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THINK PARTS – **THINK TORNOS**

Stryker Production backs.Tornos and Schwanog

G96 used for cutting on the DECO [a-line] machine

The strategic vision of Tornos

Single spindle or multispindle two systems that complement one another

THINK PARTS – **THINK TORNOS**

Summary

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Two machines make UK debut for Tornos

The MACH 2006 exhibition in the Birmingham NEC, UK in May is the bi-annual showpiece event of UK manufacturing. Co-located with the UK's major event for subcontractors – Subcon 2006, the exhibitions will undoubtedly highlight the latest technologies available in the UK marketplace.

John McBride at MACH 2004 showing customers a DECO 26a.

At the MACH exhibition on stand 5076, in hall 5, the Swiss sliding head turning centre specialist Tornos will have its first opportunity to present two exceptional new machines to the UK. Tornos will present the new Tornos DECO 8sp and the DECO 20s – the first machines of the new S-line range. Tornos will also exhibit the DECO 26a 10 axis turning centre.

The first machine launched in the new S-Line range is the DECO 8sp. The 8sp is world's first 10mm capacity single spindle CNC sliding head lathe without guidebush. With five linear axes, the DECO 8sp provides an excellent price-to-performance ratio whilst the kinematics have been adapted to execute reasonably complex parts. It is a technological solution that allows Tornos to offer an automatic lathe that guarantees a degree of precision of ±1µm (0.001mm) never seen before! The Tornos 8sp addresses new markets such as the electronics and especially the hard mini-disk sector for mobile IT applications

The second machine launch of the new S-Line range, the DECO 20s is designed to execute relatively complex parts up to 25.4mm diameter. The programming and kinematics of the DECO 20s are geared towards simplicity, which is coupled with strong mechanical elements to guarantee high precision. With 6 linear axes, the 20s has been designed for producing reasonably complex parts with an excellent price-to-potential ratio.

Numerous market studies were conducted and the DECO 20s is the resulting machine that is well suited for the automotive, medical, electronics and connector and general manufacturing sectors. The considerable strength and power provide the lathe with a very large machining capacity. Another important aspect is its versatility - the machine has 22 tool positions and a high level of interchangeability to give the DECO 20s exceptional flexibility.

These two new machines are undoubtedly set to make a huge impact at MACH 2006. On the Floyd Automatic Tooling stand will appear a fourth Tornos machine, a DECO 26a. This machine will be equipped with the Applitec Modu-Line quick-change pre-settable tooling program system on static display. This will enable visitors to get a 'hands on' experience of this exceptional tooling concept that compliments sliding head turning centres. For further details please contact Tornos or visit us on stand 5076.

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Synergy and cost cutting to perfection:

Stryker Production backs Tornos and Schwanog

Josef Baumann and Roland Reuter during a brainstorming discussion.

How continuous striving for improved efficiency and cost cutting through synergy partnerships produces tangible results, is impressively demonstrated by Stryker Leibinger GmbH & Co. KG in Freiburg. As a German subsidiary company, Stryker Leibinger is part of the Stryker Corporation based in Kalamazoo, Michigan, USA, and is considered throughout the world to be one of the most outstanding companies in the orthopaedic and medical-engineering market.

The product range is distributed across the specialist areas of endoprosthetics, traumatology, spinal surgery, instruments, microimplants and endoscopy. Other important areas include the fields of biotechnology, navigation and medical accident treatment. By cooperating closely and in partnership with leading surgeons, Stryker Leibinger has succeeded in becoming better known and enhancing its reputation as one of the leading suppliers in the development and marketing of top products for oral and maxillo-facial surgery, as well as hand surgery.

In order further to consolidate this leading market position, the company is now concentrating on the research and development of osteosynthetic systems, biomaterials, traction systems and computer-controlled navigation systems. The corporate culture is marked by a permanent drive for continuous improvement at all corporate levels. In an integrated optimisation system covering all Stryker companies worldwide, the production division of Stryker Leibinger, with the manufacture of high-precision micro-products, such as bone screws for skull plates, represents a challenge at the highest level. Roland Reuter, Tornos sales manager southwest, has been looking after Stryker Leibinger for more than 10 years. More than 40 years experience in the machine tool industry and more than 20 years sales experience in capital investment goods, form the sound basis of the Reuter synergy philosophy.

Hans-Joachim Günther and Roland Reuter during project optimisation.

Enthusiasm about the use of Schwanog whirling cutters on the DECO 10.

Clemens Güntert in conversation with Max Bühler and Heinz Buhl.

Together with Hans-Joachim Günther, the Tornos Technology Manager for Germany, considerable cost savings were achieved in several technological stages. Working with the Stryker Leibinger team that included Josef Baumann, System Manager Implants, Deputy Max Bühler and machine setter, Heinz Buhl; the latest Tornos machining centres were deployed. With its automatic sliding headstock lathes, multispindle automatic lathes and bar feeder magazines, Tornos has been a leader in the market for more than 120 years. Typical Tornos applications can be found in high precision industries, such as medical engineering, the horology industry, dental engineering, the automotive industry and connector engineering. Tornos DECO automatic sliding lathes offer maximum productivity, outstanding precision, a large number of modular options with models of up to 12 axes and make it possible to achieve outstanding technological processes. For example, at Stryker Leibinger, the previously costly manufacture of high-precision screws in three different production stages, some of it on different special machines, was successfully replaced. Utilizing the Tornos DECO 10a automatic sliding lathe, all production stages are performed on the one machine. This alone led to a huge saving in costs of more than 40 %, which gave the subject of amortisation an entirely new meaning.

Josef Baumann, System Manager Implants:

"The many years of co-operation with Reuter/Tornos is marked by trust, first class advice from Roland Reuter, together with Hans-Joachim Günther and unparalleled willingness on the part of the entire team to keep analysing and, in this way, to generate new synergy and common-sense effects."

In the case study described, the main task was to achieve additional cost benefits in the production of micro-radius bone screws on a Tornos DECO 10a.

For this, the Schwanog company was brought in as a networking partner. This company has achieved

Motivated Stryker team.

Synergy and cost cutting to perfection:

Stryker Production backs Tornos and Schwanog

Schwanog whirling head with high precision screw.

an excellent reputation in the industry as a specialist in form tool insert systems and also in highly efficient thread whirling. Managing director, Clemens Güntert and his team, faced up to the challenge of achieving double-digit cost cutting targets for bone screws with radii of 0.04mm. Up to now, traditional rotary form tools with 3 blades have been used at Stryker Leibinger. The Schwanog WEP-insert system is based on an entirely different design approach. Depending on machine size, Schwanog whirling heads are fitted with 5 or 6 insert cutters. Unlike conventional circular form tools, in the case of the Schwanog system only the inserts are turned when they become worn and thereafter they are replaced. This system simultaneously offers several benefits:

- Given the same feed rate per tooth, the manufacturing time for the thread can be halved, using the Schwanog system.
- Significant increase in tool life through using 5 or 6 faces instead of 3 cutting tools.
- Noticeable cost reduction as there is no complicated regrinding and expensive recoating.
- Marked reduction in setting up times because circular form tools do not have to be set to centre heights.
- Significantly quieter running because of the greater number of cutting edges.
- Further cost saving because cutting edges can be changed quicker using just one screw.

As a result of the successful changeover to the Schwanog WEP system, the tool life for radii of 0.04mm with implant steel 1.4441 was increased 10-fold, meaning that cost benefits of more than 30 % were achieved.

Heinz Buhl, Machine Setter:

"In view of the extremely strict requirements placed on radii of 0.04mm, the integration of the Schwanog WEP system was a very ambitious task. What was more surprising was how easily the changeover took place and what enormous time and cost advantages could be obtained."

Working with titanium a noticeably longer tool life is achieved, even in the test phase, so that the specialists and engineers involved from all three companies are sure that they can achieve the break-through to significantly improved economy within a short period.

Max Bühler, Deputy System Manager, Implants:

"What fills me with such enthusiasm about the co-operation with the Reuter/Tornos team and Schwanog, is the fact that all the partners are actively looking for solutions without being asked, which will enable our company to produce more quickly and more cost effectively and will therefore make us more successful in the market."

This example shows what enormous potential cost savings can be achieved even today, when philosophy, team spirit, the will to succeed and technology are in perfect harmony.

A summary of the optimisation stages:

1995:

The bone screws are turned on technologically uniform CNC automatic sliding lathes. In a second stage, the blanks are machined on a special machine with 4 and 6 edges. The threads are whirled on another special machine in a third process.

Disadvantage:

- Long stock storage times between manufacturing stages.
- Costly machining.
- High stock costs prior to each work stage.

1996:

Roland Reuter and Hans-Joachim Günther analyse the production sequences with the Stryker Leibinger team around Josef Baumann, System Manager Implants, Deputy Max Bühler and Machine Setter Heinz Buhl. By investing in 5 Tornos ENC 75 centres, the aim of automatic machining of bone screws, including thread whirling, using circular form tools becomes a reality for the first time.

Advantage:

- No more costly downtimes between production stages.
- Distinct cost saving.

1997:

In spite of the investments made the previous year, Stryker Leibinger follows the technology leap with the market launch of the revolutionary Tornos DECO machines. Intense teamwork and co-operation that goes way beyond the norm backs a completely new machine concept, using the new Tornos DECO10 generation.

Advantage:

- Time saving of more than 40 %.

