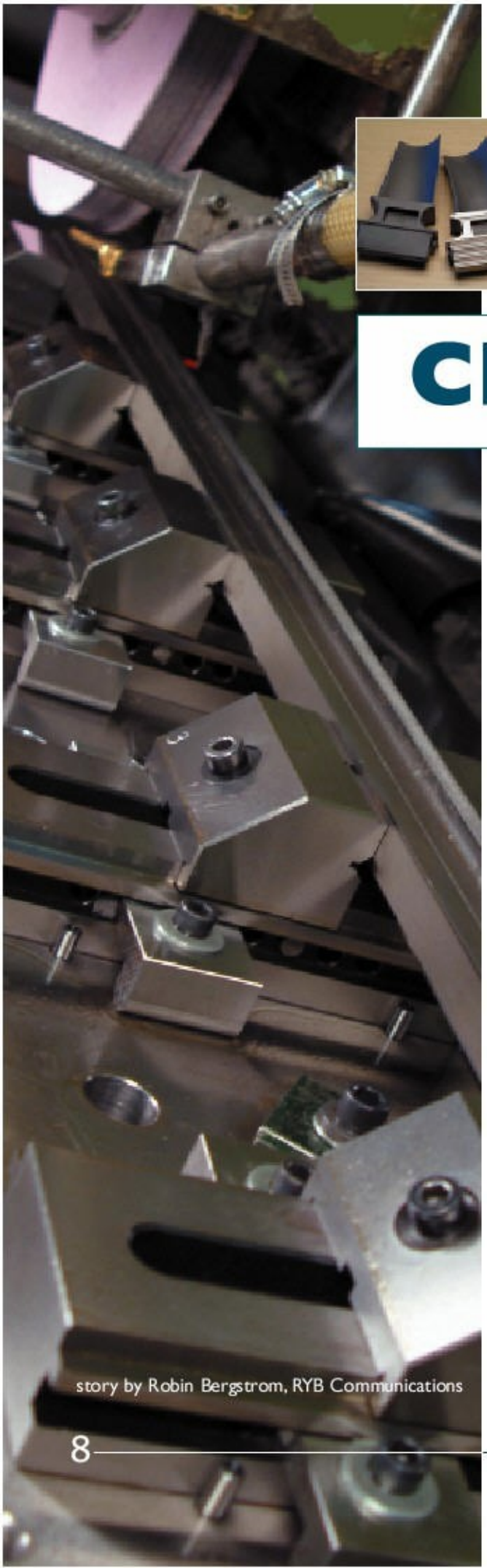


CREEPFEED grinding

why it's worth a close look

story by Robin Bergstrom, RYB Communications

According to Ken Kummer, CEO, Abrasive-Form, Inc., the trouble with creepfeed (CF) grinding is that too many people either never have heard of it, or simply just don't understand it (this despite the prolific editorial efforts of Dr. Stuart C. Salmon, the technology's revered expert). And those who are familiar with the discipline very often overlook important nuances, which taken fully into account can be turned into significant competitive advantages.

Definitions

Grinding as a manufacturing process entails a greater number of variables than perhaps any other metal-removal process. Machine rigidity, stability and repeatability, wheel materials and characteristics, dressing systems, coolant types and application, fixturing, gaging — all must work perfectly in concert to produce the desired result.

Surface grinding involves a grinding wheel reciprocating rapidly over the workpiece as it gradually lowers to its final depth of cut. According to Kummer, CF is a process where a formed grinding wheel is plunged full depth into the workpiece, effectively producing a finished part in a single pass. Its advantages include fast cycle times, high repeatability, very close tolerances, the ability to machine super alloys and fully hardened materials and superior surface finishes with essentially burr-free edges.

He also notes that CF requires machines specially designed for the process, machines with serious rigidity and power. His machines of choice: M gerle and Blohm, both from United Grinding Technologies (Miamisburg, OH).

Starting out

Kummer says that Abrasive-Form was launched as a job shop specializing in CF applications. "We began using M gerle machines in 1976 and started adding the Blohm machines in 1990. The engineering talent in Germany and Switzerland in CF machines is unparalleled. The Blohm and M gerle machines have extraordinary rigidity and thermal stability. You can idle them for a while and come back and immediately make a part right to size. And for us, in order to guarantee the highest quality levels, which used to be a competitive advantage but today is a routine expectation, we must be able to rely on our technology absolutely. Accordingly, we invest in the best."

Abrasive-Form today is 62,000 sq ft, employs 80 and is considered a full-service operation with CNC

milling, sawing, drilling, RAM and wire EDM, a radius and prep department — basically a vertically integrated operation, outsourcing only those processes they choose not to bring in-house, such as lapping and double-disk grinding.

