JULY 2005 / VOLUME 57 / NUMBER 7

BY MIKE PRINCIPATO

Hardball for nice guys, Part I

For an ambitious son of a gun, I have, over the years, apparently earned a reputation for being a pretty nice guy. I was reminded of the rewards of playing and working well with others last fall when my dad passed away. Hundreds of mourners waited in line for hours to pay their respects. As they filed by, I was astonished by the diversity of the lives my father had touched with his kindness and warm personality. I would be fortunate, I thought, to leave such a legacy at the end of my days.

The jury's out on whether I'll live up to that standard, but there is one scenario I've experienced several times in my career that activates an entirely different side of my otherwise empathetic disposition: getting stiffed on a bill.

I don't mean when a customer delays payment for any number of good reasons. Many shop owners and managers have occasionally suffered the effects of seasonal doldrums and a dozen-plus other causes for not being paid within terms. No, I'm talking about dealing with a true deadbeat account, that particularly odious species of customer who has mastered the black art of running suppliers up the flagpole for relatively modest amounts and then bolting without paying. These predators rely on the fact that most suppliers won't play hardball to collect small sums of money, but will instead write off the loss as a bad debt.

These predators rely on the fact that most suppliers won't play hardball to collect small sums of money.

I ain't one of those suppliers. In my book—the one my accountant has to reconcile at the end of my fiscal year—a sale isn't a sale until the invoice has been paid. If you feel differently, you're wealthier, busier or a hell of a lot nicer than I am. If, on the other hand, you are like me and see your receivables as more than just a way to keep score, like a weekend golf game full of mulligans and undercounted strokes, read on. I'm going to give you a crash course in hardball tactics. They're all legal (at least in Pennsylvania, and my quick and informal research on the Web indicates these tactics are legal just about everywhere; as we are bound to say, consult your attorney for specifics), they won't make you feel like a loan shark and you won't spend a fortune in legal fees.

Here's a typical scenario: Your shop produced one or several orders for an account that has not responded to your invoices or your repeated telephone calls requesting—then demanding—payment. The total amount is between $500 and $2,000 and is over 60 days past due. Alarmed, you spend a few bucks running a background check on the tardy account and learn the customer's credit history makes the Russian economy look dependable by comparison. After realizing with disgust that you've just effectively checked the lock on the proverbial barn door long after the horse trotted away, you should do the following, in order, pronto.

Spend 10 bucks to send a one-page letter via certified mail, return receipt requested, directly to your customer. The letter states, "Dear Mr. Smith: We have attempted to contact you several times for payment on the following overdue invoices … With the hope of preserving our valuable business relationship, please call me at 555/555-5555 within 5 working days from the date of this letter to confirm the date you will pay the outstanding balance due." You get the idea. Short, pleasant, specific.

If the customer is a true deadbeat, your letter won't get a response. Certified letters are a way of life for these guys. "Amateurs," the professional deadbeat will sniff. That's why your next step ups the ante significantly: a civil complaint, filed with your local district justice.

You may be thinking, "Wow, that's pretty harsh, Mike, isn't it? And is it worth the trouble?"

No, it's not harsh, my warm-and-fuzzy friend. Deadbeats are stealing from you and your employees. They require you to impose a "tax" on your honorable, prompt-paying customers to subsidize the deadbeats' lack of ethical business practices and your bad debts. They prey on your very human nature to hope that you will receive payment eventually.

As for whether filing a civil complaint is worth the trouble, I counter that it's little trouble at all. The "Government" section of your local telephone directory lists the district justices in your region. My experience with these offices is that the staff is invariably friendly and helpful, particularly if you make it clear you're representing yourself and are a bona fide working man who's been wronged. They can't give legal advice, but they can provide a sample complaint form to use as a template for your specific complaint.

Complete the simple form, pay the modest fee (usually about $100) and by all means, pay the additional cost to have the complaint served by a uniformed court official. Nothing quite launches the chain of office gossip more than a sheriff or similarly grave-looking official arriving at the deadbeat customer's reception desk holding an official document with the boss's name on it.

Now the real fun starts. Tune in next month for advice on how to prepare for—and win—your case without an attorney.

