BY MIKE PRINCIPATO

Are your help-wanted ads wanting?

Let's pretend for a moment that even though you've got a good job with a decent company, you're seriously considering changing jobs. Then you stumble across this classified ad in your local newspaper:

Experienced manager needed to run job shop. Knowledge of prod. planning and quality control a must. Comp. pay and benefits. Fax résumé to: (—) ————.

Pretty scintillating prose, huh? Makes me want to chuck what I'm doing right now and make a beeline for the nearest fax machine.

It never ceases to amaze me that in their search for their most important asset—skilled labor—otherwise highly effective managers publish help-wanted ads so uninspiring that the Dead Sea Scrolls seem like a Tom Clancy novel by comparison.

Why are so many managers guilty of this sin? I suspect it has something to do with our typically dry, engineering-oriented intellect. Or maybe we're just too cheap to pay the extra cost for a few more lines of type. The reason doesn't really matter, though. Writing better ads does. Following are some ideas to help you do that.

Let's start with a few givens. First, the economy is more robust now than it's been in years, which means that our industry has absorbed the ever-dwindling pool of qualified talent. Any decent machinist, programmer or operator is already gainfully employed and, thus, will have to be motivated to leave his or her current employer.

Second, the classifieds sections of some newspapers are better than others. Although there's nothing wrong with placing ads in several publications, if you're on a tight budget, choose the local paper with the largest classified section and run your ad Friday through Sunday, at a minimum. That'll get you the largest possible readership.

Third, even though you and I dearly love our industry, in the eyes of the average classifieds scanner, machining for a living does not inspire the same glamorous image as, say, driving a Formula 1 racecar. You're going to need to dig a little deeper creatively to come up with a better description than "job shop" if you want to generate a healthier response to your ad than the half-dozen others in the Sunday classifieds.

For example, let's start with a typical ad from my local newspaper:

Machinist, day shift, for local job shop. Five yrs. CNC exp. req'd. Comp. pay/benefits. Call (—) ————.

Contrast that with the ad I ran in the same newspaper:

Machinist needed for the day shift at XYZ Manufacturing Co., the area's most progressive contract machining company. If you've got the skills and desire to move up to a clean, air-conditioned operation that offers the best pay and benefits package in the business, consider XYZ. We produce precision parts made to order for the aerospace, optics and machinery industries and know that to be the best CNC shop, we need to hire the best CNC machinists. If you have the right stuff, call us for a confidential interview at (—) ————.

Which ad would provoke a call from one of *your* best machinists? More important than the obvious answer to that question is *why* the second ad would generate more of the right job candidates.

Yep, my ad cost more—about $300 more for the 3-day insertion. For the very same reasons you don't buy carbide when you need diamond cutters, I couldn't care less about the cost difference. Neither should you. Freeing myself of the usual cost restrictions that most employers needlessly impose on themselves, I can write copy that connects with the people I want to reach. I can eliminate penny-pinching abbreviations such as "exp." and "comp.," and convey what I want to prospective hires: That XYZ knows people matter more than the machines they run, and we don't scrimp when it comes to attracting the best.

Even though you and I dearly love our industry, in the eyes of the average classifieds scanner, machining for a living does not inspire the same glamorous image as, say, driving a Formula 1 racecar.

Note the explanation of what it is that the company produces. All the great machinists I've ever met took an interest in the parts they produced, whether for mundane reasons, like ensuring that a simple widget was produced with a bulletproof QA process, or because the parts they were machining went into fighter jets. Acknowledging that natural interest in your ad reflects an understanding of the craftsman's personality, and says you realize that what you make really matters.

Finally, your ad should respect the candidate's time and need for confidentiality. If a top-shelf guy is going to consider applying at your company, it's important that he knows you'll be discreet and work around his schedule.

Remember, the team with the best players almost always wins. To find them, you have to start with the best classified ads.

About the Author

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Choosing a cutoff saw

Manufacturing engineers view cutoff sawing as an important first step in the production process. A well-executed cutoff operation can reduce subsequent machining requirements—sometimes dramatically.

Recent advances in machine and blade technology have reduced cutting times, and the development of touch-screen control systems and sophisticated software have lowered downtime.

Two styles of machines dominate metal sawing: the bandsaw and the circular saw. The circular saw rotates a spindle on which is mounted a steel disk blade with cutting teeth on its periphery. The bandsaw turns a continuous, toothed blade that is stretched around two pulleys. One pulley is idle; the other is driven by a motor.