2004:

As a result of further co-operation between Roland Reuter and Schwanog, specialist in form tool change systems, a new optimisation target is defined for Stryker Leibinger. With the advent of the Schwanog whirl cutters, further double-digit cost advantages are to be achieved.

- Following intensive tests with Schwanog thread whirling cutters, the conventional whirling at Stryker Leibinger is replaced.
- With Schwanog thread whirling cutters cost advantages in excess of 30 % are achieved with implant steel 1.4441.

Example of the use of the Stryker screw range.

2005:

The synergy team has set as its target, the production of bone screws with radii of less than 0.04mm at considerably lower cost in titanium. The first tests under these extremely exacting requirements, in terms of precision and quality, are so promising that the team is sure of success.

If you have any questions, please contact:

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How to maximise performance!

Each year, the market demands a reduction in unit costs of machined parts. In order to meet this requirement, productivity must continually be optimized.

Improving productivity is not only achieved by deploying more highly efficient machines like the new DECOs and MULTIDECOs, but also by having a perfect understanding of the production process. In order to automate and to secure the collection of production information, various companies specialise in developing production-monitoring software packages.

Production monitoring

To meet this requirement, Tornos is offering two interfaces for the automatic collection of data from the DECO [a-line] and MULTIDECO machines:

- Electric interface.
- Ethernet interface.

What is the purpose of this information?

This information is made available by the machine to monitor production and calculate the OEE (MDE/BDE in German and TRS in French).

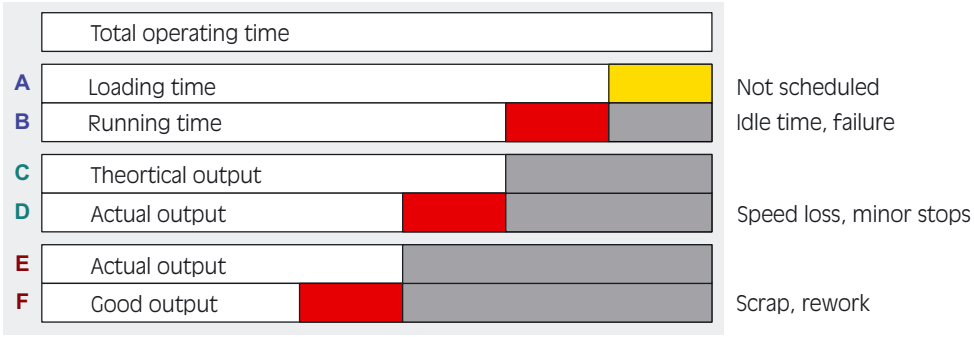
OEE: Overall Equipment Effectiveness.

MDE/BDE: Maschinen- / Betriebsdatenerfassung.

TRS: Taux de Rendement Synthétique.

What is OEE?

The OEE is obtained from three levels that determine the productivity of the machine.



OEE = B/A x D/C x F/E

B/A: Level of availability

The level of availability is the ratio between the scheduled duration of use of the machine and the time the machine is in production. Various factors influence this level:

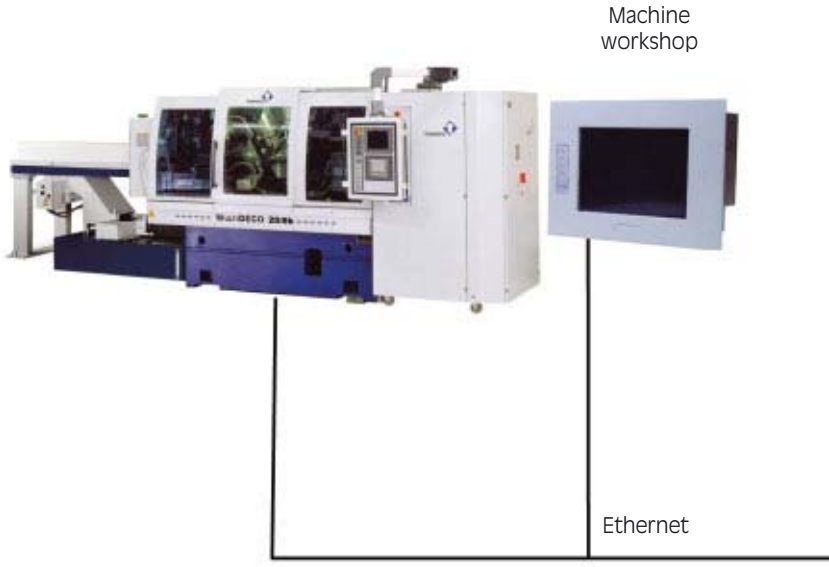
- Setting up time.
- Breakdown, servicing and preventive maintenance.
- Coffee/lunch breaks.
- Staff expectations (operator, technician, head of workshop, customer services).
- Document expectations: quality, tooling or material validation.
- Change of shift.

D/C: Level of performance

The level of performance is the ratio between the time the machine is running and the theoretical time, provided there is no loss in productivity. Different factors influence this level:

- Tool change (wear or tool breakage).
- Removal of swarf that has accumulated around the tool.
- Emptying the swarf container.
- New bar feed.
- Increase in part cycle time owing to a technical problem.

How to maximise performance!



F/E: Level of quality

The level of quality is the ratio between the number of good parts and the total number of parts produced. This level may be calculated either by sampling or by carrying out a 100 % inspection.

Electrical interface

The electrical interface is the basic solution for collecting information. It has the benefit of being compatible with all the production monitoring products on the market. However, its disadvantage is that it is very much limited to the volume of information available. An option offered by Tornos allows you to read three different types of information:

- Machine is switched on.
- Machine is in production.
- Part counting pulse.

For the DECO [a-line] machines, the electric interface also has an input to prevent the machine from going into production mode. This function is useful if you want the reason for the machine stoppage to be indicated before starting up. For this purpose, an operator's panel (not supplied by Tornos), containing all the reasons for machine stoppage can be fitted alongside the machine.

Ethernet interface

The Ethernet interface is the advanced solution to gather information. It offers the advantage of automatically providing a large volume of information. The drawback is that it requires an Ethernet connection to the machine and it offers a more elite solution, which is not supported by all production monitoring software.

Tornos is currently co-operating with ICAM (www.icam.ch), which has adapted its production monitoring software package. ERP (Entreprise Ressource Planning) software packages will likewise be adapted so this information can be collected automatically.

OPC Tornos server

Communication between the DECO [a-line] / MULTIDECO machines and the production monitoring software is by way of software located on a server – the "OPC Tornos server". This software automatically gathers a series of data through the Ethernet, which is made available to the server in a standard format that is compatible with the OPC standard. This method of working significantly simplifies the work of adapting production monitoring software packages.

OPC: OLE for Process Control (www.opcfoundation.org).

Principle of operation

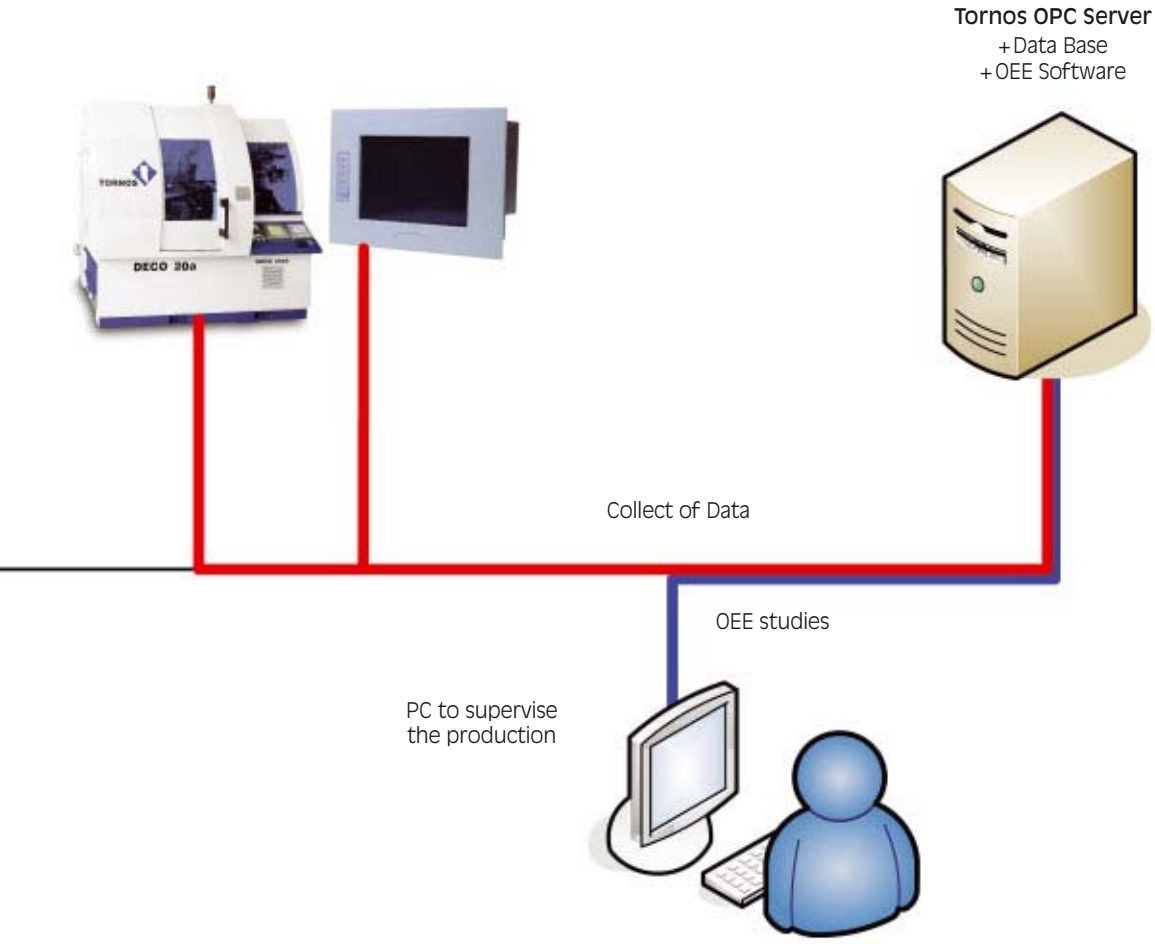
The DECO [a-line] and MULTIDECO machines are connected to a server by an Ethernet network. The "OPC Tornos server" software automatically collects the production data from the different DECO [a-line] and MULTIDECO machines. This information is then made available on the server.

