A multi-spindle turning machine for the watch making sector

How MultiDECO respond to the needs of this very exacting market segment!

Tremendous performance for tiny components

A significant development in the use of primary materials for the manufacture of watches is now in progress. On a progressive basis, brass is being replaced with stainless steel. Although this metal delivers many benefits, it is nonetheless more difficult to machine. A fact which has an adverse impact on productivity.

What should be done? Engineers at TORNOS have now found a solution.

A sector characterised by quality and precision

Working as it does in the precision world of small, exceedingly high-quality components the watch making industry is renowned for its exacting standards. It is not surprising to find that in regions typically associated with watch making such as the one located within the crescent-shaped curve of the Jura mountains in western Switzerland, you not only find sub-contractors with this high level of expertise in precision manufacture at their fingertips, but also machine manufacturers who know how to translate the needs of this sector into the design of their machine tools. TORNOS has very many years of expertise and experience in the watch making industry, which is combined with its automatic single-spindle and multi-spindle turning machines. In its quest for the exceptionally small, TORNOS has invested in the kind of production and measuring facilities that enable it to demonstrate the feasibility of components on this minute scale. It is a natural extension of this development for this manufacturer of machine tools to get firmly to grips with the problems associated with stainless steel components.

Through its tests on single-spindle turning machines, the company studied the manufacture of tiny stainless steel components for the watch making industry in very great detail. The results were then transferred to its multi-spindle turning machine. Particular interest was paid to the production of components with a ratio of diameter to length of 1:3 or 1:5, examples being crown wheels, tubes and other extremely small components.

Why opt for a multi-spindle turning machine?

The MultiDECO 20/8b is an eight-spindle turning machine capable of working with bar stock up to a diameter of twenty millimetres. This turning machine meets the high...
standards of precision required by the watch making industry. One of the difficulties faced in volume production work is to be found in the ability to deliver consistent quality throughout an extended period of production. For example, any variation in machine temperature necessarily gives rise to variations in the precision of any component being machined. These variances can often exceed one hundredth of a millimetre.

To combat this, the designers of the MultiDECO removed the cutting oil tank from the main machine structure, which contains one thousand or more litres of oil depending on the model. This oil tank is then maintained at a continuously controlled and stable temperature. The 300 litres/minute of oil flowing through the machining area at any given time are able to be maintained at a controlled temperature of ± 0.2 degrees centigrade thanks to this temperature stabilisation of the oil. Since this same oil travels through the bearings as well as through the spindles, it ensures that the entire machine is maintained at a stable temperature level.

A controlled machining area

To further improve the quality of temperature control in the machine, and to prevent any build-up of heat in the machining area itself, oil vapours are evacuated through a filtered outlet. By eliminating hot zones, the machine is able to achieve higher standards of precision while at the same time protecting its environment.

The flow of temperature-controlled oil also delivers other benefits. For example, without this system the temperature of a spindle could easily rise to 60°C. In doing so it would become prone to the influence of any changes in ambient air during bar changes. All you would need to do is to open a door to the machining area for inspection purposes or to remove swarf and the temperature of the spindle could drop with adverse implications for machining precision.

However, because the spindles are cooled the temperature of these units is controlled continuously thereby avoiding variations in temperature. This ensures that the machine remains temperature-controlled at all times enhancing its capability for precision work. Machine operators on the search for that last elusive micron of accuracy will certainly appreciate this fact.

A real facility with the smallest of components

Although your thoughts may be of twenty millimetre bar stock when the MultiDECO 20/8b is first mentioned, you should remember that this multi-spindle turning machine is able to work with bar stock diameters as low as four millimetres without requiring any specific developments on the machine. This dimension matches the bar stock diameters required by the watch making industry for a particular range of components, which now includes parts manufactured from stainless steel.

Even the feed unit is equipped to enable automatic loading of this kind of slim-line bar stock. The entire original concept of this machine can therefore be retained without requiring any modification whatsoever. The need to work with tooling designed to suit the needs of the watch making sector did not pose any particular problems to the engineers at TORNOS – after all, they can call upon their many years of experience in this sector.
Having created a way of producing small components on a standard multi-spindle turning machine, this expertise can easily be transposed to other sectors. Examples of this would be sectors such as electrical engineering, electronics, pneumatics, medical or others.