Each type of saw has pros and cons. Choosing the best one for a cutoff operation depends on many factors, including material and production capacity, required surface finish, kerf loss, process flexibility, specified tolerances, speed and cost.

Nevertheless, there are rules of thumb that can help establish which technology is most likely to satisfy given requirements and provide the lowest cost per cut.*

Circular saws are favored for small-to-medium sections and solids—up to about 6"—when surface finish and squareness are critical, especially if miter cutting is involved. Up-stroking circular machines are good for smallish structural jobs, thanks to their compact, safe design, which facilitates easy and quick setups.

The design of circular saws is such that they offer unmatched access to their tables. This allows them to better accommodate the jigs and fixtures used to hold castings and similar workpieces.

High-volume jobs involving short-length stock with diameters up to around 4" is the domain of magazine-fed, automatic circular saws running disposable carbide or cermet blades. These machines offer high throughput because of their fast cutting capabilities and short cycle times.

The larger the size of the material to be cut and the tougher its grade, the more likely a bandsaw will be the correct—and maybe the only—machine for the job. Large bundles favor the bandsaw, which has the advantage of a thinner blade, meaning it generates a lower cutting force and is less likely to snag in the cut or spin material.

Bundle cutting—particularly round materials—is a topic all it's own and should be approached with caution. A caveat for sawing any bundled material: Take it easy. Don't be tempted to cut too big a bundle at too high a feed rate.

Once technical demands have been satisfied, the focus changes to choosing the most cost-effective equipment. Again, it's impossible to make concrete recommendations that apply to all situations, but the overriding goal is to achieve the lowest cost per cut. A CNC, touch-screen-operated circular sawing cell may achieve that for a global manufacturer of agricultural equipment, whereas a semi-automatic bandsaw may offer the lower cost per cut for a small job shop.

An often-asked question is, "What level of sawing automation do I need: manual, semi-automatic, fully automatic or CNC?" There are exceptions, but, generally, choose a manual or semi-automatic saw for low-throughput jobs; automatic saws for applications with high throughput and large batch sizes; and CNC saws for high-throughput applications involving small batches.

Kaltenbach Inc.

There are two main types of saws used for cutoff operations: the circular saw (shown) and the bandsaw. Choosing the best one for a specific operation depends on material and production capacity, required surface finish, kerf loss, process flexibility, specified tolerances, speed and cost.

Often, the best applications for CNC saws are those considered to be manual "drudge" jobs. (This assumes, of course, that the volume of parts justifies the investment.) Today's CNC sawing cells can autofeed different materials, alter clamping pressure to suit a particular material, make straight or miter cuts, and sort scrap from good parts.

A CNC saw will provide better part repeatability and quality than is possible with a manual machine. Space and manpower savings, however, are what really make the difference. One CNC sawing cell and one operator can often replace half a dozen manual machines and operators while maintaining production rates and raising quality.

** The guidelines contained in this article apply only to mainstream sawing applications. And, even in those cases, there are exceptions.*

The hot rod connection

BY BILL KENNEDY, CONTRIBUTING EDITOR

Some of the high-tech R&D parts Bill Burdick makes at Machined Parts USA in Livermore, Calif., wind up in outer space. However, one recent prototype he made was intended for down-to-earth fun. The part was a "coupler adapter" for use in the Merlin Roadster: a 3-wheel, fiberglass-bodied, Harley Davidson-powered, single-seat vehicle that its maker, Merlin Motors Inc., Renton, Wash., calls "a personal hot rod." The coupler adapter connects the vehicle's 88-hp, V-twin motorcycle engine to its 4-speed automotive transmission.

As part of his prototype machining services, Burdick provides manufacturing engineering assistance. He worked with Merlin to modify the coupler's initial design, and changed the manufacturing process to machine the part in one piece and eliminate welding of dowel pins. "It gave them a much stronger part," he said.

The coupler was made from a 5.5"-dia., 4.2"-long section of 36- to 38-HRC 4140 steel bar stock. To hold the workpiece on a Haas VF2 3-axis machining center, Burdick made special vise jaws to grip ¾" of the bottom of the workpiece.