About the Author

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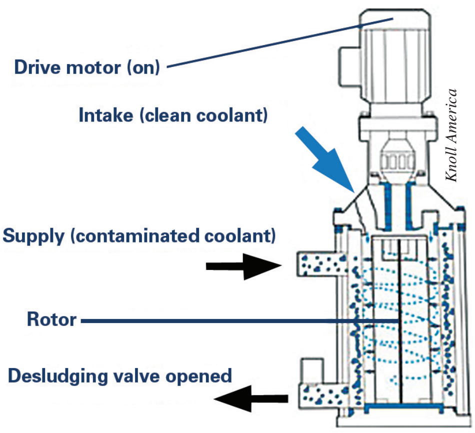
Essentials of coolant filtration

Although dry or near-dry machining is being performed more, most metalcutting operations still use coolant, or cutting fluid. Coolant does more than limit the amount of heat generated during machining; it also helps perform the essential function of evacuating chips from the cutting zone. Chips must be flushed continuously to prevent them from being recut, which can lead to tool failure and the marring of surface finishes. But this flushing action mixes chips into the coolant, necessitating filtration of the cutting fluid.



A stand-alone filtration system may support a single machine or work cell.

The methods of coolant filtration, in the most basic sense, are separation and filtration. In separation, larger particles are removed from the fluid by means of a physical force or through a coarse grate, whereas in filtration, smaller particles are extracted by sending the coolant through some type of barrier.

Three basic styles of filtration systems exist: in-line, stand-alone and centralized.

With an in-line system, the filter is mounted within the fluid line coming into the machine. The coolant exits the other side of this ported filter and goes to the tool/workpiece interface.

With a stand-alone system, the coolant is pumped to a stand-alone filter unit, a separate piece of equipment that sits next to the machine tool and may support one machine or a small cell of machines.

Typically, large operations employ centralized systems to supply coolant to many machines. Coolant and particles are returned together from the machining operations to the central system where the coolant is filtered remotely and then returned.

Normally, filtration systems are engineered for a specific application. The primary application factors are the viscosity of the fluid, the type of material in the fluid being removed, the rate of fluid being filtered, and the rate of particulate mass being introduced into the fluid. These factors determine the efficient flux rate of a filter in a given application, which is the rate of fluid cleaned efficiently for the application with a given filter.

Most filtration methods differ according to the types of materials being filtered from the coolant. For instance, methods of filtering ferrous and nonferrous materials differ in terms of their ability to use magnetism, because magnets attract ferrous particles. Even within ferrous particles there are further differences. For example, machining cast iron introduces high populations of small particles, whereas steel particles are not as small, and are traditionally the easiest materials to filter.

When machining aluminum, the chips may float, or the aluminum alloy may have a high silicon content requiring special attention for filtration. This is because silicon particles are abrasive, and, if not removed, they will create premature wear on every surface they contact. Aluminum with a low silicon content, say 5 percent or less, doesn't need such special consideration.

A key consideration in coolant filtration is what type of filter media will be used. This will determine a feasible flux rate. Attention to this flux rate will largely determine the level of maintenance required for the coolant filtration system. Any system that challenges its flux rate requires an intensive amount of maintenance. A system appropriately proportioned for its flux rate, which uses disposable media, either bags, rolls of paper or cartridges, requires maintenance, but not as much. A system that uses a permanent filtration media, such as a wire-mesh fabric, is maintenance-free, and allows particulate to settle out and be removed by a drag chain.

Another key consideration in coolant filtration is how tight the tolerances are for the parts being machined, and how small the chips being removed are to maintain optimal performance.

Machining can generate microscopic chips called "fines," which are smaller than the human eye can see, typically at the 40μm threshold. Removing fines extends the life of machine tools and cutting tools, and improves the surface finish of the machined part. However, removing fines under 010μm is only necessary for applications where tolerances of the part being machined are exceedingly tight. Otherwise, filtering particles from 50μm to 100μm is usually sufficient.

If it is effectively maintained, the life of a quantity of coolant fluid is considered indefinite.

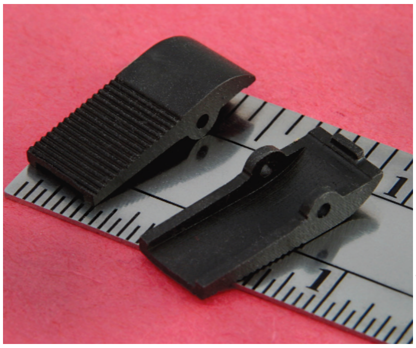
Information provided by Knoll America Inc., Madison Heights, Mich. For information about the company's coolant equipment, call (248) 588-1500, visit www.martecproducts.com or ***enter information services #320***.