The monitoring software then reads this data and saves it to a database and edits the production monitoring reports.

Generally speaking, such production monitoring systems (not supplied by Tornos) are completed by operator panels that highlight additional information.

Ethernet

All the DECO [a-line] and MULTIDECO machines fitted with a memory card reader can also be fitted with an Ethernet connection. Only some DECO 7/10 machines do not have the memory card reader and consequently cannot be connected to the Ethernet network.



Data collected by the OPC Tornos server

Production information

- Machine switched on.
- Machine in production.
- Number of batch parts machined.
- Number of batch parts remaining to be machined.
- Total number of parts produced on the machine.
- Machining area door open.
- Motor area door open.
- There is no bar in the bar feeder.
- Machine in pre-heating mode
- Axes override at 100 %.
- Modification to a tool offset.
- Modification to spindle shift.

Information on the part

- Date and time of loading the last program.
- Name of part program.
- Part cycle time.
- Name of TB-DECO machine database.
- Part length.
- Part diameter. *
- Material machined. *
- Part drawing number. *

Machine information

- Type of CNC.
- Machine identification number.
- Type of machine.
- PMC software version.

** Information available if indicated in the TB-DECO part program.*

An unrivalled solution

With the "OPC Tornos server" software, you now have the most complete automatic information-gathering solution available on the market. This solution offers unrivalled reliability in monitoring production, thereby making work much easier for the operators and machine setters. This efficient interface will later be extended to the DECO [s-line].

Precision due to optimal cleaning

EgaClean - Amsonic's hydrocarbon technology is the result of applied research into the replacement of toxic, chlorinated solvents. Below is a successful case study of how this system has been implemented in the UK.

Technoturn is a company based in Hastings (England) that has been producing precision turned parts for 10 years. In 1998 the company made its first move into CNC manufacture, when the CEO saw an article in a magazine about a company that was operating 24/7 unmanned, he thought: "Why can't we do that here"?

Ongoing investment in CNC machines allowed for a rapid development and an increased production capacity. But this increased production brought its own problems, especially concerning the cleaning of the parts. So David McIlwain, Technoturn's Managing Director, looked at the market for an efficient, productive, labour saving and environmentally friendly cleaning solution.

The answer was a fully automatic ***Amsonic EgaClean 4100*** cleaning machine. "Until now, the parts have been cleaned manually with trichloroethylene. With the new cleaning machine, the weekend's production can be cleaned by Monday instead of Tuesday afternoon. Our customers get cleaner products that are environmentally friendly and we get a quicker, cleaner and fully controllable process that is much less labour intensive. The ***EgaClean***'s productivity and efficiency are extraordinarily high" says McIlwain.

The ***EgaClean*** single chamber cleaning machine uses Isoparaffin, a non-chlorinated AIII solvent. The cleaning quality has been increased compared to the manual cleaning with trichloroethylene.

The EgaClean process consists of the following steps:

- Immersion cleaning with hot solvent (above the flashpoint) with ultrasonics and micro filtration.
- Vapour phase.
- Vacuum drying.

Technical data:

- Cycle time: 7-14 min.
- Basket weight: up to 50 kg.
- Basket movement: Rotating, oscillation, static.
- External dimensions: 2560 x 1335 x 2050mm (B x L x H).
- Concentration of C in mg/m²: 10.8.
- Hydrocarbon film in Nm: 13.8.
- PC control with process documentation, visualisation of the machine and modem connection.

Cleaned parts.

Pollution in mg C	0.032
Pollution in mg C/m²	10.8
Hydrocarbon film in nanometers	13.8

EGAclean 4100 in use at Technoturn.

A new generation of cleaning equipment

The ***Amsonic***'s ***EGAclean*** concept uses the Isoparaffin's (class AIII) high temperature to increase its dissolving effect on oils and greases. The continuous distillation saves solvent and guarantees a consistently high cleaning quality. The progressive elimination of chlorine additives in cutting oils and their replacement by other additives that are not compatible with chlorinated solvents shows the efficiency of AIII solvents compared to tri- or perchloroethylene.

It only remains to say that the hydrocarbon nano-film on cleaned parts is a perfect protection against corrosion for approx. four weeks. Plating, welding, gluing, heat treatment, physical vapour deposition (PVD) and CVD coating are amongst the most common working following an ***EgaClean*** cleaning process.

Specification of costs:

Cleaning costs	0.041 M/kg
Productivity Basket dimensions	approx. 200-300 kg/h 520 x 320 x 200 mm
Yearly consumption Emissions in the air	200 litres of Isoparaffin (Distillation sump is burnt in cement factories) 1.7 kg VOC per year
Yearly power consumption	approx. 17'000 kWh

Amsonic
Precision Cleaning

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Electric spindles for the DECO

This unit does not have an option number. If you are interested, please contact your Tornos salesperson.

Application

In order to extend its machine facilities, Tornos is constantly offering new upgrades. Tornos now allows you to discover the latest deployment of high-speed spindles, also known as electric spindles or even high-frequency spindles.

The use of these spindles is particularly recommended for machining small components that have to be executed with great precision and at a very high output. The spindles are ideal for micro-drilling or micro-milling in steel, titanium and additional difficult to cut materials. This application has now been extended to spindles with even greater diameters than those used for micro-machining operations. We are talking here of spindles with a diameter of up to 60mm that can also guarantee more consistent machining.

Advantage points

- Provides a significant increase in output coupled with excellent part quality.
- Generates little burring therefore leading to a good surface finish.
- Allows extreme operations to be executed.
- Ensures optimum tool life.
- Work area is freed up.
- The small size allows the spindles to be fitted to different tool systems, both for bar operation and back-operation.
- Does not impinge on the space required for other tools.
- Simple to install thanks to a tool holder block that has been turned to the diameter of the spindle being fitted.

Remarks

The electric spindle is operational through a synchronous motor with independent supply and it is fully sealed against the cutting oil.

An additional enclosure is required for the spindle supply, comprising of a generator to check the speed of rotation and a cooling system for large diameter spindles.

Technical characteristics (according to the type of equipment fitted):

- Speed: 5,000 to 100,000 rpm.
- Spindle power: 150 W to 1.2 kW.
- Machining diameter: 0.1 mm to 12 mm.
- Bearings: precision bearings lubricated for life.

Compatibility

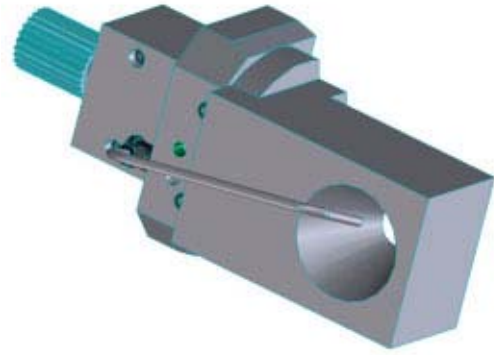
Compatible with all the single spindle and multispindle Tornos lathes, but essentially with the DECO (single spindle).

Availability

Available upon request.

24° whirling unit

This unit does not have an option number. If you are interested, please contact your Tornos salesperson.



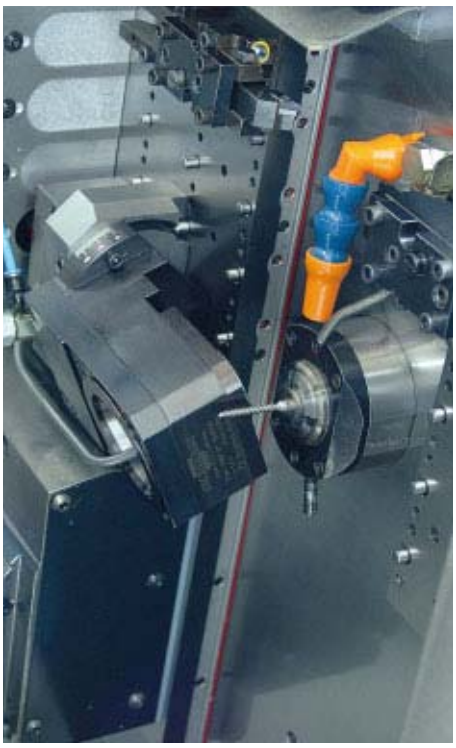
Application

This whirling unit is used for the series machining of double threads with a helical angle of 15° to 24°, both internal and external, of parts made from stainless steel or titanium.

