AUGUST 2005 / VOLUME 57 / NUMBER 8

BY MIKE PRINCIPATO

Hardball for nice guys, Part II

Last month, I suggested a handful of simple, time-tested and diplomatic ways to collect on an overdue receivable. But, as I pointed out, never underestimate the capacity of a deadbeat to ignore diplomacy. Some of these guys respond only to the "nuclear option": a formal civil complaint, filed at the office of the local district justice.

Up until now, you may have dismissed the idea of filing a civil complaint—kind of a minilawsuit—out of fear it might cost you more than the overdue receivable is worth. It certainly could, if you're assuming you need a lawyer to file the complaint. Simple arithmetic tells you that if the law firm of Dewey, Cheatum & Howe charges you $250 an hour to collect a $1,000 overdue receivable, you won't be getting much of a return on your investment.

The good news, though, is you do not necessarily need an attorney to file a complaint and win at the subsequent hearing, if you're willing to follow a few simple guidelines.

Often, the party with the most detail, supported by the most accurate and professional-looking corroborating evidence, wins.

First, keep in mind that this type of complaint is intended for relatively modest damage claims, typically up to $10,000. Thus, by design, the format of a complaint form is pretty straightforward and brief (usually two pages) and contains little confusing legalese. For about a hundred bucks, your local district justice will supply you with the necessary form and several options for serving the complaint to the defendant. As I advised last month, spring for the few extra bucks it costs to have the complaint delivered in person by a uniformed court official.

The form itself is pretty simple, requiring you to identify the defendant (Mr. Deadbeat) and supply a brief description of the basis for your complaint and the monetary damages you're seeking as a result of the incident. Complete the form and return it to the same district justice's office. The staff there will photocopy it and mail it with an official cover form advising both parties of the complaint and a hearing date.

The complaint form's main purpose is to notify the defendant he's being sued, not to make your case. Don't use the form to pour out your frustrations about being stiffed—save that thunder for the official court hearing. Otherwise, you'll unnecessarily tip your hand about the firepower you'll be bringing to the hearing.

In my experience, the real deal maker or breaker in any complaint is the attention to detail supplied at the hearing. Often, the party with the most detail, supported by the most accurate and professional-looking corroborating evidence, wins. So if you want to win, you'll need to spend an hour or two preparing for the hearing. Think of it as a chance to play Perry Mason, strike a blow for justice for the little guy or simply serve notice to professional deadbeats everywhere that you're mad as hell and not going to take it anymore.

Whatever your motivation, here's a list of what you'll need to win your case and recover your overdue receivable:

- All the paperwork related to the overdue invoice in question, ranging from the original estimate and, if you have one, log of the original telephone, fax, e-mail or personal inquiry to the most recent letter requesting payment from the defendant. Refer to the deadbeat as "defendant" throughout this and all other related documents—it drives the point home with the district justice hearing the case that you fully appreciate the seriousness of his or her courtroom. Arrange it in chronological order and type a simple cover sheet labeled "Civil Complaint against 'X' filed by 'Y' Exhibit A."
- Include a one-page account, in chronological order, describing each distinct effort your company made to collect the debt from the defendant. Create a similar cover page as described above, this one labeled "Exhibit B."
- Exhibit C should be two sets of company literature, one for your company and one from the defendant's company (print it from its Web site, if necessary). This helps establish for the justice that the respective companies, which he will probably know nothing about, are ongoing businesses in a reasonable position to have a commerical relationship dependent on trust and credit terms.

All of the above items should be prepared in triplicate, so that at the beginning of the hearing you can give one packet each to the justice and the defendant. But you'll need one last item—a "cheat sheet"—for your own private use.

The cheat sheet is your ace in the hole for your presentation to the justice, and isn't anything fancier than a list, in order, of the points you want to make during that presentation. The cheat sheet should also contain reminders to yourself to refer the justice and defendant to the exhibits listed above at the appropriate times during your presentation.

Buttressed by your well-prepared evidence, thank the district justice for his or her time and watch the defendant wilt, overwhelmed by your preparedness. Then watch your mailbox for what will likely be a notification of your well-deserved victory.

No need to send me a retainer fee, either. Good luck!

About the Author

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Clamp down with a milling machine vise

Two basic types of vises exist for holding workpieces on mills: the general-purpose style and the precision milling machine vise. The former, which is for general applications, does not ensure part quality. The latter, on the other hand, is a precision device that assures the production of tight-tolerance parts.