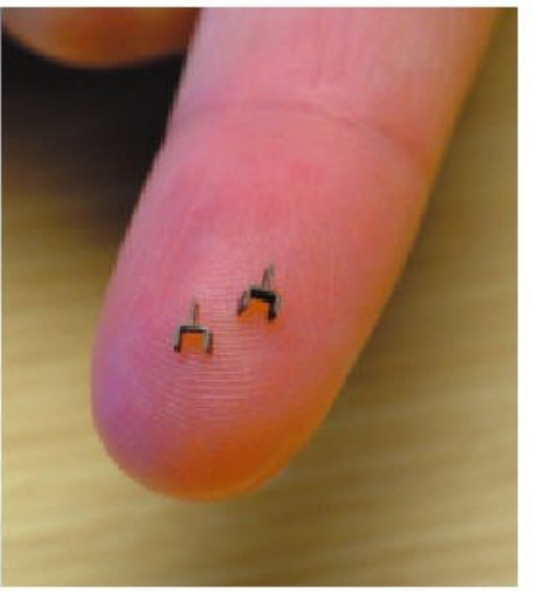
"Our customers would like to see us even more vertically integrated," Kummer says, "to take on more of the entire job — buying castings and doing heat-treat, for example. While we consider ourselves a single-source supplier, some of these disciplines we just won't bring inside. We network and partner with the best who specialize in those areas. Our goal is to establish long-term partnerships with our customers — two, three or more years — where we can really apply our full range of resources to ongoing customer projects, serving as a virtual extension of their plant floors."

Abrasive-Form processes just about any material that can be ground: aluminum, cold rolled steel, high-nickel alloys, hardened materials, carbide, tool steels, ceramics. Volumes run from a single part per day up to 50,000 a day. Applications include aerospace engine components, power generation, land based turbines, automotive engine and drive train components, tiny medical parts, consumer products, and parts for the packaging, hand tool, paper and pulp industries as well as the military. Typical tolerances are 0.0005", while many are routinely ±0.0002". CpKs of 1.33 are the rule.

"There's very little we can't do," Kummer says. "Slots for hydraulic vane pumps and aerospace turbine blades — jobs in very difficult-to-grind materials and with very, very close tolerances. We do linear operations of all sorts as well as contours. We can do 3D grinding and have machines with up to fix-axis control. With a combination of CBN and diamond wheels, plus continuous dressing, we've got a lot in our arsenal."

Nuances

"Anybody can go out and buy a 50 or 65 hp Blohm or M gerle," Kummer says, "but the question is, what are they going to do with it and how? Crucial to answering this question is fixturing — in creepfeed grinding, you're tied at the hip with fixturing."



Much depends on one's fixturing knowledge and creativity, Kummer says. Such as the overall approach to a job — whether you can use the entire wheel width, whether you can perform several operations in one pass, by orienting the part first on one side, then the second side, then up on an angle. Can you put all the forms in the wheel at once, so you can grind the forms in a single pass, thereby eliminating operations? Can you grind everything in one machine, in one pass, so that throughput and productivity are fully maximized? All these issues are tied to fixturing.

"We have a division that designs all our fixturing," Kummer says. "It's all they do. Top-flight toolmakers and engineers. If you combine good fixturing with the best machines and the world's best operators, you have an unbeatable combination. We also have a considerable weapon in our arsenal in the form of United Grinding. They not only serve as the supplier of the best creepfeed machines and service for those machines, but they also are a highly involved source of engineering input — especially in the make-or-break details, things like fixturing."

Kummer suggests that because CF is seen largely as a niche process, there's a lot of education involved in working with customers. For example, Abrasive-Form will know that a part can be done with CF, but what's not known is that the part could be done three times faster if they were provided with a more qualified locating surface, of if there were a provision for a clamping surface that could be machined away later.

"We really need to sit down together with our customers early on and brainstorm a project," Kummer says.

"They don't know all of what we can do, and we don't know what they need, beyond what a print says — which may overlook issues of functionality, past manufacturing problems, product reject issues, and so on. For example, if we know that a part has historically had a lubrication problem, we can grind an oil groove right in during the CF process. It doesn't affect our process at all, but it eliminates a downstream problem."

Ask, then act

Asking the right questions is crucial in any undertaking, and CF is no exception. "The tendency," Kummer says, "is to look at CF as an isolated discipline, when really it should be viewed as an integral part of the manufacturing process and the product life cycle." He relates that in one case they asked a customer what their biggest problem was with the product once it was in the field. The response was that it wore out, and then they'd have to replace it on a costly service call. Kummer's team looked at the part and its end-use and recommended the customer move up to a harder material. "In general, the usual routine is to try to make things out of the cheapest material you can live with, like cold rolled steel," Kummer notes. "In this case, we suggested a change to tool steel. Which solved the wear problem and also enhanced the customer's quality reputation. And to us it made no difference. The CF cost for grinding either material was the same."

In another instance a customer asked to have a slot ground in a part. Kummer's team asked what operations were performed after the slot-grinding process. The customer noted that there was a deburring operation on one corner of the part. The solution here? Add a chamfer on the grinding wheel and chamfer the corner at the same time the slot is ground.

"You see," Kummer says, "if we can get enough information early enough, there's a lot we can do in a single CF pass. The problem is getting people to think outside the box — or at least get them to pursue new ideas together."

Ken Kummer, CEO, Abrasive-Form