

# Grinding out advantage

**Producing fir-tree root tools; diamond/CBN grinding wheel forms; plus a company combining hard turning and grinding. Andrew Allcock reports**

**C**entrax Turbine Components Ltd (CTCL) specialises in compressor and turbine aerofoils, discs, shafts, casings, associated hardware including sub assemblies and engine modules. It is an approved supplier to many gas turbine engine manufacturing companies worldwide, for civil and military aerospace and industrial gas turbines applications as well as for military auxiliary power units.

The company's aerofoil facility specialises in the machining of single insertable compressor blades, compressor blisks (a rotor disc with integral blades machined from a solid piece of material), turbine rotor blades and nozzle guide vanes for aero and land based gas turbine engines. Fir-tree profiles or dovetails allow them to be located into the female disc slots.

## COMPLEX FORM CUTTER

This root fixing is often manufactured using a complex form cutter – a tapered tool with helical geometry, made in the shape of a symmetrical 'fir tree' or dovetail. Usually manufactured from carbide, root cutters have extremely demanding accuracy specifications, typically under five microns, and are regarded globally as one of the most expensive, intricate and time-consuming cutting tools to produce.

By utilising an ANCA RX7+ Grinder plus iView, iGrind and iBalance software, the company is now able to grind root cutters in a single set-up, on a single machine.

"Centrax strives constantly to improve all of its processes by upgrading working practices, and by investing in the latest



*Cranden Diamond's Wasino conveys a strong message of quality and accuracy to customers*

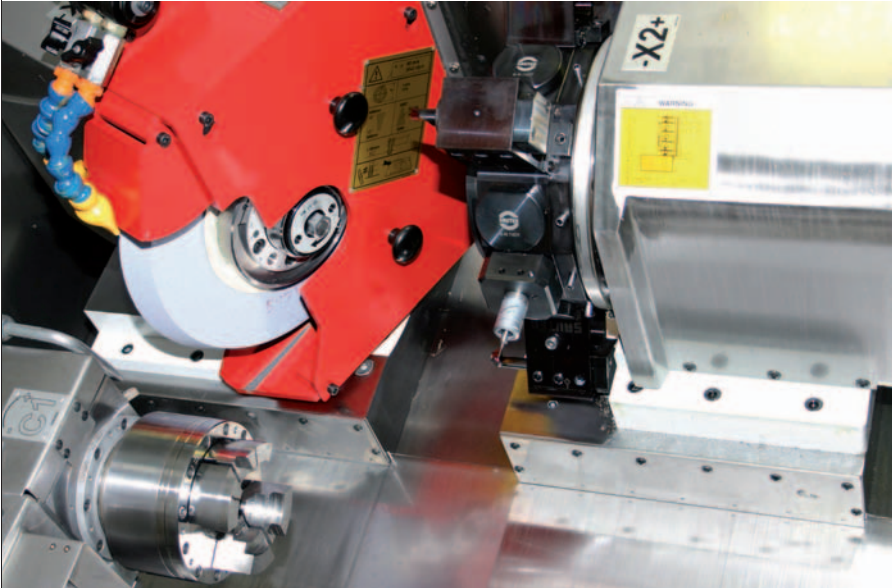
machine tool technology and high quality tooling," says Andy Bould, Centrax, R&D and operations team leader. "As part of our continuous improvement philosophy, we considered the possibility of producing our own carbide fir-tree cutters, along with many other cutting tools, in-house.

"Our new ANCA machine has enabled us to manufacture, in-house, high quality fir-tree cutters, plus a wide range of other specialised carbide and HSS tools, to a higher standard than those previous delivered by our tooling

suppliers. As our RX7 Grinder has exceeded our expectations, our predicted payback on investment period will be even shorter than that anticipated.

"Typical of the advantages we have gained is that our previous tools would allow us to manufacture only one blisk before tool replacement became necessary; we are now able to produce six blisks from our in-house manufactured tools," Mr Bould confirms.