The main components of a milling machine vise are the base plate, the movable and fixed jaws, the operating screw and the replaceable jaw plates. The base plate, or body, is a solid mass of steel that's machined and ground square. The fixed and movable jaws are mounted to the base plate. To ensure stability, concentricity, squareness and flatness, the jaws are also machined and ground square.

The operating, or lead, screw repositions the movable jaw from total closure to the desired length for holding a workpiece. Three common maximum openings are available: 5.5", 7.5" and 8.8". Typically, a crank handle opens and closes the lead screw. In addition, vises are available with hydraulic spindles, where a hydraulic element activates the lead screw and multiplies the gripping power of a manually operated vise. A hydraulic spindle adds $100 to $200 to the price tag, and the hydraulic spindle's operating screw is a bit larger than a standard lead screw, so the vise body is also slightly larger.

The replaceable hard or soft jaw plates lock to the moving and stationary jaws and are available in a variety of configurations. Most hard jaws are flat, but serrated, V-grooved (with horizontal or vertical grooves), round, semiround and other geometric styles are offered. When a unique workpiece shape needs to be held in a vise, soft jaws can be machined to a mirror image of the shape to grip the part appropriately.

A vise can be mounted in any machine that has a T-slotted bed. The most common mounting method uses two T-slot bolts, which are inserted through slots in the bottom of the bed, positioned into the two slots in the vise's base and locked in place with nuts. Other gripping mechanisms, such as rectangular fingers and clamps, are available.

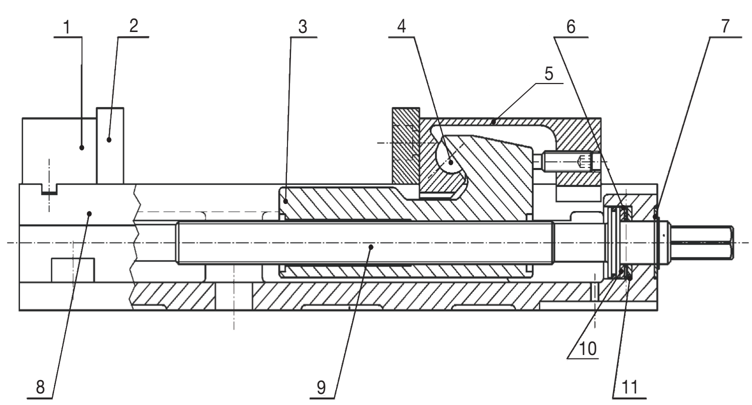
Vises can also be mounted onto tombstones. Doing so allows the end user to, for example, machine parts on all four sides using an indexing table. Another option for machining multiple parts in one fixturing is mounting vises on a pallet. While the palletized workpieces are being machined, the operator pulls parts off the pallet that were previously in the machine, inspects them and reloads the pallet.

Like most machining equipment, options are offered for vises. One popular and handy option is a swivel base, which allows the vise to be swiveled up to 360°. And similar to other accessories for increasing flexibility and accuracy, such as angle heads and rotary tables, mounting a vise to a swivel base means the vise's rigidity and accuracy are slightly reduced. It's also one more component that has to be secured before the tool meets the metal.

A precision milling machine vise made of a high-quality material, such as forged steel, with its lead screw protected from dirt, chips and coolant is designed to last several years or more. The only required maintenance is periodic cleaning to remove grime and chips.

A modular precision vise is similar to a milling vise, but it provides more flexibility regarding clamping possibilities. Modular vises enable multiple parts to be held in a single vise without clamping deflection. They are suitable for milling, drilling, grinding, and tapping operations on vertical and horizontal machining centers.

A precision machine vise for CNC milling machines.



1. Fixed jaw
2. Jaw plate (flat)
3. Slider
4. Pressure half pin
5. Movable jaw
6. Niddle bearing
7. Washer
8. Body
9. Operating screw
10. Inside washer
11. Outside washer