Rear-sight insight

BY BILL KENNEDY, CONTRIBUTING EDITOR

Swiss-style lathes are known for their capability to produce small, precise, round parts complete in one setup. However, Evans Machining Service Inc., Clairton, Pa., fully exploits the workholding and precision machining abilities of a Marubeni Citizen-Cincom M32 Swiss-style CNC lathe to make thousands of parts that are not round at all.

Defense products are Evans Machining's specialty. One example is a 0.680"-long x 0.275"-wide x 0.150"-thick rear-sight catch for a light machine gun. The manufacturing process began when Dan Evans, vice president of production, created a part drawing in AutoCAD software using a customer-provided scanned image of the part print. He used Solidworks 3-D design software to convert the drawing into a 3-D model and then imported the model into Partmaker SwissCAM software to generate the machining program.


B. Kennedy

Evans Machining produces these rear-sight catches on a Swiss-style lathe.

The part is machined from a 12'-long, ⅜"-dia. bar of annealed 8620 carbon steel. To assure part repeatability, Evans buys ground and polished stock. "Plus nothing, minus a half a thousandth," he said.

After an IMECA bar feeder sends the workpiece into the machine, the first machining operation is a light facing cut on the bar end with an Iscar 80º-diamond, TiAlN-coated CCMT insert, run at a spindle speed of 2,500 rpm and a feed rate of 0.005 ipr. Next, with the same tool at identical cutting parameters, Evans turns the bar to a 0.280" diameter. He doesn't use a smaller-diameter bar to begin with because "if you have ¼"-dia. bar stock going through the guide bushing, it may chatter more than a ⅜"-dia. bar, especially when you are milling," Evans said. "That extra stock does make a difference [because otherwise] you're basically machining a piece of spaghetti."

Next, an Iscar ¼"-dia., carbide endmill roughs one side of the part flat. After the part is indexed 180º, the same tool mills the other side. Both cuts are done at 5,000 rpm and 15 ipm. The part is indexed another 90º, and the endmill roughs the contour of the part's bottom at 2,200 rpm and 6 ipm.

Then, on the same bottom side of the part, a longitudinal 0.200"-wide x 0.625"-long x 0.050"-deep slot is milled with three passes of a 4mm-wide Iscar Multimaster slotting cutter. The first pass down the center of the slot takes place at 2,000 rpm and 2 ipm, followed by passes on either side of center at 2,500 rpm and 5 ipm.

The next feature machined is a tiny 0.110"-long x 0.030"-high x 0.050"-thick "nub" at the part's free end. To create the nub's height, a 0.125" Iscar carbide endmill runs straight across the part width at 4,500 rpm and 10 ipm. Then it mills the nub's side at 8,000 rpm and 4 ipm, and finishes the nub's ends with two passes at 8,000 rpm and 5 ipm. The 0.125" mill has a 0.010" corner radius, and it's applied again, also at 8,000 rpm and 5 ipm, to clean out larger radiuses left by the ¼"-dia., 0.50"-radius endmill applied earlier. Run at 8,000 rpm and 6 ipm, the smaller endmill then finishes the sides of the part previously roughed by the larger tool.

Evans said the most critical operations in the production of any part are those that directly affect part function. In use, the rear-sight catch rotates on a pin that passes through two holes. If the holes are sized incorrectly or are out of line, the catch will not operate smoothly. Although the pin goes straight through the part, Evans doesn't make the two 0.050"-dia. holes with one straight-through drilling pass. A carbide circuit board drill from Titex drills the holes separately from each side of the part, indexing 180º between passes. "To drill one side and then the other side is more accurate," he said. "If you tried to drill all the way through, the drill definitely would walk on the other side."

Evans pointed out that use of ground stock helps assure part accuracy when indexing between drilling passes. The drill protrudes from the collet ⅛", and is run at 8,000 rpm and 1 ipm.

Through all previous operations, the top side of the part remains unmachined, providing strength and stability during work on the bottom side. Now, the ¼" endmill used previously roughs and finishes the top of the part. Evans said he climb mills to minimize cutting pressure and takes two passes. The first is at 3,500 rpm and 3.5 ipm, and it leaves less than 0.001" excess material for a finish cut at 3,000 rpm and 8 ipm. Evans said the lower finishing speed and light cut essentially eliminate chatter.