Therefore, it is surprising that roughly 90 % of threads in the dental and medical industries are now whirled. This process is also applied to industries such as the aeronautical, automotive and horology sectors.

Strong points

- It is more economical and more precise than conventional thread cutting.
- Enables machining of double threads with a helical angle of 15° to 24°.
- Leads to a reduction in costs as reworking operations are dispensed with.
- Very good quality surface finishes are obtained.



Remarks

- This unit requires air-oil lubrication. Note: it goes beyond the standard tool lines and therefore requires extremely accurate handling.
- The cutting fluids play a major part in obtaining longer tool life and excellent surface finishes. If you have any questions please do not hesitate to contact your Motorex agent or other specialists.

Technical characteristics

- Location: The unit occupies 2 positions, T24 and T25 + 1 standby position T26.
- Max. speed: 5,000 rpm.
- Reduction: 36-toothed pulley = a reduction of 1.5.
- Max. torque: 16 Nm.

Compatibility

DECO 20a and 26a.

Availability

Immediately available ex-works.

Taking on the world

Maintaining a competitive edge, and as important in today's climate – to prevent work migrating to Asia, Diamant Precision Engineering Ltd of Tilehurst, Reading has purchased a series of Tornos sliding head lathes.

When the ISO9001 company felt the need to improve its productivity in 1999, the aerospace manufacturer started its successful relationship with Tornos by acquiring a Tornos DECO 20 sliding head turning centre.

"A lot of our competitors have lost work to Asian markets and to steer clear of this and prevent work going East, we have invested in the latest machine tool technology. After buying our first Tornos we instantly recognised its value to our business. This move has enabled us to concentrate on high technology sectors and high value parts. Since this introduction we have also purchased a Tornos DECO 13 for small components and two DECO 26 machines for turned parts up to 32mm diameter," says John Dewhurst Managing Director of Diamant Precision Engineering Ltd.

The new Tornos machines have enabled Diamant to diversify into alternate sectors and niche markets that were previously outside the company's scope. Now, Diamant Precision predominantly manufactures seating, undercarriage pins and related components for the aerospace sector with additional work being conducted for the motor racing, transducer and general subcontract industries.

Working in high technology sectors may reduce the impact of the cheaper Asian economies, but the price for this security buffer is a need for high specification machine tools capable of machining intricate components in one-hit. Not only do the Tornos machines provide the capability to machine parts in one-hit, the rigid and robust build of the machines allow Diamant Precision to cut 303 and 431 stainless steels as well as additional difficult to cut materials with speed, precision and excellent surface finishes.

"We manufacture batches that run from a couple of hundred up to 2000. When making batches of this size the Tornos machines are quick to set up and change over to

alternate parts; whilst the productivity is second to none," continues Mr Dewhurst.

When asked why the company selected Tornos machines for its machine shop, Mr Dewhurst continues: "When we were initially looking for turning centres, we looked at numerous machines but we really liked the Tornos TB-DECO programming system. Unique to Tornos, the programming software is easy to use and efficient. Another factor that drew us towards the Tornos machines was the company's excellent reputation."

"Tornos are renowned for high quality machine tools and our operation has benefited from this superior quality. We were also keen to purchase a machine from a European manufacturer. However, the most important aspect of any machine acquisition is the cycle times and Tornos proved significantly quicker than the other sliding head lathe manufacturers in the market," concludes Mr Dewhurst.

Diamant Precision Engineering Ltd

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Tornos cuts cycle times for BTMA member

As a fifth generation family business and BTMA member, Herve Engineering Ltd can boast a distinguished history of supplying high quality turned components to customers the world over. Today, one way the ISO9001 registered and accredited company competes successfully in the face of low cost global competition is to deploy 13-axis CNC sliding head auto technology from Tornos.

Founded in 1850, the current managing director of Herve Engineering, Ken Herve is undertaking the guardianship of this respected sub-contract manufacturer. Based in Shoeburyness, Essex, Herve Engineering is currently enjoying a period of growth and stability and in 2004 the company witnessed growth in the region of 17 percent: turnover currently stands at £1.2 million.

Part of the reason can be attributed to the company's planned programme of investment in recent years, which has included the acquisition of two NC automatic, single spindle sliding headstock lathes with counter spindles from Tornos, a DECO 26 and DECO 20.

"Before we bought the DECO machines we assessed the marketplace and decided that they were the fastest machines available for the type of work we wanted to do. We looked at other models but Tornos appeared to be the pioneers of rapid movement. At Herve we have always believed in trying to be the leader rather than the follower and it was apparent that Tornos had the same philosophy," explains Mr Herve.

Buying two different size capacity DECO machines reflects Herve Engineering's ambition to offer the marketplace as much flexibility as possible. "One of our strengths is that we have never concentrated on one particular 'envelope' of component size," continues Mr Herve. "It's a policy that has put us in a very strong market position and maximises our opportunity to capture and maintain new customers. After all, while we always welcome new orders, it's the customer's second and subsequent orders that we really want."

Today the two DECO machines fed by Tornos Robobar bar feeders are kept busy producing turned parts in batches of 1500 and above to industries such as electrical/ electronic, automotive, domestic appliance and gas. Typical materials include a selection of mild steels and non-ferrous metals as well as some stainless steels.

Tolerances are tight in keeping with the precision nature of the components being manufactured, 0.01mm in some instances depending on material.

Although the machines run 24 hours a day whenever possible, the biggest benefit offered to Herve Engineering is the completion of turned parts in a single operation. "While we could manufacture these parts before we had the Tornos machines, lead-times were longer because of the multiple set-ups required," he says. "Using the counter spindle and back operation functionality of the DECO machines has represented a halving of many cycle times at Herve. For instance, one particular stainless steel shaft we make features two tapped holes passing through a milled flat. Today this part takes 60 seconds to complete on the DECO 20 whereas before it was a two or three operation job. The machines have also allowed us to pursue more complex work."

Herve Engineering is a good example of UK manufacturing fighting back. "Despite all the obstacles put in front of us, such as the minimum wage, rising energy costs, rising raw material costs and endless legislation and red tape, we're still competing, we're still investing and we're as busy as ever. I can't emphasise enough the importance of investment. Our Tornos DECO machines particularly, have ensured that we can compete on a productivity level with anyone in the world," concludes Mr Herve.

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G96 used for cutting on the DECO [a-line] machine

The G96 function, which provides a constant-speed cutting operation, has been incorporated in the ADV 2006 version of the TB-DECO. The function is associated with G92 and G97 and is described in the programming help of the TB-DECO ADV 2006 software package.

Specific application for single spindles machines

An interesting case regarding the use of G96 is part cutting at a constant cutting speed, especially for large bar diameters (DECO 20, 26). It is also very useful to have this function when carrying out initial cutting following a RESET and whilst the new bar is being cut by the macro G914. This article describes how to adapt an existing part program so that bar cutting can be executed with G96 in active mode, in the following three cases:

1. following a RESET in the INIT program (G910),

2. for each cycle, during the part cutting operation,

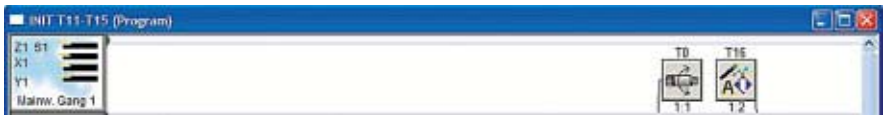
3. when cutting the new bar (G914).

1° Following a RESET in the INIT program (G910)

Steps to be taken to execute the initial cut in constant cutting speed mode G96:

1. Open the INIT program.

2. Search for the operation containing the G910 macro (generally last operation of the 1st line of operation).



3. Modify the ISO code as shown below:

~~G96~~	**G96**
G900	G92 S6000
G901	G96 S120
M8	G901
G4 X5	M8
G910	G4 X5
M800 P1=-1874	G910
	M800 P1=-1874

The code G92 limits the maximum spindle speed. The cutting speed is indicated in [m/min] or [feet/min] in the S-instruction according to G96.

2° For each cycle, during the part cutting operation

1. In the main program, open the cutting operation (in our example 1:9) and enter the following ISO code:

~~G96~~	**G96**
G1 X1=#2032 G100	G96 S120
G1 X1=2 F0.07	G1 X1=#2032 G100
G1 X1=-0.5 F0.05	G1 X1=2 F0.07
	G1 X1=-0.5 F0.05 M103 S2000

2. The M103 S2000 control on the last ISO code line is necessary to prevent any looping error for spindle S1. The value must correspond to that featuring in the window «initial spindle speed» for S1.

3rd icon from the left

Tip: Using G96 means that you can dispense with using the G904 macro that was hitherto prescribed for part cutting at a constant, pseudo cutting speed.

3° When cutting the new bar (G914)

In order to cut the new bar at a constant cutting speed, after loading via the bar-feeder, macro G914 has undergone adaptation. A new parameter, P5, is available:

P5 = Cutting the new bar at a constant cutting speed. If P5=1 actuation of G96 for cutting the new bar at a constant cutting speed.

The cutting speed in [m/min] or [feet/min] will be entered in parameter P4.