All machining was performed with flood coolant. To begin, Burdick faces 0.100" from the top of the workpiece with a ¾"-dia., 5-flute, P/M endmill from Bassett Tool, operating at a 150-sfm cutting speed and 0.003" chip load per tooth. Then, with the same tool and cutting parameters, he milled the coupler's OD, cutting ½" deep with a ½" step-over. The first cut produced a 2.11"-dia., 0.315"-high central post. Then the cutter stepped out radially and down axially to create a 2.364" diameter to a depth of 2.112". Another step out and down yielded a 3.150" diameter extending 2.502" deep. The last cut made a 4.80" diameter to a depth of 3.102".

"The part ends up being like a stepped cylinder with a flange on it," Burdick said. The cutting path included inside radiuses of ¼" and outside radiuses of ⅛" on the steps.

Next, Burdick made a 1.20"-deep axial hole in the central post with a 1"-dia., titanium-nitride-coated HSS Silver & Deming-style drill, running at 200 rpm and a 0.9-ipm feed rate. He machined the hole to a 1.040" diameter and contoured its mouth with a ½"-dia., 5-flute, coated carbide Bassett endmill at 669 rpm and 5.4 ipm, stepping down in 0.05" increments. Burdick then helically milled an M28×1.5"-deep thread in the hole with a carbide thread mill from Niagara Cutter, using a program stored in the Haas CNC. The M28 thread is a special metric size to match the vehicle's transmission shaft.

In Burdick's revised design of the coupler, press-fit dowel pins join coupler components and locate them between the engine and transmission. To accommodate one set of pins, Burdick drilled, bored and reamed eight smaller holes around the mouth of the threaded hole. A size "N" (0.302"-dia.) TiN-coated HSS drill made the 0.55"-deep holes at 685 rpm and 3.2 ipm, followed by a 0.312"-dia. uncoated carbide boring tool in a Criterion boring head run at 1,846 rpm and 4.1 ipm, to a depth of 0.53". A cobalt reamer enlarged the diameter to 0.314" to provide a press fit for the 8mm (0.315") dowel pins. The first series of operations consumed 1 hour and 20 minutes.

Burdick then flipped the coupler over and gripped the 2.11"-dia. central post in the vise. With the same 5-flute, P/M endmill and cutting parameters used earlier, Burdick faced 0.100" off the top of the part, then milled the OD that had been held in the vise to a diameter of 5.301".

Next, with a 1½"-dia., TiN-coated HSS Silver & Deming-style drill, Burdick made a 1.900"-deep pilot hole in the center of the part at 150 rpm and 0.9 ipm. The hole gave him a place to begin milling out the coupler's cavity. "It's [done] entirely by side milling, I don't have to plunge-mill at all," he said.

He milled the cavity with another Bassett P/M endmill, this one a ¾"-dia., 3-flute tool featuring 0.060", 45° cutting-edge chamfers. The cavity was stepped. The first diameter of 4.350" extends to a depth of 1.100", a second diameter of 3.500" goes 1.200" deep, and a final diameter of 1.750" continues to a depth of 1.900". The endmill ran at 300 sfm and a 0.005" chip load per tooth.

Photos: Merlin Motors

This coupler adapter is machined specifically for the Merlin Roadster.

"I could have fed it faster but it would have pulled the part out of the vise," Burdick said. "These new high-tech cutting tools are just amazing. The chips just come off smoking. You have to keep a good load on the cutter and take a good chip or else it dulls itself."

Burdick then drilled, bored and reamed 16 more dowel pin holes around the outside edge of the coupler's flange using the same tools employed to make the previous set of dowel pin holes. The operations on the second side of the coupler took about an hour.

The coupler has a second component. "It's pretty much the same as the other piece, only it's shorter and the dowel pin holes mate to the other part," Burdick said. A Harley Davidson primary gear goes inside the two mating parts, and a threaded shaft screws into the M28 thread to pull the coupler up against the transmission.

Burdick has made six of the couplers, with more on order as final development of the roadster continues.

Creativity and variety characterize Burdick's work. "I can't compete with people who are making blocks with holes and paying people five or 10 dollars an hour. I'm a one-man shop with a lot of overhead. I have to do work that's valuable and pays well. Besides, I like doing something new all the time," he said.

For more information about Machined Parts USA, call (925) 371-7787 or visit http://pages.sbcglobal.net/machpartsusa/. For more information about the Merlin Roadster, visit www. merlinmotorsusa.com.