Next, Evans makes 17 serrations, each 0.020" wide x 0.020" deep, across the top of the part with a 90º-included-angle cutter from Internal Tool.

In the final machining operation, an Iscar DGL parting tool cuts the part from the bar at 1,500 rpm and 0.001 ipr. Evans said using a left-handed lead tool minimizes the central burr that is left on the part when it falls off the bar just before the

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Land of the free (software)

BY DAVID GEHMAN AND
GREGORY FARNUM

Is free software for the shop worth more than you pay for it?

It depends. Any software, free or not, can be pretty valuable if it fits your needs.

It should come as no surprise that some free software is hard to use, and it rarely is designed to be a comprehensive, integrated system. Free software tends to consist of point tools, that is, utilities for specific tasks.

A bit of searching on the Web will generate links to metalworking software, some free, some low cost and most—naturally—available at full price. We had no idea how rich the resources were until we typed three keywords in Google: free metalworking software.

The absolute gem is Marv Klotz's Software for People Who Build Things at www.geocities.com/mklotz.geo. A retired aerospace physicist and self-educated machinist, Klotz has a home shop where, among other things, he builds stationary engine models from scratch.

"Many people helped me get started in metalcutting," Klotz said. "They gave freely of their knowledge, and I'm simply redistributing the riches by offering a few things myself."

Just as you might want to find out the details about the designer, the design methodology and the fabrication of an experimental plane before leaving the ground in it, you must qualify free software for your uses.

Because steam, vacuum and Stirling engines embody almost everything in mechanical design and metalcutting—and you can count on an aerospace physicist to have a decent technical background—you are likely to find more than one useful utility or link at this site.

Among the 120-plus goodies (written in the professional programming environment, C) are a number of programs that enable what Klotz calls HAM, Human-Assisted Machining, or manually doing what a CNC machine can accomplish. While these programs are fine for hobbyists, there are some useful items for commercial shops as well: a program to determine cut-lengths that optimize yield from available stock, a differential dividing head program and numerous mathematics utilities.

Programs from others listed on Klotz's site include a table of 400 or so standard threads by size and a G-code writer for CNC programming.

For those who live in the alternate OS world of Linux, there is Enhanced

Machine Controller, a CNC driver at www.linuxcnc.org. It controls machines with up to six axes via G-code input.

Finally, Metalworking.com, which is targeted toward hobbyists and small businesses, has a number of free and low-cost programs of varying vintage and ability.

Every computer program takes you into its own world, but the more polished, commercial varieties ease you in as gently as possible. They generally follow familiar interface and file conventions.

In contrast, freeware can sometimes reflect brilliant programming but work with puzzling or nonstandard interfaces. For example, Klotz's programs all run in DOS, because he has no love for Windows. They run fine from what Windows calls the Command Prompt, and DOS provides an efficient and rapid environment. But in the end, they help those who help themselves—the hand-holding you might have come to expect from Windows is not there.

With free software, documentation is likely to be sparse, and support is usually not part of the equation. Many a fledging utility has been withdrawn or turned into a for-pay application after the developers found themselves inundated with requests—even demands—for extensive support.

Just as you might want to find out the details about the designer, the design methodology and the fabrication of an experimental plane before leaving the ground in it, you must qualify free software for your uses. "Part of being a machinist is being able to verify your tools, and that goes as much for software as it does for micrometers and calipers," Klotz said. Outcomes will be smoother if the program's results are accurate, if they embrace an engineering approach you trust, and you are confident it applies to your workpiece materials, methods and machines. Klotz's methodology wisely draws on defaults, most of which you can change, and his packages generally contain test cases that allow you to see how a given program works and judge whether results are what you expect.

Free software will likely continue to exist even in an increasingly commercialized world. Klotz continues to get what he calls "interesting problems to solve. The variety has mushroomed over the years, and I get a lot of good responses." If you're a manufacturing professional, it behooves you to check out the world of free software. The price is right, and you just might find something of value for your shop. △

About the Authors

David Gehman has been writing about manufacturing and software for more than 20 years. Gregory Farnum is a Detroit-based journalist specializing in industrial and scientific issues.