Steps to be taken to cut a new bar in constant cutting speed mode, G96:

1. Open the NEW_BAR program

2. Open operation 1:1 containing the G914 macro

3. Modify the ISO code as shown below:

~~G96~~	**G96**
G901	G901
G914	G92 S6000
	G914 P4=120 P5=1

The G92 code limits the maximum spindle speed. The cutting speed is indicated in [m/min] or [feet/min] in the S-instruction according to G96.

Remark:

Consult programming aids for functions G92, G96 and G97 and G914 of TB-DECO in addition to the above article.

The strategic vision of Tornos

Meeting with Mr. Raymond Stauffer, Tornos CEO

From left to right, Mr. Raymond Stauffer CEO, Mr. Frôté, chairman of the board and Mr. Maquelin, CFO/COO at the conference of 21st March 2006.

The products that were recently launched by Tornos incorporate new characteristics for the company. A range of machines designed to execute much simpler parts, has seen the light of day, both in the single spindle and multispindle sectors. Does this not contradict a range of machines used for more complex machining operations that is also being developed? What is the basis governing these options?

To find out a little more about the strategy governing these developments, DECO Magazine had a meeting with Mr. Stauffer, CEO.

RS: Technological progress must be based on customer require-

New MULTIDECO 20/8d, facility to execute complex parts both in operation and back-operation mode.

ments. It is only if you have an in-depth knowledge of the markets that it becomes possible to provide products that really match requirements. In order to achieve this objective, we place great importance on the close cooperation between our Business Units and Research and Development.

DM: Can we look at these different points in greater detail and do they really set you apart from your competitors?

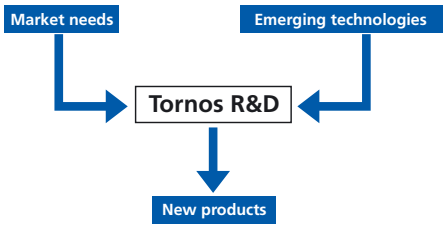
RS: Our overriding concern in this respect is customer satisfaction. To achieve this, it is essential that we always listen to their needs so that we can understand what it is that they are faced with. It is essential that technological developments and innovations stem from market trends, so that our products are fully matched to requirements and working processes. It is the ambition of Tornos to become a real supplier of 'production systems' by adding all the peripherals to the machine that are needed to execute complete operations and to handle the finished parts.

These services include an efficient and effective customer service that incorporates speed and quality. We therefore believe that the After-Sales department is a fully independent 'product'. We want to provide that 'extra' something to our clients.

DM: How do you incorporate market data at Research & Development level?

RS: The creativity of our project team is constantly stimulated by defined requirements, with the order of the day being 'technology to serve simplicity'.

Research and Development activities are also carried out externally by partners working with companies and/or institutions which specialise in different sectors. Project reviews enable a permanent check to be carried out to ensure that our concepts actually comply with real market requirements.



Showing how incorporation between the market elements and technical developments are ensured through R&D.

DM: Some projects seem to be very extensive – how do you deal with these?

RS: We attach particular importance to such factors as client proximity, project management, feasibility studies, reliability, cost analysis, the development of skills and quality aspects. If these are well controlled this will lead to operational excellence!

DM: To conclude, what would you like to say to your clients?

RS: We strongly urge them to inform us of any new ideas, comments and criticisms, because it is only thanks to their co-operation that together, we shall hold the 'key to success'!

A satisfied customer is a good indicator!

Palletization system on the MULTIDECO, an obvious difference to bulk extraction.

The strategic lines of Tornos

- *Considerable market awareness.*
- *Offering the client the right product.*
- *Research and development.*
- *Operational excellence.*

Hidden savings potential:
Cost optimisation on automatic lathes

As a small parts turning professional, you know that the requirements of the market are become stricter day by day. This applies to all areas, from the quality of the parts being produced to the cleaning process. By using the latest automatic lathes, tools and trailblazing MOTOREX ORTHO cutting oil; the hidden savings potential can be utilised and the costs measurably reduced!

Success factor – "automatic, multispindle lathe"

It is well known that conventional, automatic single spindle lathes execute the machining stages of complex parts in sequence. Often the various machining stages are even carried out on several machines. This not only increases the time per part but can also reduce precision because there are several handling and clamping stages.

The basic condition for the competitive production of complex parts is obvious and that is the availability of an automatic multispindle lathe, such as a MULTIDECO 20/8d. A fundamental advantage of this multispindle machine is the 8 motorised spindles, each of which can be individually driven at independent speeds. Therefore, each spindle works at the optimum speed and machining is executed simultaneously. The higher investment cost pays for itself through productivity which is on average four times greater.

Success factor – "new type of tools"

More rapid cutting without risk is now possible with the new type of tool holders and innovative coatings, which are deposited by the

modern PVD process (Physical Vapour Deposition). For example, the throw-away insert, GC 4225 for steel by SANDVIK® made from a gradient sintered substrate with optimum hardness and toughness, in conjunction with an Al_2O_3-coating. This new technology offers extreme cutting edge reliability and, because of the diffusion barrier, outstanding resistance to wear. Because of the extended life of the throw-away insert, fewer insert changes are necessary for the required quantity of workpieces in mass production. Fewer cutting edge changes means increased precision and productivity as well as increased process reliability on large series runs, essential for production without operators.

The innovative potential of the machine tool manufacturers is great and shows no signs of slowing. This, of course, is also reflected in the costs of the tools. The use of innovative new generations of tools, which have established themselves in the market also make sense from a business point of view.

Eight at a stroke; the MULTIDECO 20/8d simultaneously uses 8 spindles, each of which can be driven at independent speeds. The productivity of complex parts increases significantly! Depending on order structure, it is worth evaluating the purchase of an automatic, multispindle lathe.

It makes sense to encase the machine as a whole, including the swarf trough. In modern automatic lathes this is now standard – in the case of older machines, this can be retrofitted. The more "closed" the circuit, the better.

Success factor – "cutting oil of the MOTOREX-ᵛmax generation"

Optimum conditions for maximum efficiency and machining results are provided by the universal cutting oil, SWISSCUT ORTHO, of the ᵛmax-generation from MOTOREX. We will go into this subject in greater detail in order to reveal the latent savings potential:

1. The choice of the right cutting oil

In principle, all materials can be machined with SWISSCUT ORTHO. This means that you only need one machining fluid, therefore greatly increasing the flexibility in planning the use of machines and reducing handling and storage costs.

2. Optimum cutting data thanks to ᵛmax-technology

Together with more powerful automatic lathes and innovative tools, the cutting values can be specifically enhanced to achieve shorter production times. This means that the machine tool has a higher basic capacity.

3. Measurably longer tool life

ORTHO cutting oils have been developed in collaboration with the leading tool manufacturers. Today, many tools have integrated cooling and lubricating ducts (dia. <0.1mm), which take the cutting oil at high pressure of up to approx. 70 bar right to the forefront of the action.

Hidden savings potential: Cost optimisation on automatic lathes

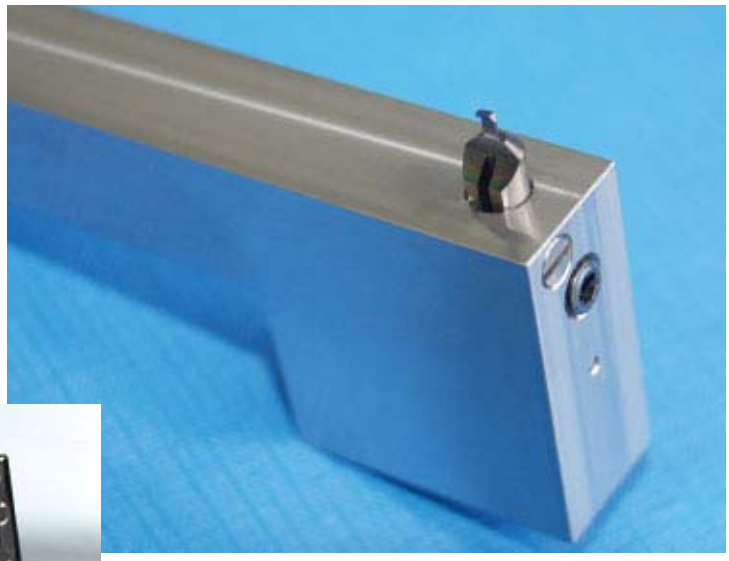
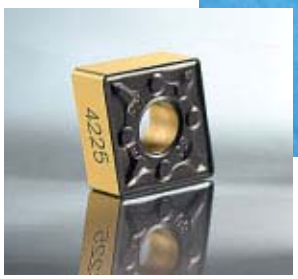


Photo: SANDVIK®



PVD-coated throw-away insert GC 4225 from SANDVIK®

The tool holders used today are regularly being developed, so when a tool needs to be replaced, it can be replaced by one that is exactly the same. This is the only way that production can be resumed quickly.

Special additives reduce friction resistance, thereby resulting in longer tool life, maximum surface quality and shorter machine down times.

4. Low odour and low mist – the oil remains in the machine

Because automatic lathes are fully encased and because ORTHO cutting oils are formulated to produce very little mist, the fluid remains where it belongs – in the machine. This immediately has a positive effect on costs in several ways: less oil loss through atomisation, reduced cleaning costs and improved occupational TLV-values (Threshold Limit Value) in the ambient air at the place of work.