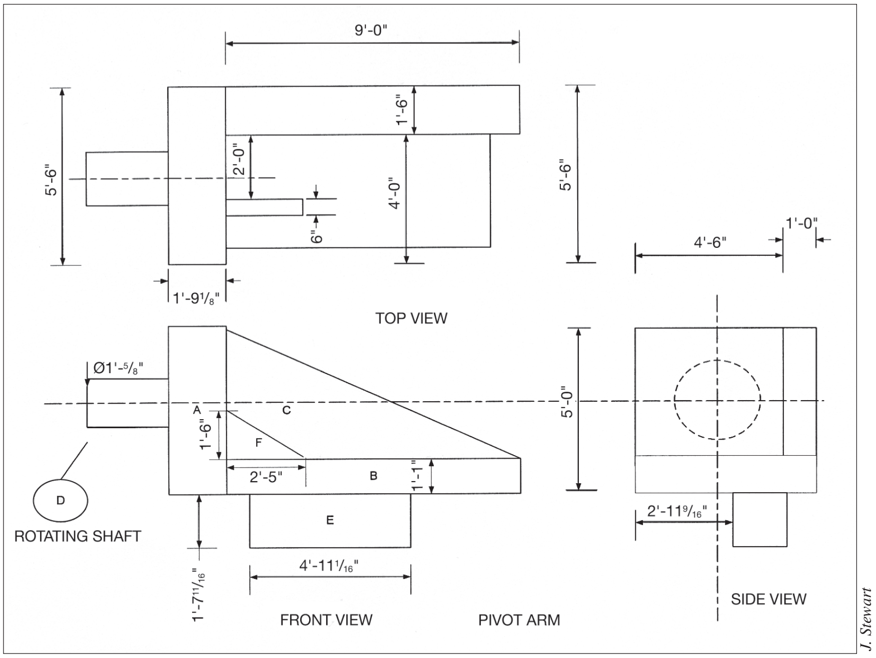
Toolmex

Special thanks to Andrew Latawiec, product manager, and Frank Sespico, national account manager, of Toolmex Corp., Natick, Mass. For more information about the company's Bison workholding and TMX cutting tool brands, call (508) 653-8897, visit www.toolmex.com or ***enter 305 on the Information Services card.***

Blueprint brainteaser

BY JOHN P. STEWART

Editor's note: The following is the second in a series of brainteasers submitted by a CUTTING TOOL ENGINEERING reader.



Occasionally, a draftsman makes a drawing error on a blueprint, which eventually reaches the shop floor despite the formal double-checking of the blueprint en route. Workers who are able to detect design errors before beginning a job are worth their weight in tool steel and can save their employers thousands of dollars in needless repair costs.

In this drawing, simple industrial drawing errors have been purposely included in the design. Searching for these errors and correcting them is an exercise that obliges the reader to study all the views to arrive at the correct answers.

This drawing of a pivot arm contains nine errors. Can you find them? If you find one to three errors, consider yourself an apprentice. Find four to six and you can work from blueprints with supervision. Find seven to nine and you can work from blueprints without supervision. Answers appear on page 5.

Engineers make engines

BY BILL KENNEDY, CONTRIBUTING EDITOR

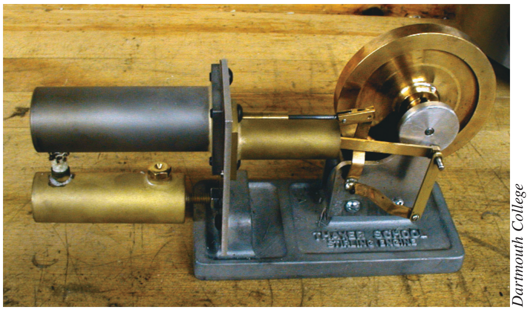
Every month, Part Time describes how a shop combines engineering principles and machining skills to produce a complex or challenging part. The occasion of CTE's 50th anniversary is a good time to think about how those principles and skills relate.

Learning about this relationship is part of the curriculum at Dartmouth College's Thayer School of Engineering. As part of their Engineering Science 25 Introduction to Thermodynamics class, students spend about 23 hours machining and assembling the parts of a model Stirling engine. An early 19th century invention, the Stirling engine creates motion by exploiting the effects of temperature-controlled air as it expands and contracts.

Kevin Baron, manager of the school's machine shop and an instructor, believes that competence in engineering requires a strong basic science education coupled with a distinctive set of technical skills. "It turns out that machining parts is a great way to train engineers," he said. "Students come into workshops and remember why they wanted to be engineers. It wasn't so they can go upstairs and solve partial differential equations—it was to make stuff."

Making things is about making tools, Baron added, so the purpose of the model making "is not to train new machinists—it is to teach engineers how to exploit the toolmaking power of machine shops. If an engineer develops a new device, a key part of that development process requires the engineer to think about the tools, molds, dies and procedures for fabricating the product he or she imagines. Often what they are inventing is not the device itself, but the process, tooling and path to creating that device."

