

Modular savings

Given the way in which batch machining is increasingly dictated by JIT and on-demand component manufacture, modular tooling is a cost-effective way to drive up productivity. Chris Powley reports

One of the greatest challenges facing companies involved in metal cutting is increasing the productive cutting time of machine tools. One answer, according to tooling supplier Kennametal, is to switch to modular quick-change tooling in order to reduce the downtime associated with indexing insert edges or changing the entire insert.

The Kingswinford, West Midlands-based supplier points out that such a switch also significantly reduces set-up times, by allowing the correct tools for the job to be set in advance, thereby ensuring that tools are ready at the machine when the job is to be run. It claims that loading a quick-change tool into the machine typically takes less than one minute, compared to the five to 15 minutes required for a conventional tool.

With a modern machine tool costing around £1 a minute to operate, it doesn't take a massive increase in effective metal cutting time to pay back the investment in modular tooling.

That's the claim made by Tony Godden, Sandvik Coromant's senior specialist – tooling products and OTS support. An acknowledged expert on the application of modular tooling, Mr Godden says: "When recommending a Coromant Capto modular tooling set-up, we would be looking to achieve at least 500 hours per year of additional productive machining time."

However, it is a fact that modular

Mill-turn machinations

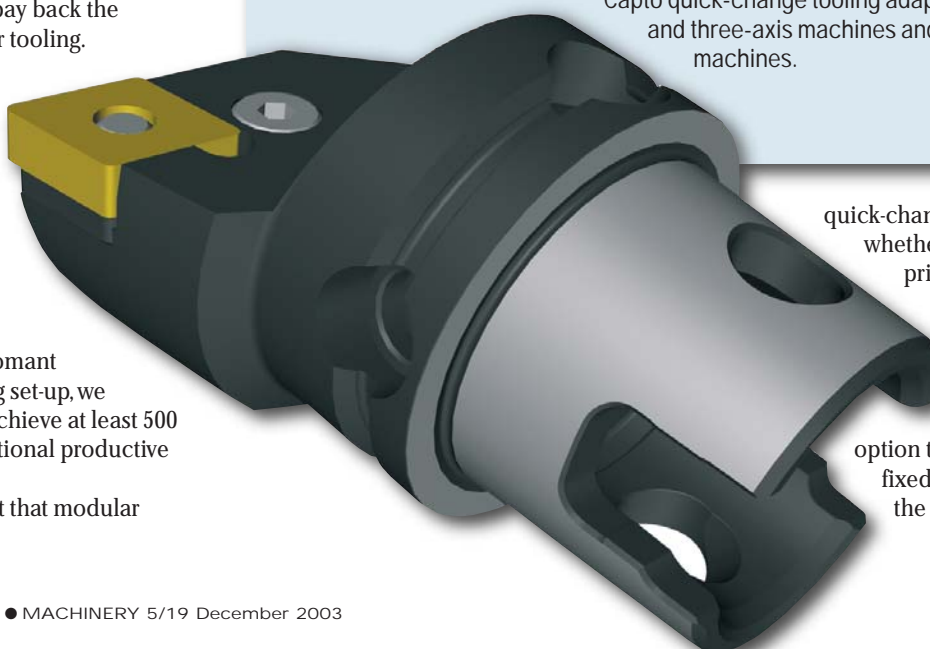
Kennametal's modular KM system has been modified to meet the demand of modern and increasingly popular mill-turn machines. Previously the tool vee groove in the KM system permitted automatic tool changing but did not provide indexing capability for the tool gripper in the tool magazine. The new KM63UT (Kennametal Modular 63 Universal Tool Changing – pictured) system has four holes in the vee groove and is equipped with: two horizontally-opposed location holes in the groove for the tool changer and for storage in the tool magazine; two deeper additional holes which can be used for tool orientation; two vertically-orientated holes in the groove which support a tool identification chip.

The system is fully compatible with KM63 and UT36 adapters and can be used in automatic or manual tool change situations. There's optimised coolant supply directly onto the cutting point, guaranteeing highest level performance, while for dry machining the coolant hole can be closed off by a screw.

With further variation in the four holes, a wide range of machine-specific configurations for tool changing and magazine storage can be satisfied.

Craftsman Tools, Otley, West Yorkshire is developing next generation toolholders. The work focuses on the interchangeability of parts between holders, common flexible fixturing and ease of manufacture in order to achieve a high-quality, competitively priced product. The toolholders under development will include static and driven toolholders for three-axis machines and Coromant

Capto quick-change tooling adaptors for two- and three-axis machines and for mill-turn machines.



quick-change tooling, whether for turning or prismatic applications, is in the short-term a more expensive toolholding option than conventional fixed tooling, although the benefits can

provide a rapid payback. It is equally true that any company seeking to obtain the maximum benefit should approach the subject in a more scientific manner than is perhaps usually the case where tooling is concerned.