5. Workpieces can easily be cleaned

Because of a temperature-defined adhesion additive, the cutting oil adheres well to the workpiece only in the operating temperature range during machining. Outside this temperature range, SWISSCUT ORTHO can be quickly and efficiently be removed.

6. Swarf – a cost factor that is often underestimated

Swarf is part of metal machining like flour to baking – but as soon as the bread is in the oven, you want the flour off the table. It is roughly similar in the case of swarf. It accumulates and can severely impede the machining process. By using the thin ORTHO NF-X ISO VG 15 the swarf settles in an optimum manner thereby considerably reducing the discharge of oil. The thin cutting oil can also be better separated in the swarf centrifuge and subsequently filtered more efficiently.

7. New additives protect paints, varnishes and sealing materials

Given the complex formulation of modern cutting oils, care must be taken that no critical side effects are produced. Hence, ORTHO cutting oils were tested for their compatibility with plastics and elastomers by an independent test laboratory of a leading seal manufacturer (Parker Hannifin®). Compatibility with used varnishes

If you count the surface areas of all the swarf this will produce enormously large surfaces. This is why the swarf first has to be efficiently centrifuged and the oil then filtered with the finest possible filter. Almost "dry" swarf is the result!

was also checked. The results certified the high level of compatibility of ORTHO NF-X with all the materials tested.

8. Disposal – if at all, then without problem

Many small part manufacturers regularly replace the discharged cutting oil in a circuit with a mixture of filtered oil, used cutting oil and fresh cutting oil. By careful handling and because of the high resistance of SWISSCUT ORTHO to ageing, disposal of the medium is dispensed with. However, if a machine has to be refilled, the product, which is free from heavy metal and chlorine causes no disposal problems or additional charges at all.

We would be happy to give you further information about the new generation of ORTHO NF-X cutting oils and cost optimisation measures for your company and recommend that you carry out a practical test with SWISSCUT ORTHO under the supervision of an industry specialist from MOTOREX.

Parts washing – a cost factor that must not be underestimated. The aim is to clean the parts to the level required by the client. Following machining, as little cutting oil as possible should adhere to the part, which then has to be washed away.

Further information can be obtained from:

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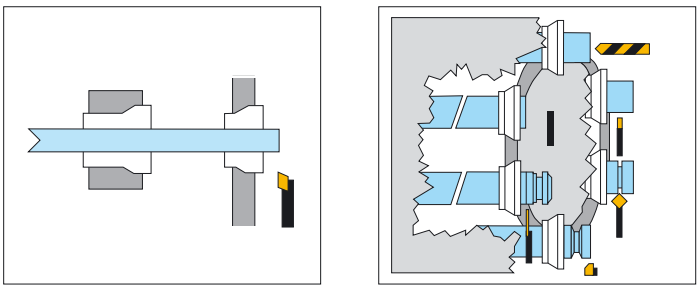
Single spindle or multispindle

two systems that complement one another

With regard to automatic lathes, there are two lathe families that vie for favours in the small parts turning industry – the single spindle and multispindle lathes. But are they really fighting for the market? DECO Magazine compared the two systems.



Difference between single spindle and multispindle.

The precision turning sector is confronted by many demanding market criteria. The cost price of the part is basically the number one criteria of all requirements. There is no doubt at all that the demand for precision goes hand in hand with the lowest possible price. Manufacturers of automatic lathes have been fully aware of customer requirements for a long time now and are now offering single spindle type lathes as well as the multispindle versions, thereby meeting market requirements. Even if the choice between these two types is not always obvious to the operator, there are always criteria to help him make the right decision.

The single spindle lathe with sliding headstock for machining highly complex parts

From amongst the family of automatic single spindle lathes, the specialists essentially distinguish between two types of machines: one with a headstock and the other with a sliding headstock. The second option attracts most interest from users, with its range of diameters of up to around 32 mm, since a single spindle lathe fitted with a sliding headstock and guide bush can produce both long and short parts at very high precision.

At the outset, a single spindle lathe with sliding headstock and guide bush executes fairly long parts with great precision at high output. This requirement has now been upgraded – the specialists have found that some of the parts produced on this type of lathe are not as long

DECO 20s: The efficient and economical solution for manufacturing parts of moderate complexity.

Single spindle or multispindle two systems

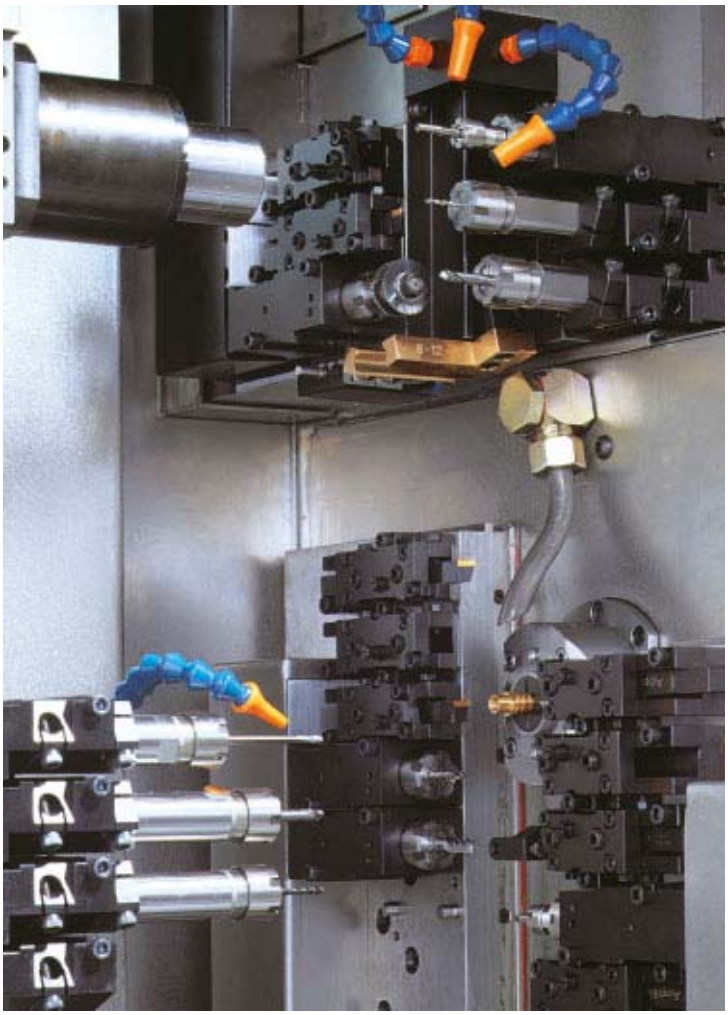
Typical parts for single spindle machines.

Complexity

With the aim of reducing the number of parts in a product, the designer is looking at ways of increasing part functions, hence the marked increase in part complexity. This complexity leads one to the crucial issue of part feasibility and hence to the question of whether this part can be machined to its completely finished state in a single clamping operation on one machine alone, or whether several machines would have to be deployed.

Some single spindle lathes are fitted with a range of tools extending to 25, with all of them up to twelve axes, depending on model. These axes can work simultaneously on one and the same part, meaning that several operations can be carried out at the same time. For example, it is possible to proceed with turning operations using two tools at the same time whilst also machining the front sections. Four different operations are possible at the same time. This confers on this type of lathe a remarkable degree as they were previously. The length of the part is no longer the sole overriding criterion. Machine output and precision are now also of great importance.

During precision turning, the operator can achieve a degree of precision of around 4 microns using a lathe with sliding headstock and guide bush. One model recently launched on the market – a lathe with a sliding headstock but without guide bush – is guaranteed to achieve a degree of precision of 2 microns.



DECO machining area, spindle and counter-spindle for machining 2 parts simultaneously.

that complement one another

Barfeeder for the DECO 13a, type Robobar, to guarantee autonomous production.

of flexibility and output, as a result of combining the simultaneity of movement and the extremely rapid displacement of the axes. Thanks to these features, the single spindle lathe is the best response to the question of the feasibility of machining extremely complex parts.

The counter-spindle – an undeniable benefit

All Tornos single spindle lathes are currently fitted with a counter-spindle. A single spindle lathe may, therefore, be fitted with two spindles, despite its designation. Before separating the part from the bar, the part is picked up by the counter-spindle fitted with its own tooling, which then finishes off the part by back-operation. All parts leaving the machine are therefore finished parts.

A highly efficient unit

The diversity of tooling means that this type of automatic lathe is capable of executing highly complex work, such as polygon machining, thread whirling or various milling and cutting operations. In order to make this type of machining even more user-friendly for the operator, Tornos designed a specific range of units.

On a single spindle lathe, it is typically possible to use all the tools and combine the machining operations in line with operator preferences. Using the same number of tools, the manufacturer will be able to execute a vast number of operations.

Large or small series runs?

The specialists are unanimous: Whilst in the past, especially with cam-operated machines, these lathes were essentially designed to produce large series runs. This is no longer of essential importance today. The single spindle lathe is now used essentially – thanks in particular to the deployment of numeric control, both for large and medium-series runs – to machine complicated to highly complicated parts. However, it is quite common for a parts manufacturer to use a single spindle lathe for a pre-series run of more simple parts, because once the process has been validated, production is transferred to a multispindle lathe. Thanks to the machine's facilities of producing highly worked parts, it sometimes happens that the small parts turner reverts to a single spindle sliding headstock lathe to create one-offs or small series runs of up to 15 parts.