Making the model's 35 machined parts requires turning, milling, drilling, internal and external threading, reaming, countersinking, boring, sawing and even hand filing. Workpiece materials include brass, aluminum, stainless steel, cold-rolled 1018 steel and 0-1 drill rod.



Dartmouth College

Engineering students perform a variety of machining operations on a selection of work materials to produce parts assembled into a model Stirling engine.

The parts the students make range from simple brass levers to components that require multiple machining operations. One such detailed part is a heat-transfer-piston guide bushing made from ½"-dia. brass bar stock. After a student cuts the stock to a length of 15/8" with a hacksaw, the workpiece is clamped with a ½" collet in a lathe, faced and turned to a ¼" diameter for a length of 1". Then the bushing is flipped, clamped in a ¼" collet and turned to a ¼" diameter for a ½", which leaves a ½"-dia., ⅛"-wide collar. That ¼"-dia. shaft is then threaded with a ¼-28 die to within 3/32" of the collar. A 5/32"-wide spacer is put on the threaded end and secured with a ¼-28 hex nut. A student then faces the bushing end and nut until the nut is 3/32" wide and ¼" of threaded shaft remains.

The bushing is center-drilled and through-drilled with a No. 33 drill, pecking about every ⅛". A straight-flute reamer finishes the hole to a 0.126" diameter. After the edges of the nut are filed clean, it and the spacer are removed and the nut is set aside for later use. While the bushing is still in the collet, the collar is filed flat on one side to within 1/16" of the shaft.

The machine shop's equipment includes six engine lathes, five manual Bridgeport vertical mills, two CNC lathes, two CNC mills, an EDM, drill presses, bandsaws and grinders.

The students make most of the parts on manual machines. Bacon said: "We like training engineers of the future on machine tools of the past. Old machine tools are obvious and robust. Stand behind an old LeBlond engine lathe and you can see the feed screws turning to move the saddle. You have to think about tool geometry and manually select feeds and speeds. You have to think about the relationship between surface speed and rpm. Old machine tools are a great place to start when you're trying to explain why things are done the way they are today."

Nonetheless, modern machining technology isn't ignored. The students experience CNC machining during the milling of two bearing plates from ⅛"-thick flat aluminum stock. After two 2¼"×3¼" pieces of the stock are cut with a bandsaw, the saw cuts are filed smooth. An instructor then clamps the stock onto a simple fixture where small clamp blocks secure the thin plate. The CNC machine is used to drill one 19/64"-, one 31/64"- and two 3/16"-dia. holes into the plate. Then four socket-head cap screws are screwed into the now-tapped holes to anchor the plate for edge milling, the clamp blocks are removed, and a ½"-dia., 2-flute endmill is applied to machine the plate contours.

Some of the machining applications present learning opportunities in and of themselves. In a few instances, students make round end caps for heat-transfer pistons and tubes from square stock. In making a piston cap, a 1/16"-thick, 1 15/16"-square brass plate with a ¼"-dia. hole in it is mounted on a 1"-dia. plug. The plug is chucked in a lathe, then a student turns the plate to make a 1 1/16"-dia. round cap for the piston.

"The interrupted cuts are a challenge, and we have discussed trepanning as an alternative," Baron said. "The trade-off is that the trepanning setup is a little more complicated and the tool pressure creates more deflection."

Presently, most job "coaches" suggest students take light cuts with a carbide insert to make the cap. "The nice thing about instructing 'newbies' is that something is learned no matter what you do," Baron said.

The students also witness "nontraditional" machining techniques when making a connector link from 3⁄16"×1⁄2"×7⁄8" brass bar stock. After milling the stock to 3⁄16"×1⁄4"×3⁄4", a student applies a No. 50 drill to make two holes, centered 1⁄8" from the bar end, through the 1⁄4" side. Then an instructor demonstrates EDMing to make two 5⁄16"-deep × 0.067"-wide slots in the ends of the bar, perpendicular to the holes.

Baron said making the models gives students insight they can apply throughout their engineering careers.

"Then we watch them change the world," he said.

For more information about the Thayer School of Engineering at Dartmouth College, call (603) 646-3261 or visithttp://engineering.dartmouth.edu/thayer.

Answers to Blueprint Bainteaser

1. The circle in the side view, indicated by dotted lines, is visibly much larger than the diameter of the rotating shaft shown in the front and top views.

