car to the south of Tübingen is located the town of Gomaringen. In this small town at the edge of the Swabian alp Paul Horn started to produce carbide grooving tools in 1969. Today our “Speciality Department” manufactures CBN- and PCD tipped inserts in this historic facility.

Small, clean and highly productive

Within the organisational structure of HORN the Gomaringen plant is part of our general production facility and falls under the responsibility of Mr. Walter Wiedenhöfer. Under the supervision of Mr. Aribert Schroth 20 employees manufacture mainly custom-designed grooving inserts.

Very high skill levels and technical competence mean they are able to produce even the most complex insert geometries to very high quality standards.

All special inserts are based on standard catalog inserts. After the technical planning and design in Tübingen the real profile is produced in Gomaringen. How this is done – by CNC grinding, manual grinding or by wire erosion – is defined by the team headed by Aribert Schroth.

Latest CNC Machines and manual skills

Two newly installed full 6-Axis CNC grinding machines, as well as older manual and CNC grinding machines are available for manufacture of inserts and rotary symmetric tools. The grinding technology of the CNC machines includes contact pressure control and in-process gauging which corrects the dimensions automatically – allowing very precise grinding of the geometries.

Grinding CBN-/PCD tipped inserts means manufacturing the inserts with tolerances of $< 5 \mu\text{m}$. An alternative to grinding the cutting edge profiles is provided by two wire erosion machines. Whether an insert is ground or manufactured by wire erosion depends on the complexity of the profile and the most cost effective manufacturing route.

Production and quality control are carried out in a climate controlled room with a maximum temperature variation of 3°C . For the end-user this guarantees a high level of dimensional repeatability, providing the basis for production of high precision components.

Measuring and documenting manufacturing results

Not all profiles can be economically produced on CNC machines. Often our employees can produce the smallest details and specific contour sections easier and faster on the manual universal grinding machines. Their skills are central to being able to produce individual profiles in small quantities very economically. Independent of the manufacturing process all cutting edges are measured on a video measuring machine. With this technology it is possible to compare the profile of the designed tool with the manufactured tool. This measuring technology and the skills of our employees make it possible to measure even the most complicated shapes and profiles.

Special profiles facing increased demand

Usually it is necessary to produce between 5 and 20 inserts for cutting tests. This number can easily increase up to 100 pcs. depending on the complexity of the trials and the requirements for adjustment of the insert geometry. In fact, the number of inserts requested from customers for trials are continuously growing. To manufacture the inserts economically



Working area of the 6-Axis grinding machine.

and to comply with delivery schedules a team centred approach plays a highly important role. Moreover, because time is of the essence the Gomaringen facility normally works with a 3-shift system to provide maximum flexibility.

Tooling Systems for all applications

With the increasing complexity of applications the demands placed on the Gomaringen facility grow. One of the key aspects is the grinding of CBN inserts. Due to the fact that we have very well organised production we are able to offer a very wide program of CBN types for different applications, and provide the best combination of insert, toolholder, carbide grade and coating.

And if we can't satisfy the customer with the most comprehensive standard range of grooving tools available our Team in Gomaringen will produce the special tools in their own way: competent, fast, precise and economical.



Erosion of a CBN special insert. The diameter of the wire is 0,03 mm

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Hartmetall-Werkzeugfabrik

Paul Horn GmbH

Postfach 1720

72007 Tübingen

Tel.: 07071 70 04-0

Fax: 07071 7 28 93

E-Mail: info@phorn.de

www.phorn.de

HORN France S. A.

665, Av. Blaise Pascal

Bat Anagonda III

F - 77127 Lieusaint

Tel.: +33 -1-64 88 59 58

Fax: +33 -1-64 88 60 49

E-Mail: infos@horn.fr

www.horn.fr

HORN UK

32 New Street

Ringwood, Hampshire

GB - BH24 3AD, England

Tel.: +44 -1425-48 18 00

Fax: +44 -1425-48 18 90

E-Mail: info@phorn.co.uk

www.phorn.co.uk

HORN USA Inc.

Suite 205

320, Premier Court

USA - Franklin, TN 37067

Tel.: +1 -615-771-41 00

Fax: +1 -615-771-41 01

E-Mail: sales@hornusa.com

www.hornusa.com

FEBAMETAL S.p.a.

Via Grandi, 15

I - 10095 Grugliasco

Tel.: +39 -011-770 14 12

Fax: +39 -011-770 15 24

E-Mail: febametal@febametal.com

www.febametal.com

HORN Magyarország Kft.

Szent István út 10/A

HU - 9021 Győr

Tel.: +36 -96 -55 05 31

Fax: +36 -96 -55 05 32

E-Mail: technik@phorn.hu

www.phorn.hu