Little automation

With respect to single spindle lathes, there is presently little demand for automated systems at the outlets of the finished parts. All lathes are fitted with a bar feeder system, thereby allowing work with automatic machines. As a solutions provider, Tornos, together with its partners, is currently looking at solutions to meet specific requirements at the part outlet. What must be borne in mind is that parts machined on a single spindle lathe may have very different dimensions from one batch to the other, which entails other solutions for each case, thereby making it very difficult to develop standard solutions.

Single spindle or multispindle two systems

The multispindle machine – simultaneous production

Unlike the single spindle lathe, the multispindle lathe has from six to eight main spindles. This means that one lathe can machine six or eight parts respectively simultaneously, with the swarf being evacuated. The multispindle lathe is typically one with a headstock, thereby making it pre-destined to produce relatively short parts. With its axes arranged in x and y and its facilities of machining the part from the front, this multispindle lathe is a high-output machine.

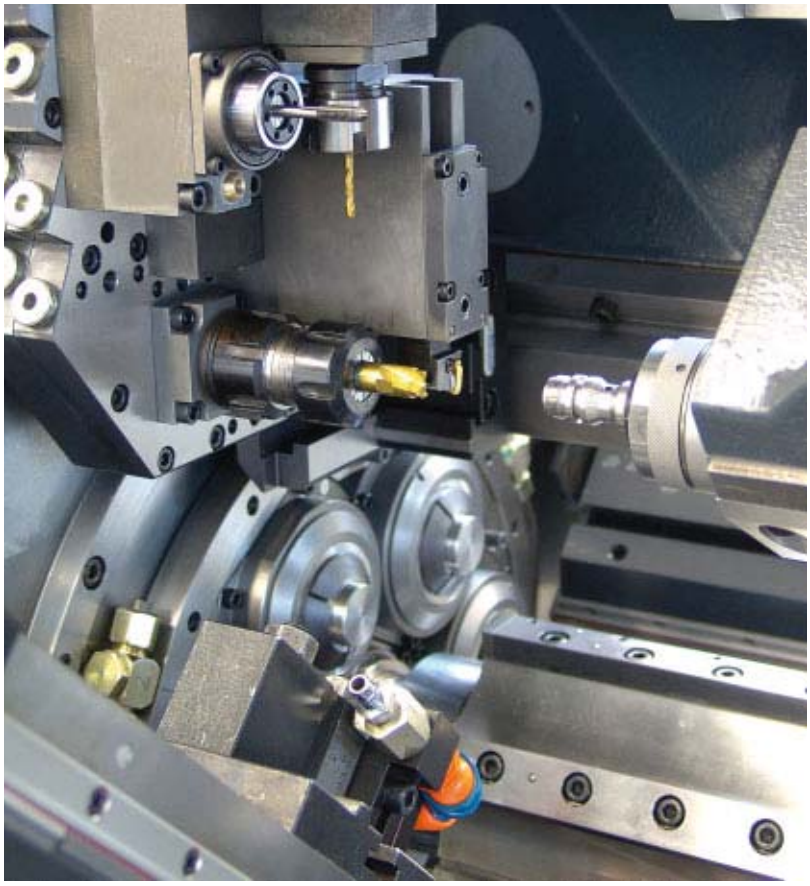
The strong point of a multispindle machine is clearly its rate of output expressed in number of parts. The specialists' estimate that a multispindle lathe with six spindles is roughly 4 to 5 times faster; and a lathe with eight spindles roughly 4 to 6 times faster than a single spindle machine. These machines are often adapted to meet customer requirements.

The counter-spindle – an additional benefit

With a multispindle lathe, a counter-spindle picks up the part from the last spindle before it subsequently becomes an independent part. As the counter-spindle has tooling in the x, y and z positions on the lathe, back-operations can be executed on the part, thereby providing the operator with a wide choice with regard to machining the end of the part and completing it without further handling. With five tools used for back-operation, the spectrum of parts that can be fully executed on a multispindle lathe has considerably increased. Tornos is now providing its clients with the opportunity to complete more parts than could be achieved with a conventional multispindle lathe. The company even launched on the market a multispindle lathe with two counter spindles, in other words a lathe with two times five tools for back-operation, which significantly increases its productivity. The multispindle machine therefore meets one of the

MULTIDECO 32/6c, palletisation system 100% incorporated in the machine.

that complement one another



Back-operation device on the MULTIDECO, how to execute complex operations with multispindles.

most important customer requirements, namely the ability to machine a complete part on one single machine.

Bars and the like

Even if the standard feed is a bar feeder, it is also possible to add automated handling devices, such as chuckers for one-off rough-machined parts, especially for the slightly larger parts. This lathe is therefore adapted to a vast range of parts from the various industrial sectors, such as the automotive sector.

Single clamp – high precision guaranteed

Once the part is clamped in the spindle, the barrel turns from one position to another. With a CNC machine, the position is also corrected for each change to within tolerances of 1 to 2 microns. Consequently, for each change the control positions the barrel offset for each part to zero. This means that the part is always ideally aligned for the pertinent operations. A CNC machine is therefore more precise than a cam-operated machine, which does not have these facilities. This barrel offset provides a huge advantage, especially when part precision is at the top of the range.

Reduced complexity

Whilst increased productivity is one of the big assets of multispindle lathes, all machining operations must follow on. These operations can only be executed provided the tools are available for each station. The operator would find himself somewhat limited if faced with this complexity. However, the exception is found in the latest generation of multispindle lathes, which have the facility of using the counter-spindle with five tools. Given the fact that at this moment in manufacture, the part is in a situation similar to that with a single spindle lathe, it is possible to execute far more operations than with the other models.

This would provide the operator with all the time to position the various machining operations so that he can better balance out the machining time per station. By proceeding in this way, the operator can achieve somewhat surprising increases in output. In order to execute less complex parts on an

Single spindle or multispindle two systems

Typical parts for multispindles machines.

8-spindle machine, the machine can be used like two lathes each with four spindles and thus even double output. Each of these two "machines" has three cross slides, three front units and one back-operation, meaning that the parts being executed can be machined on both sides and completely finished.

Compact and spacious

It is true that an automatic multispindle lathe takes up a certain amount of floor area. However, the operator of an automatic lathe would like a compact machine that takes up little space. But at the same time he wants to have the largest machine possible to ensure optimum swarf evacuation and easy access to all parts of the lathe. This is why the engineers are always looking for the best way to meet these two requirements simultaneously. They have been fairly successful with those machines that provide much easier access to the work areas. A big step forwards was achieved with the new Tornos solutions, such as the auxiliary units, i.e. the palletisation system, swarf conveyor and cooler, which have been incorporated into the design of the machine to reduce the floor space requirement to a minimum.

High output and large stocks of raw material

Nowadays, up to two tonnes of raw material can be deposited in the bar feeder, thereby ensuring good machining autonomy with the lathe. In addition to this, finished parts can be unloaded onto pallets positioned on a slide that has been adapted for subsequent washing operations. The same pallet can be used to feed the parts to an automated assembly system with the final client. Such a facility is currently mainly used in the automotive sector.

Summary

What system should be chosen? In the majority of cases the choice is governed by the geometry of the part, the obvious increase in output, the series run and the investment potential. However, the user may find themselves in a situation where the choice is not as clear-cut. In such cases, it would be necessary to have an in-depth discussion with a specialist in order to assess all the facets of modern production.

There are situations where the part can be economically executed both on a single spindle and multispindle

Part ejection controlled or not? This could sometimes make a difference!

that complement one another

lathe. Where production on a single spindle machine multiplied by the number of machines required to achieve the production volume of a multispindle machine comes to an equivalent price, and then it's up to the user to decide: it is obvious that the floor area taken up by several machines is larger than that used by one multispindle lathe. With several single spindle machines he will achieve greater flexibility from his production facilities, as he has several machines available.

A mixed machine fleet – is this a risk?

With regard to a part that can be machined on both production machines, the user can quite well opt for medium-series runs on a single spindle lathe before going on to the multispindle lathe once the production run gets much larger. Where there is a strong demand for parts, he would be able to produce a large number of parts on the multispindle lathe far more quickly. Against this, the single spindle lathe is more suitable for producing different types of parts in small batches.

In order to make things easier with a mixed fleet of machines, the programming tool developed by Tornos – the TB DECO – can be used both for a single spindle and multispindle machine. This is of enormous benefit to the user wishing to work with both types of machine because the programmer only needs to be familiar with one programming tool.

Conclusion

The heading – "Single spindle or multispindle – two systems that complement one another" is also like a summary to this article. After reading these few pages the reader will realise that this is exactly the case but it is not always easy to make a distinction between the two. If we look at both sides of the coin – very highly complex parts, long parts, precision to within a few microns for the single spindle machines and much shorter parts and much larger series runs for the multispindle machines - the equation is clear: there still remains a large number of parts that can be produced on both types of lathes. But based on what criteria? Many parameters can be envisaged, from the history of the company to the large series runs, not forgetting the materials being machined, company preferences and many others. With its extensive range, Tornos covers all small parts turning requirements and offers a service that allows its clients to find the best machine that meets its requirements.