2. The thickness of workpiece item (PC) C in the side view is not the same as is shown in the top view.

3. In the side view, PC B aligns with PC A, which is not the case in the top view.

4. In the top view, the end of PC C extends beyond PC B; PC C aligns evenly with PC B in the front view.

5. Length is not given for PC D.

6. Locating dimension from end of part is missing for PC E.

7. Dotted lines are missing in the top view for PC E.

8. Rib F shown in the front view and the top view is not shown in the side view.

9. The thickness of PC E is not given.

Quickening the pace

BY JAMES A. HARVEY

The first in a series of tips drawn from the book Machine Shop Trade Secrets.

Machinists are often asked to produce parts that were needed "yesterday." Most people, including myself, don't want to work any harder or faster than we have to. At times, though, we have to get the lead out and get going. The following suggestions may help you work more quickly:

■ Use dedicated tools.

This business of having one tool that does everything isn't very efficient. For the most part, each tool should serve just one purpose. For example, have an assortment of dedicated air tools. I have a drawer full of cheap air spindles, each mounted with different cutters or abrasives. If I need to cut off a pin, for instance, I can be cutting within seconds, instead of fiddling around with wrenches and collets. I suppose you could get carried away with this type of thinking. I wouldn't go so far as to buy a handle for each socket I have. Nevertheless, having and using dedicated tools can raise your working speed.

■ Use stub drills.

Anytime you can drill a hole without center drilling first, you save whatever time it would have taken to do that center drilling. Normally, a high percentage of holes are simply clearance holes used for bolting parts together. Clearance holes are usually from 0.015" to 0.030" larger than the bolt diameter.

If you know you're going to drill clearance holes or other noncritical holes, then you can apply a stub drill without center drilling. A stub drill that has been properly web-thinned cuts with little pressure and produces surprisingly accurate holes. You can either buy stub drills already made or make them by cutting standard-length drill bits and regrinding the tips.


J. Harvey

For rough milling, it's hard to beat a short, beefy corncob-type cutter.

Even if the stub drill runs out a little bit as you start a hole, you'll probably have enough tolerance on a clearance hole so that it won't matter. If the hole is deep or has to be precisely located, then it is best to center-drill first to maintain an accurate location.

■ Rough ugly.

I believe there is some truth to the idea that "roughing is where you make your money." Bear in mind, you can't do much roughing if there is little material that needs to be removed.

The most efficient roughing takes place with a saw. Within reason, you should try to remove as much material as possible or practical when sawing.

Roughing is sort of a behind-the-scenes operation where you get to do it as fast and ugly as you want. Roughing is one operation where you get a chance to erase your tracks later—take advantage of the situation.

■ Work your machine hard when roughing, but do it the right way.

You want to make your machine groan, not beg for mercy. I believe increasing the feed is the best way to remove stock quickly. By keeping the DOC and spindle speed moderate, you may be able to increase the feed to get things moving.

Increasing the DOC also works, but that puts a lot of pressure on the cutter and machine components. Instead, you want to put load on the motor. If you hear the motor bog down when a large-diameter cutter enters the material, then you can be confident you're working the machine hard without abusing it.

■ Power-tap blind-holes.

If you drill a tap size hole at least twice as deep as the threads you need, chips will have a place to go and won't cause binding. Use a spiral point or gun tap so chips get pushed ahead of the tap. A spiral point or gun tap won't bind like a plug tap or hand tap. As long as you use a sharp tap with some cutting oil and give the chips a place to go, the tap should cut freely.

If the design of the part is such that you don't have enough material to drill a hole at least twice as deep as the thread, then it is safer to either hand-tap to final depth or use a tap that pulls chips out the top. By hand tapping, you can gauge the amount of torque you put on the tap and clean the chips out as you go.

Occasionally, you hear a machinist say: "Why should I work fast? I'm in no hurry. I get paid the same hourly rate regardless of how fast I work." That may be true, but by learning how to work fast—while keeping in mind that doing a job correctly is always the first priority—you'll have that option when you need it.

About the Author

James A. Harvey is a machinist and plastic-injection moldmaker based in Garden Grove, Calif. He can be e-mailed at HarvDog42@aol.com. Machining Tips is adapted from information in his book Machine Shop Trade Secrets: A Guide to Manufacturing Machine Shop Practices, which is published by Industrial Press Inc., New York. The publisher can be reached by calling (212) 889-6330 or visiting www.industrialpress.com.

