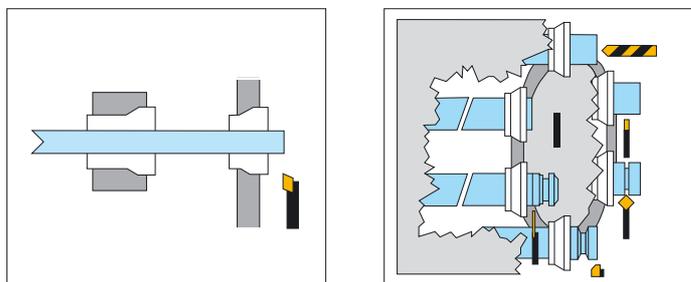


Single spindle or multispindle

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.

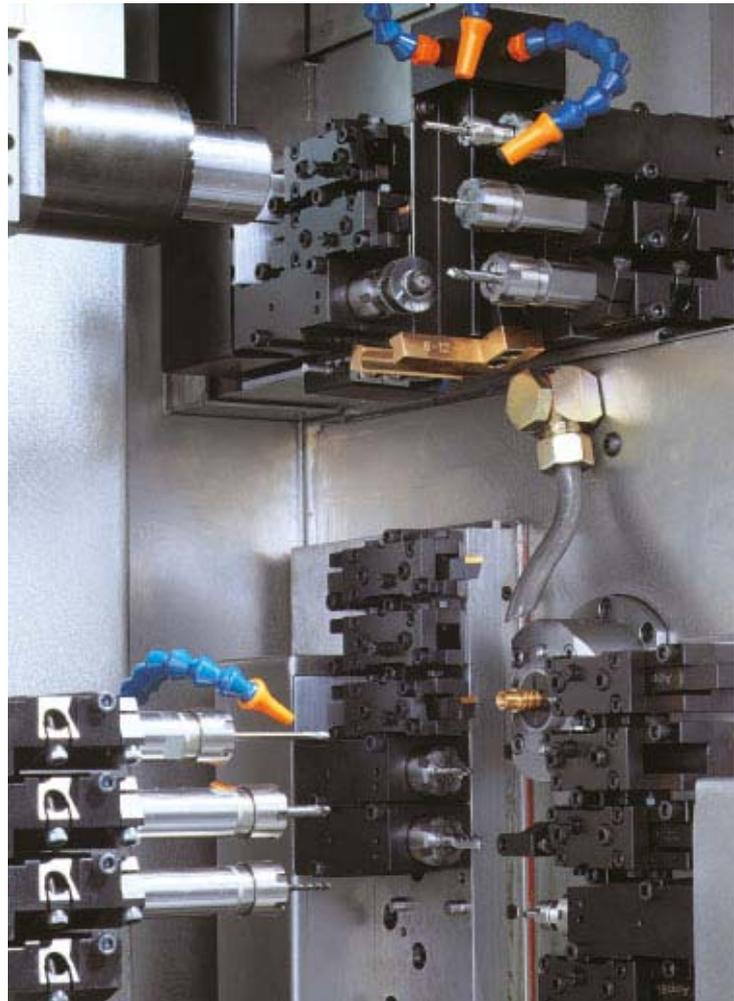
Complexity

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 vali-

dated, 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 multi-

spindle 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

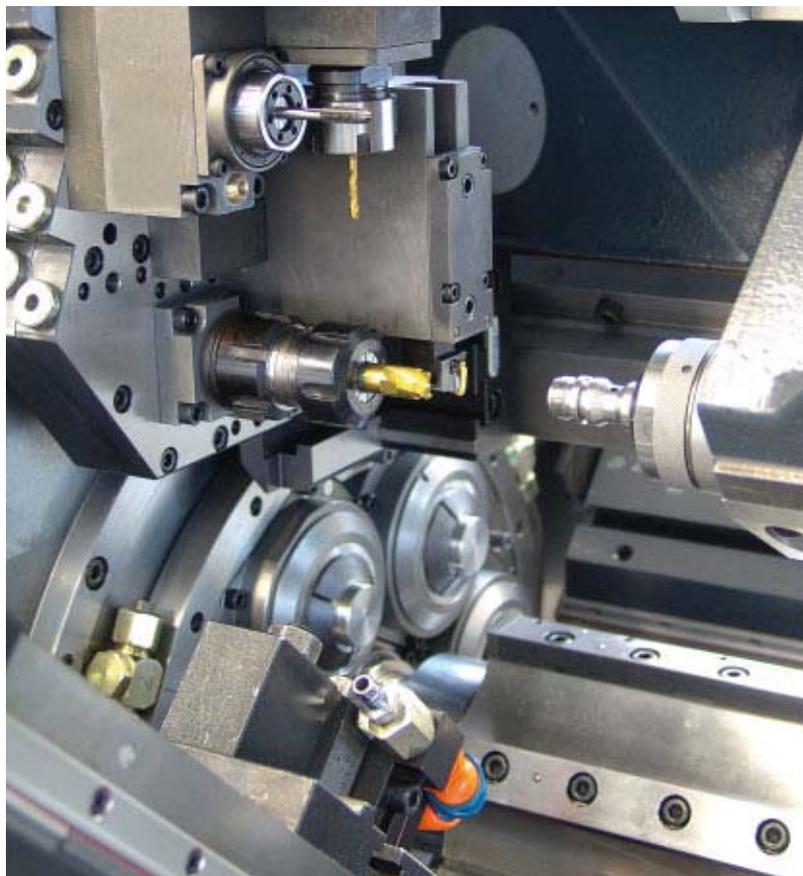
With a multispindle lathe, a counter-spindle picks up the part from the last spindle before it subsequently becomes an independent part. As the counter-spindle has tooling in the x, y and z positions on the lathe, back-operations can be executed on the part, thereby providing the operator with a

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 chucks 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 ma-

chine, 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 multi-spindle 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 read-

er 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.