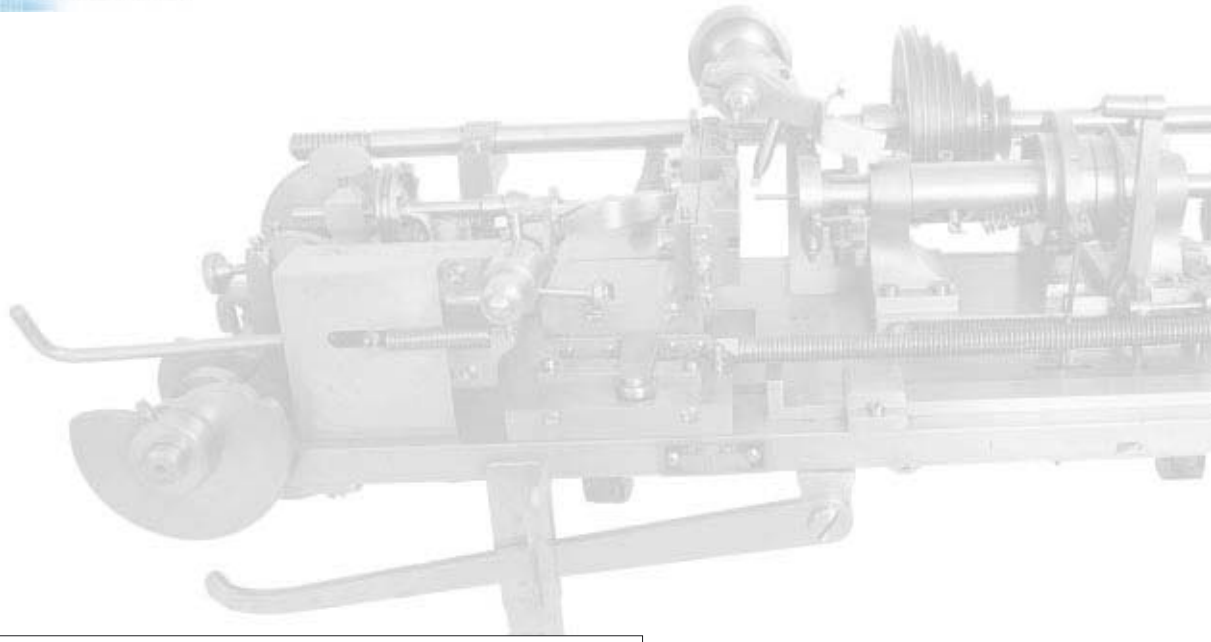
Research and development

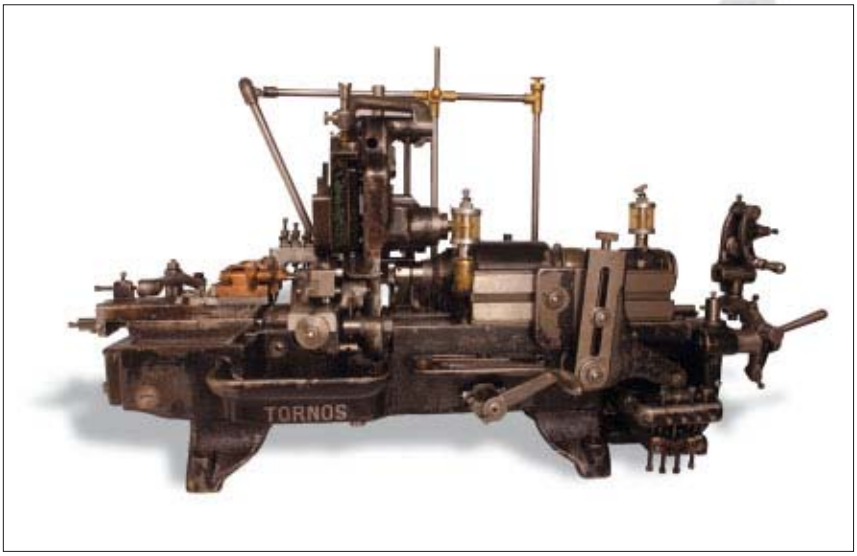
Tornos invests five percent of its turnover in product research and development. The development sector, made up of three units, is permanently involved in researching innovations for the machines and special units. One unit specialises in developing single spindle lathes and the other in developing multispindle lathes. The third unit is working on applications used for both types of machine.

Training

Modern automatic lathes have facilities that a few years ago were considered "impossible". Small parts turning production to within a tolerance of ± 1 micron was regarded as a state of utopia for quite some time. However, in order to benefit from the overall performance offered by these production facilities and achieve "perfection", we strongly recommend that you attend a training course. At the Tornos training centre, all users can familiarise themselves with each product, meaning that from the outset they will be assured of productivity and quality.

From the first machines





Jean-Marie Joliclon

The first automatic lathes only comprised mechanical parts. On examining the kinematics, it was easy to understand which cam actuated which tool and which vernier regulated a range. Handling the verniers and grips defined the ergonomics of the product and a product was judged ergonomic when it could be used without the operator becoming contorted.

As technology advanced, the mechanical elements were hidden behind casings and safety shields whilst the movements were controlled by numeric control via specific programs. These programs used a jargon that had to be learnt before even starting on the smallest task. It was no longer possible to use or understand the operation of the machine without going through its 'user interface'. The operators changed into neuronal contortionists! In the 1980s, the operators expressed a new requirement: simplicity of use. From then on, the talk was always of user friendliness. But what exactly is this ergonomy or this simple machine ?

to the present day

You said user-friendly and simple ?

To answer this, the first attempt was inspired by the following observation : To stand out, one has to produce machines with more and more extensive facilities. To sell what are now complicated products, it became necessary to reduce the obvious complexity. On the one hand, everybody wants products that are easy to use, have straightforward procedures and simple explanations. However, the tasks to be executed have become more and more complex. We want to execute complicated things but in a simple way.

As far back as 1986, with its TB-Logic[1], Tornos launched a software program that was destined to simplify the operator's life. For clients executing complex to highly complex parts, this tool turned out to be exceptionally efficient, at least for the initial programming operations. Then, because they had to learn by example, the operators no longer required the tool. As far as they were concerned, handling complex machines had become easy.

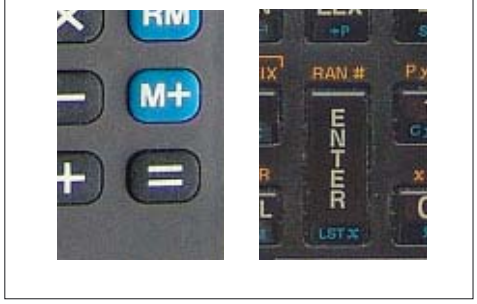
We should underline here at what point something that appears difficult can become simple. Simplicity depends very much on the person and the point in time. A few days ago my 4-year old son wanted to start a puzzle just when it was time for bed. I told him "we'll do it tomorrow". He then asked, "what's tomorrow ?" After thinking about it for a moment I replied: "tomorrow is something that comes after night, when a new day breaks". I felt that I had found a fairly good explanation and that the question was, in fact, fairly simple. The next morning, at first light, he ran towards me and proudly said : "today is tomorrow !" …

Simple for whom ?

When multiplying these observations, one can say that simplicity depends on several factors. For example, the Swiss army knife is unequivocally the simplest tool for

[1] *One of the first FAO systems in the world and the first for precision turning.*

From the first machines to the present day



McGiver or any other explorer wanting to use a simple tool that provides maximum possibilities. But, this is not necessarily the simplest tool for everyone. Although the Swiss army knife has a screwdriver, in many cases it would be far easier using a specific type of screwdriver. Let us now look at pocket calculators, for example. Everyone has his or her own way of doing things (HP or Texas) and has already been faced with having to use one of the "other makes". But is one calculator really simpler to use than another ? Is it not really a question of what one is used to ?

If some facilities are never used by the user, one must make absolutely sure that he is very dependent on those that he does use. In other words, the operator or user must be at the heart of the definition.

One cannot claim that a machine interface is or is not simple. One must be more specific and say : an interface is simple for a given user and for a given job.

- *Independent or only very slightly dependent on the prior knowledge of the user, the visible amount of information, the volume of things that have to be remembered, ergonomy, and the number of actions required, etc.*
- *Dependency on the user: goal to be achieved, prior knowledge of the trade (technologies, programming. other machine) and of the machine (experience), tastes and customs etc.*

"For whom is it simple ?"

"What does simple mean for the operators ?"

Becoming aware of these aspects led Tornos to expand the programming range of its machines that are designed to produce simple parts for customers familiar with ISO programming language.

The new DECO 20s and DECO 8sp machines are not only programmable in ISO but also with the help of the powerful TB-DECO software, thereby providing those users accustomed to this tool with the facility of programming with ease ! Is this not also the simplicity of offering a solution that is perfectly matched to the different requirements of our clients ?

"Simple to do what ?"

Let's be realistic : the only thing that counts is the produced part. The other concepts (e.g. tool number) are but clever devices. The quality of the part being produced should be at the forefront of the operator's thoughts. All the other aspects are the means to achieve this and must gradually vanish from the interfaces. Simplicity must be at the service of production.

Conclusion

Let us remind ourselves at what point it is annoying to receive a new software version with a completely different interface and having to re-learn everything each time.

To prevent our clients from having to suffer this frustration and continue with simply developing our range, we do not offer radically different types of interface but rather provide continuous improvements that never upset the habits of operators who are familiar with our products.

What we want is for all operators to find our machine interfaces "simple and user-friendly" so that they can produce good parts simply.

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