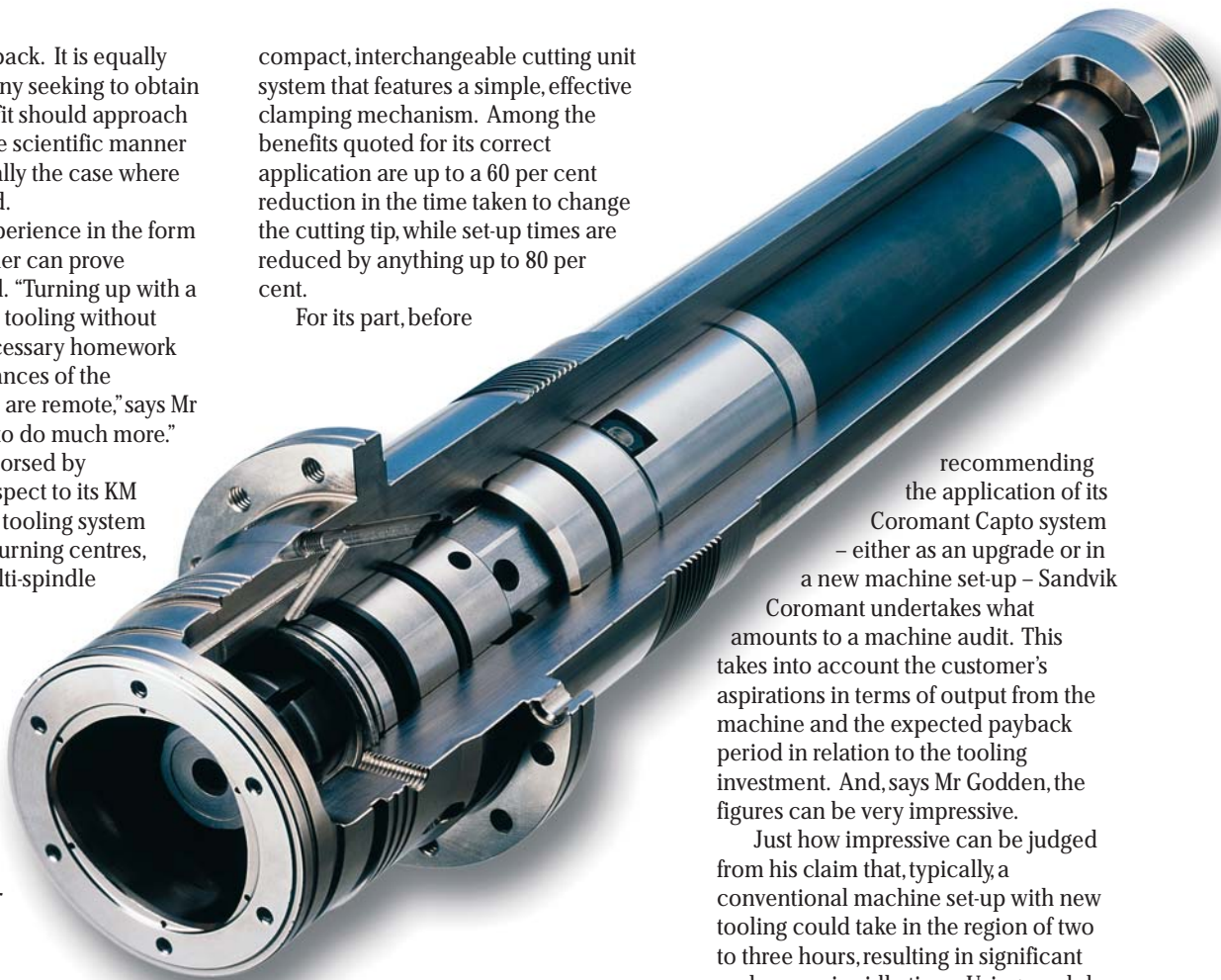
It is here that experience in the form of a specialist supplier can prove extremely beneficial. "Turning up with a boot full of modular tooling without having done the necessary homework would mean the chances of the customer benefitting are remote," says Mr Godden. "You have to do much more."

This point is endorsed by Kennametal with respect to its KM Micro quick-change tooling system for Swiss-style CNC turning centres, small lathes and multi-spindle machines. This is a

Sandvik's use of a nitrogen gas spring in place of the traditional Belleville washer avoids 'power fade' in its Capto modular tooling system

compact, interchangeable cutting unit system that features a simple, effective clamping mechanism. Among the benefits quoted for its correct application are up to a 60 per cent reduction in the time taken to change the cutting tip, while set-up times are reduced by anything up to 80 per cent.

For its part, before



recommending the application of its Coromant Capto system – either as an upgrade or in a new machine set-up – Sandvik

Coromant undertakes what amounts to a machine audit. This takes into account the customer's aspirations in terms of output from the machine and the expected payback period in relation to the tooling investment. And, says Mr Godden, the figures can be very impressive.

Just how impressive can be judged from his claim that, typically, a conventional machine set-up with new tooling could take in the region of two to three hours, resulting in significant and expensive idle time. Using modular tools pre-set off the machine, a tooling changeover, he says, can be accomplished in as little as 15 minutes.