BY DR. JEFFREY BADGER

Cermets and rotary dressing

Archives MNATP, Collection Meillassoux

Dear Doc,

I started grinding cermet tools and am having a heck of a time, as they keep shattering. Any recommendations?

The Doc replies:

Cermet tools are difficult to grind for two reasons. First, they're very hard, so they dull and wear your diamond grinding wheel. Second, because cermets are so hard and brittle, they are sensitive to heat and temperature gradients.

Begin by accepting the fact that you won't be able to grind cermet as easily as solid carbide. Wheel wear is going to be greater and cycle times are going to be longer.

Next, switch to a smaller-grit wheel, say, from a 220 to a 320, and a more friable, angular-shaped abrasive. A more friable abrasive is one that is "crumbly," or fractures and self-sharpens during grinding. A more angular-shaped grit, as opposed to a blocky-shaped one, attacks the workpiece more aggressively. Every wheel manufacturer has a different designation, but if you tell the salesman you want a more friable, angular-shaped grit, he'll know what you mean. The downside of switching is wheel wear will increase. That's a fact of life if you want to prevent cermet workpieces from shattering.

But I assume you need production today with the wheel you have. So, until a new wheel arrives, here's what to do: improve wheel cooling by matching coolant velocity with wheel velocity; decrease the metal-removal rate, preferably by dropping the in-feed per pass instead of the workpiece speed; and drop the wheel speed. If you're running at 6,000 sfm, drop it to, say, 4,000 sfm.

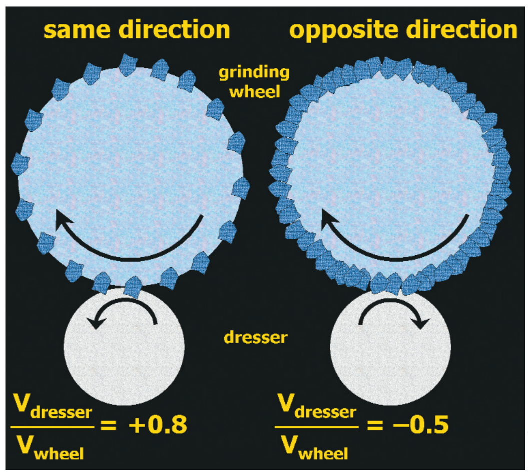
It'll be a tough go, and you'll get a fair bit of wheel wear, but you'll be able to reduce heat and produce cermet tools that won't shatter.

Dear Doc,

I'm cylindrical grinding with a vitrified-alumina wheel. I rotary-dress it with a diamond dresser, but have no idea about how fast to rotate the dresser. I've heard the number 0.8 mentioned, but have no idea what it means. Can you help?

The Doc replies:

By changing the speed of the dresser in relation to the grinding wheel speed, you can change the wheel's topography. When the diamond dresser is rotating in the opposite direction as the grinding wheel, the diamonds tend to "grind" the grits in the grinding wheel, producing a closed and somewhat dull wheel topography. This imparts a fine surface finish on the workpiece, but generates more heat.



J. Badger

When the dresser and the grinding wheel are rotating in the same direction, a ratio of surface speed of about 0.8 for the dresser compared to the wheel produces an open, sharp wheel.

When the dressing wheel is rotating in the same direction as the grinding wheel, the diamonds tend to crush the grits in the grinding wheel, producing an open and sharp topography. This leads to a rougher surface finish on the workpiece, but less heat is generated.

Several studies have shown that the optimal speeds for producing a sharp grinding wheel and achieving a high mmr is when the ratio of the dresser surface speed to the wheel surface speed is 0.8, with both going in the same direction at the point of contact. This means the grinding wheel is running about 25 percent faster than the dresser. So, if the wheel is running at 8,000 sfm, you want the dresser running at around 6,400 sfm. If your machine thinks in rpm, the equation is:

$$\text{dresser rpm} = 0.8 \times \text{wheel rpm} \times \frac{\text{wheel diameter}}{\text{dresser diameter.}}$$

Use any units you wish, as long as you're consistent.

If you have lots of material to remove from the workpiece, you can dress the grinding wheel both ways. Dress at 0.8 and rough-grind most of the stock. Then change the dresser's direction of rotation and speed, for example, to -0.5, to produce a dull, closed wheel for the last few finishing passes. Or, if your machine won't let you change the direction of the dresser, increase the speed of the grinding wheel so that it's going much faster than the dresser, with a ratio of, say, 0.2. This will have the same effect of producing a closed, dull wheel, which is good for creating a fine surface finish. △

About the Author

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