At Cranden Diamond, the installation of a new Wasino GLS-5T Optical Profile Grinder (OPG), supplied by Colin



*The Studer S242 combines hard turning and grinding, saving mould tool maker Kleinhenz much time*

Gladwell Machine Tools, is a major part of the company's expansion program to maintain its lead in the manufacture of high precision profile CBN and diamond grinding wheels.

The company produces an average of 500 profile grinding wheels per month, these then being electroplated with diamond and CBN. Cranden produces tooling to within +/- 3' on angles and hold tolerances of +/- 3 microns over the abrasive coating and is the largest manufacturer of its kind in the United Kingdom. Its wheels are supplied to many sectors, including: aerospace/turbine blade manufactures; Formula One teams; prosthetics manufacture/medical industry; and the company is a supplier of diamond tooling world-wide for carbide insert grinding, ceramics, plasma sprayed rollers and grinding of all super hard materials. Cranden employs 45 qualified engineers and laboratory staff and exports 60 per cent of its products worldwide.

Increasingly, customers are less happy to view the sample that CDP supplies with all of its wheels as actual proof of the form that its grinding wheel generates – not all customers possess a shadow-graph these days and CNC machinery often needs to be told where a

specific form actually is on a wheel.

To plug this information gap, it was necessary to have a means of being able to grind profile forms to within sub-micron tolerances, and to be able to check and prove the integrity of each ground part on the very machine that produced the form. This is one of the reasons co-founder Andrew Cranshaw decided to invest in a Wasino GLS-5T optical precision profile grinder.

#### HIGHEST ACCURACY

The GLS-5T OPG has attracted many high quality customers throughout Europe as a result of its unique capabilities, it is claimed. Accuracy levels are exceptionally high with the machine's measuring system having a resolution of 50 nanometers (0.05 of a micron), and so can achieve high positional accuracy of 0.1µm with surface finishes < 0.1 µm.

Says Mr Cranshaw: "As our customers' demands change, we have had to change. It is all about being able to supply our customers a profile wheel that is guaranteed to grind exactly, and to hold its diamond form for longer than our competitors. We still offer a very fast turn around, and a competitive price, but the Wasino GLS-5T gives our existing customers confidence in seeing that we

are able to invest in the latest technology in the market to maintain our high quality. It also tells potential customers that we are available to offer them a diamond/CBN profile wheel and service better than that of our competitors."

Kleinhenz in Friedrichsdorf in the German state of Hesse has installed a Studer S242 machine to combine its cylindrical grinding and hard turning operations. The company's mainstay is toolmaking for plastic injection moulding, with tools for PET bottles its largest growth area.

The company has already installed mill-turn technology to combine turning and milling onto the same machine, so the 242 represents an extension of that thinking. Recalls Harald Ernst, grinding and hard turning foreman: "Hard turning has replaced many grinding operations in the last few years, reducing operating times. Nevertheless, hard turning cannot be reliably used to produce certain components. Additional grinding is required in these cases, which made reclamping necessary. We wanted to machine these parts on one machine – that was our fundamental aim."

The S242 is available as a short or a long machine (400 mm and 1000 mm between centres), with Kleinhenz opting for the long version having two slides – an external grinding spindle and a turret. Mr Ernst explains: "This is exactly what we need right now. That's because the typical workpieces for this machine are chucking components with cross bores and multi-edged surfaces, which require interrupted cut machining.

"Most of the parts are made of difficult-to-machine materials and also have an inner contour which is often conical or which contains tangentially converging radii. This would be very expensive to manufacture with grinding and must therefore be hard turned."

Tolerances are under 5 µm and the S242 is said to maintain these "effortlessly", but the highlight is the boost to productivity. Says Mr Ernst: "Depending on the part, we achieve a reduction in operating time of between 30 and 50 percent with the S242." □