BY MICHAEL DEREN

Are you in a rut?

A few weeks ago, Bruce and Tony, who work for a major cutting tool manufacturer, stopped by to visit me at the shop. We buy the bulk of our cutting tools from them and Bruce knows he's always welcome. Tony is the "new kid on the block" and Bruce wanted to introduce him to me.

After introductions and some chit-chat, Bruce asked me when I would try this new, super-duper, whiz-bang carbide cutter of theirs. Mind you, he's been asking me to try it—without obligation—since last summer. I kept making excuses because the cutter is not cheap; actually, it is downright expensive. But mostly, I just didn't feel like doing cutting tests.

Truth be told, I have been in a rut for the last year or so. I usually go to the trade shows, see what's new, listen to the hype, grab some literature and file the lit when I get back to the office. Then I go about my usual routine of trials and tribulations with the parts we're working on.

Their timing, however, couldn't have been better. We were having a heck of a time with one particular production run. Cutters were breaking and feeds were slow. Also, the cutters were noisy. When I showed Bruce and Tony the job, Bruce exclaimed, "Have I got the cutter for you!" Can you guess which cutter? Yup, the one he's been trying to get me to use for the last year. They were having a promo, so I placed an order and the tools arrived the next day. Bruce and Tony came by, we changed our cutters for theirs and proceeded to run the job with their input.

Let me tell you something. Based on the test results, those cutters are worth their weight in gold!

Previously, we would run 60 parts, break at least five cutters and the feed was 6 to 8 ipm. Now, after 60 parts, there are no broken cutters and the feed is over 22 ipm.

Although we could buy four of our old cutters for the price of one new tool, we've almost tripled productivity and reduced overall tool costs. So, no matter how you look at it, we are money ahead.

Now that they had me psyched up and out of my rut, Bruce saw his moment of opportunity. Knowing we also made form tools for die sets, he asked if I wanted to test the other cutter he had been trying to get me to buy for the last year or so. Yup, I bit—hook, line and sinker. I told him we were doing a form die the following week. "I'll get you a cutter to try for the job, and we'll be here," he said.

The trouble we were having with the job was in the initial roughing operation. Our dies are large and were taking up to two shifts for the initial roughing. The cutter we were using is called "high velocity" by a manufacturer who farms out its cutter and insert manufacturing to the lowest bidders. We were machining at approximately 28 ipm with a 0.050" DOC. We were getting exactly what we paid for.

Soon, the tool arrived and so did Tony. Bruce figured it was time for Tony to fend for himself. Tony and his cutter performed flawlessly. After Tony gave me the feeds and speeds to use with the new cutter, I thought to myself that as soon as that cutter touches the workpiece, it's time to duck. But at more than 152 ipm with a 0.040" DOC, the cutter only wanted more. We roughed in less than 4 hours and only indexed the inserts one time. With the old cutter, it would take 13 to 16 hours to rough, we would use at least a 10-pack of inserts and the cutter body would sustain damage as well.

Although we could buy four of our old cutters for the price of one new tool, we've almost tripled productivity and reduced overall tool costs. So, no matter how you look at it, we are money ahead.

I had become complacent over the last couple of years and just accepted the status quo. Well, thanks to Bruce and Tony, I had my wake-up call. Are they welcome here? You know they are. When they come with another latest and greatest tool, will I try it? What do you think? △

About the Author

Michael Deren is a CNC applications engineer and a regular CTE contributor. He can be e-mailed at mderen@prexar.com.

PART TIME

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cutoff blade completes the cut. As it is, the burr is only 0.0005" to 0.0010" in diameter. "We can zap it on a secondary operation on a surface grinder."

The burr, and the secondary sanding operation, could be eliminated if the part was grasped in the subspindle collet during cutoff. The shop elects to forgo that option because the part's shape is difficult to grip, and its radius could be crushed by the collet.

After the part is cut off, the cutoff tool retracts, the bar advances about ¼", and the cutoff tool performs a repeat pass to prepare the bar end for machining of the next part.

Total machining time is 3.45 minutes. The parts are heat-treated to 42 HRC, finished in a glass-bead tumbler and finally receive a black manganese phosphate coating. The customer orders lots of 2,000 parts, and the shop runs about 30,000 of the rear-sight catches annually.

For more information about Evans Machining Services, call (412) 233-3556 or visit www.evansmachine.com.