But that's not to say that modular quick-change tooling is the answer in every instance. "If a customer has a situation where he has only one or two set-ups a week using, say, just four tools for cutting aluminium, I often tell him that, in terms of a Capto installation, I can't help," says Mr Godden. "The system really comes into its own in multiple set-ups where it is rare that an increase in productivity of 25 per cent or more cannot be achieved."

Sandvik Coromant estimates that seldom is more than 35 per cent of the total machine time available to be used for actually cutting metal, a statistic that underpinned the conceptual thinking behind its Capto system. And it has

Not fade away

The polygon tapered coupling at the heart of the Capto concept has been proven on hundreds of thousands of applications around the world. But at the recent EMO exhibition in Milan, Sandvik Coromant unveiled its new nitrogen gas spring, which replaces the traditional Belleville washer-based mechanical retaining mechanism.

This development overcomes mechanical spring system 'fade'. Mechanical spring life is estimated to be in the region of 200 000 clampings, after which measurable loss can occur. In the gas spring version, life is at least 2 million clampings and it is permanently in balance. From the machine tool builder's perspective, the new unit has the advantage of being more compact, 20 per cent smaller in diameter and 20 per cent shorter in length.

Another new development – currently at prototype stage but scheduled for introduction in mid-2004 – is the Composite Disc Interface (CDI). This will provide greater flexibility and faster indexing of tools fitted in the turret. It is designed for use with radial fixed and axial tools, and can also be used with driven tools, either straight or angled.

Shrink-fit induction

Shrink-fit clamping is an increasingly popular technique for securely clamping a tool into a toolholder, says Gewefa, and it has added another option to its range of equipment to support this technique.

The company's new InduTerm G5 Mk II features a separate cooling system that can be placed over the cutter once it is secured, cooling the assembly in 30 seconds.

Featuring a turntable, an operator can be working on one tool set-up while a fixed cutter cools. Each machine comes with five sleeves to cover diameters from 5 to 32 mm, tackling both carbide and HSS cutters.

The InduTerm G5 Mk II is intended to complement Gewefa's InduTerm G5 unit which has a shrink time of 2-7 seconds and 25 second cooling cycle.

since developed the system as a genuinely universal productivity enhancement, as the system can be used on turning centres, lathes, and milling and drilling machines.

CAUTION, PLEASE

Even so, Gordon Mortimer, managing director of newly-formed Frezite UK, cautions that while modular tooling has its place, not everything is as it seems. "If you were to survey all modular installations, I believe you would find that 90 per cent of users do not break down the tooling. Many do not even have sister tooling pre-set and continue to change inserts in the machine when they become worn."

But when it comes to getting the best from an investment in modular tooling, Mr Godden counters that planning is everything. "More and more modern day multi-axis simultaneous machine tools are being used to achieve finish machined components in a single set-up from solid. But batch quantities dictated by components produced on demand are often very small. The machine shop simply cannot afford to waste valuable machine uptime in protracted tool

changing operations."

In terms of cost benefits, Sandvik Coromant reckons that, when using Capto, the combination of reduced set-up and idle times due to insert manipulation will typically produce 50 extra productive hours per clamping unit per year. Add to this what is described as the inherent stability of the coupling in comparison with conventional tooling, and an increase in feed of 0.1 mm/rev can produce a similar annual productivity increase.

This 'inherent stability' is the result of a coupling that is extremely strong as regards stiffness and resistance to deflection. In productivity terms, this equates to a repeatable accuracy of ± 20 microns in the x and y axes.

This virtually eliminates the need for measuring cuts, another time-saver that, according to Sandvik's Mr Godden, can produce up to 200 hours of additional machining time.

Being self-centring and balanced by design, the polygon coupling design of

the Capto system minimises run-out and gives the insert a consistent centre height to within ± 2 microns. And, in terms of ease of use, it's worth noting that the toolholder clamps into the turret with just a half-turn of an Allen key.

Looking ahead, Frezite UK's Gordon Mortimer says that as spindle speeds continue to increase, especially in the automotive and aerospace sectors where there are moves a way from

ferrous materials and towards aluminium and Kevlar, for example, tool balancing is becoming a more serious issue. The Portuguese parent company began manufacturing tooling systems in 1978 but while offering modular quick-change tooling it also promotes the alternative of shrink-fit tooling.

TAKING A BALANCED VIEW

"Over the past five to six years, there has been a big push toward higher spindle speeds in rotating tool applications," says Mr Mortimer, "but as the speeds increase, any errors in the tool connection magnify the out-of-balance condition."

While this does not present difficulties in turning applications, where the speed of rotation of driven tooling is much lower, as higher speeds become the norm in prismatic applications, balancing will inevitably become more significant. The obvious end game would be to have a solid tool from front to back, but the alternative of shrink-fit tooling is, he argues, closer to that ideal than modular tooling in terms of balance and hence performance. **M**