**Identical feel, enhanced productivity, equivalent quality**

The multi-spindle turning machine employs very similar technology to its single-spindle counterpart and also operates with the help of the TB-DECO software. As a consequence, the programming operation is identical in both cases. This means that any operator familiar with the use of TORNOS single-spindle turning machines will readily be able to acquire the expertise required to work on the MultiDECO. In a similar manner, this also means that all the knowledge TORNOS has built up in the watch making sector with its single-spindle units can also be transferred reasonably simply to the specialists working on these multi-spindle machines. Experience has also demonstrated that programming is actually simpler on multi-spindle unit because the machining operations are distributed across several locations – eight in this particular case.

The watch making industry is renowned for its exacting quality requirements. While dimensional tolerances, even for casing components have to be achieved, just as they have anywhere else the primary emphasis needs to be placed on external appearance – on surface finish. This needs to be nothing less than perfect, something that is easy to achieve on a MultiDECO turning machine. Depending on user requirements, components can be finished without requiring any recourse to additional operations on other items of equipment.

**Installation space and production output**

Self-evidently, an automatic turning machine like the MultiDECO 20/8b will require two to three times the installation space of a single-spindle turning machine. Broadly speaking, this requirement is compensated for by the gain in productivity which can, for a given component, improve from 105 seconds to a mere 18 seconds, i.e. a substantially greater improvement in production output. You should also bear in mind that, in a multi-spindle unit like the MultiDECO 20/8b; eight components can be in production concurrently at any given time.

For any component manufacturer seeking continuous improvements in productivity through the use of an ultra-high performance piece of equipment, the choice of an automatic multi-spindle turning machine has to be a compelling one, especially in terms of its ability to more than pay for itself.
A marriage of expertise and experience

Specialists whose experience was obtained on the single-spindle units employed in the watch making industry found it very easy to transfer their expertise to multi-spindle units. The simple fact that these turning specialists conducted their programming work with TB DECO software automatically meant that they were already moving in a familiar universe. This made their programming task much easier.

The attractions of MultiDECO units also lie in their modern concept combined with digital control. If any correction to precision is required during a volume production run, operators can enter a correction of just one micron and the machine will then respond by exactly one micron. This fact has been verified by many successive series of tests. This incidentally demonstrates that operators, by virtue of their existing expertise and experience, are able to remain in full control of their machines at all times. A multi-spindle turning machine is therefore an exceedingly satisfying tool to work with because it is able to operate with exactly the same tools as employed on its single-spindle counterparts.

A clean environment

The MultiDECO 20/8b meets the clean environment needs of any modern watch making facility where cleanliness and protection from noise and vapour emissions have become important issues. It would not be far from the truth to view a modern watch making facility like a laboratory environment. The MultiDECO, despite being an automatic multi-spindle turning machine complies perfectly with these criteria. Here once again, TORNOS has managed to deliver what is needed using a standard machine with standard equipment. For example, the first inspection tests into machine noise emission levels have demonstrated that these units satisfy customer criteria.

Conclusions

TORNOS has very many years of expertise and experience gained by working hand in hand with its customers. This same expertise can also be transferred to other sectors, e.g. medical, electronics, hydraulics and others. Users of multi-spindle turning machines have until now been used to manufacturing components at a consistent size: now TORNOS has shown that it can also produce very small parts down to a diameter of three millimetres, even on fairly large machines.

With its digital control system the MultiDECO is an exceptionally flexible machine, both in terms of the components it can produce, the materials it can work with and the length of production runs. Single-spindle technology was transferred to its multi-spindle counterpart. This transfer enabled the flexibility of a single-spindle turning machine to be combined with the productivity of a multi-spindle unit. The fact that both types of machine operate using the same software and the same programming philosophy ensures that either is easy to integrate into any existing range of production machines.

While there may be benefits in using a multi-spindle unit for certain needs, there is still a robust market requirement for single-spindle units. Customer needs must always be the guiding factor when considering how best to answer the question of which solution is most suitable for a given application.

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