Burr begone

Dear Doc,

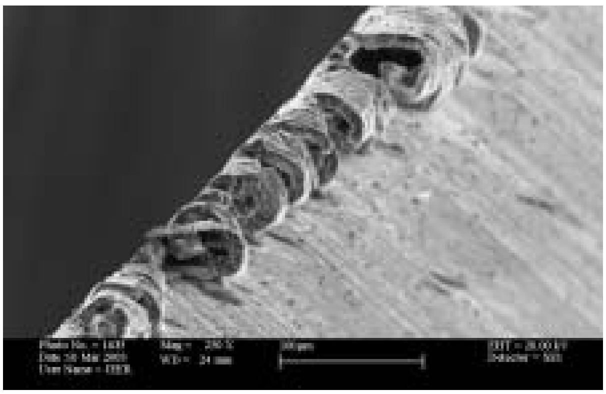
The company I work for grinds industrial knives. We rough-grind to form with a superabrasive wheel and then finish-grind the edge with an aluminum-oxide wheel. We have problems with burr formation when finish grinding, which causes chipping of the knife edge during use, i.e. when the knife starts cutting, the burr rips off and takes a sizable chunk of the surrounding material with it. Can you recommend a wheel that won't produce burrs?

The Doc replies:

First, you need to get away from the notion that there is any such thing as burr-free grinding. There isn't. During every grinding operation there are three modes of contact at the grit/workpiece interface: cutting, in the form of chips, plowing of material to the sides and front of the grits, and rubbing of the grits against the workpiece.

It is front plowing that primarily causes burr formation—each successive grit pushes more and more material in front of the grinding zone until a burr develops. Side plowing can also cause burr formation to the side of the wheel.

Some grinders combat burr formation by performing successively finer grinding operations on adjacent sides, often in opposing directions, to make the burrs smaller and smaller. But they never eliminate it. They just reduce it to a negligible level. After that there's the option of performing a finishing operation, such as honing. After finishing, burrs are so small as to be considered eliminated.



Burr formation is caused by plowing of material to the front of the grits.

So you have to decide if you really want to *eliminate* burrs, which means extra time and extra cost, or just *reduce* them to an acceptable level, which, with a little forethought, can often be accomplished with no adverse effects to cycle times or part quality.

The most common cause of excessive burr formation is a dull, closed wheel. Grinding too gently can also cause excessive burr formation. In both cases, the grits never penetrate deeply into the workpiece. They just skim the surface and push material.

The solution is to increase chip formation and decrease plowing. This can be accomplished several ways:

- Sharpen the wheel by dressing it more aggressively, either by a deeper dressing depth or, preferably, a faster dressing diamond. Or, if using a diamond roll, increase the feed rate, decrease the dwell time, and choose roller and wheel speeds so the dresser crushes the grits.
- Choose a lower-grade, "softer" wheel—one in which the grits pop out once they become dull.
- Choose an "open" wheel with a high structure number, which means the wheel is more porous.
- If using a CBN or diamond wheel, choose angular grits instead of blocky ones.
- Grind aggressively so the grits penetrate the workpiece and form chips instead of just pushing material.

All of these methods reduce burr formation. The downside is that all of them produce a rougher surface.

You can remedy this by switching to a smaller grit size, but this usually means longer cycle times. A better solution is to look at your speeds, feeds, how you dress and when you dress, and then map the entire cycle to make some intelligent choices to reduce burr formation.

One strategy I have seen smart grinders use is to mix up their grinding parameters. For example, instead of grinding 0.010" off the workpiece in ten 0.001" grinding passes with the same grinding and dressing parameters, the grinder dresses the wheel aggressively so it's sharp and grinds nine 0.001" passes at high speed. Now he's got little burr formation, but a rough surface. He then dresses the wheel bluntly, with a slow diamond speed and infeed, and grinds the last pass gently. Here, with his dull wheel, he's generating more burr formation than before, but it's only for one pass, so there's not a lot and it doesn't build up. And, with his dull wheel, he's imparting a smoother surface. Also, because the first nine passes were done at high speed, his cycle time is about the same or shorter. The result is a significant reduction in burr formation, a slight improvement in surface finish and no real change in cycle time.

Of course, every grinding operation is different. So the grinder has to put some thought into his strategy. But armed with knowledge of the fundamentals—what causes burr formation, how to reduce it and what are the side effects—the wise grinder has the tools to develop his own strategy in his battle against burr formation. △

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