

Special Machine Manufacturer Brings Gear Making In-House

Better turnaround, quality and efficiency, but this move's not for everyone.

Ray Mackowsky

When you have a multi-million-dollar transfer line sitting on the shop floor waiting for gears that might take up to two months to get, you have a costly bottleneck.

Ann Arbor Machine Co., a manufacturer of synchronous transfer lines, dial index tables, broach machines, plastic blow molding equipment and special EDM machines, located in Chelsea, MI, found itself in this situation.

Customer Deadlines Hindered By Lack of Gears

Ann Arbor Machine was jobbing out a million dollars worth of gears to a vendor over the course of a year. But turnaround was at times approaching two months. This severely limited the company's ability to complete multi-million-dollar metal-working equipment to meet its customers' deadlines.

To solve the problem, Ann Arbor Machine looked at various options. Would it make economic sense to buy a gear manufacturing company or to invest in gear hobbing equipment and make the gears in-house? With the majority of its gear needs being met with quantities of one to three and sizes from 1/2" to 8", could the investment be justified? Would either of these options bring the needed response time? And, if the work was brought in-house, would new or used equipment be the better investment?

New Hobbing Machine Purchased

After looking to buy a local gear manufacturer and finally abandoning this idea, Founder and Chairman Robert Betzig decided to bring the work in-house. He hired Bob Turke, who at one time had his own gear manufacturing company, to run the department. Turke purchased a new Gleason Phoenix 125GH six-axis, CNC gear hobbing machine, a number of used

shaping and shaving machines and an M & M gear analyzer.

Turke said that Ann Arbor could have gone with a used hobbing machine. However, machines the company looked at couldn't match the gear-making versatility, precision or quality that the new machine offered.

For Ann Arbor, not only did it make economic sense to produce the gears in-house, but gear turnaround, at times, was cut to a matter of hours. "We felt that the cost per gear was about the same or a little lower than sending gears to a vendor. However, the most important thing for us was to get gears when we needed them and with consistent quality," Turke said.

How to Decide

Turke said that one way for a company to decide if it's worthwhile to bring gear production in-house is to look at the payback time. If a company can pay back its initial machine investment in three to five years, Turke believes that it would be a good investment. Also, by bringing gear production in-house, he feels that quality can go up because of more stringent controls and faster feedback if problems arise.

Turke added that three important parameters should be looked at before a company decides on in-house gear manufacturing: timing, quality and cost, in that order.

Timing relates to the needs of your company. What kind of turnarounds are you getting from your current vendor? Is the turnaround hampering manufacturing of other parts or products? Is it causing problems with customer deliveries?

Quality is important. If your vendor isn't giving you what's needed, your end product isn't satisfying your customers' needs, and you might lose them. Turke



To streamline gear production at Ann Arbor Machine Co., most gears have the same pitch and pressure angles. Gears manufactured are usually straight spur gears and some with internal splines.

believes in-house gear production can give you higher quality because you're watching over every step of the process.

Lastly, gear cost is significant. How much can you save by producing gears in-house; or, conversely, how much will it cost you to produce them compared to buying them somewhere else? If you have a very narrow selection of gears to make, it could be less expensive to produce them in-house. But if you need many different types of gears that require honing, grinding, shaving and various other operations in small lots, payback could be lengthy because of the specialized operator skills needed and the number of different machines required to produce the gears.

In the case of Ann Arbor Machine, gears produced in-house were not significantly less expensive than outsourced gears, but the control over the process and delivery times made the investment in in-house manufacturing worthwhile.

Pitfalls

Some of the pitfalls of bringing gear production in-house include the responsibility of dealing with various vendors that you might never have worked with

before, such as heat treaters. With in-house manufacturing, you also need the equipment to verify the quality from these vendors, adding another expense and additional demands on your time.

Also, competent gear manufacturing personnel are hard to get. You'll probably need an overall coordinator, the department head and at least one good production person, depending on your needs. So now you have more payroll and more personnel coordination.

New or Used?

Should you buy used equipment or new? Turke said that from a technology standpoint, new equipment's production speed will be greater, quality will be better (new machine rigidity, superior CNC controls, etc.) and gear setup time will be less because of the machine controls' ease of use. On the other hand, late-model used machines are sometimes available with no lead time for 1/2 to 1/3 the price of new and, depending on the

application you have in mind, they may suit your purposes.

Turke explained that another reason for purchasing new equipment is the possibly positive impression it may make on potential customers. It might tip the balance in favor of your company and bring in work, as it has for Ann Arbor Machine. New equipment is also under warranty and training is provided by manufacturers. If you don't have trained personnel to fix used equipment, breakdowns can cause significant production problems.

Financing

The question of leasing equipment rather than buying it outright with cash or with bank or manufacturer/dealer financing is an option to be explored. Each choice has its attractions. Leasing allows you to use the equipment during crunch times or for particular projects and then return or upgrade it, but over the long haul, it can cost as much as buying the machine in the first place. Every company has different needs and expectations for in-house gear manufacturing, and this decision needs to be evaluated in the light of them.

Gears Designed for Ease of Manufacturing

There's more to manufacturing gears in-house than simply bringing in the machines to do the work. Through careful planning, Ann Arbor Machine optimized its production.

To streamline production at Ann Arbor, most gears have the same pitch and pressure angles. Production is usually limited to straight spur gears and some with internal splines. All gear cutting on



Close-up of gear being cut. All hobs are made of PM 45 high speed steel, TiN coated with AA tolerance. They have a single start and a class "AAA" line of action.

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the new Gleason is done with 8" long hobs except for straight-sided splines, which are done with 3" hobs.

All hobs are made of PM 45 high speed steel, TiN coated with an AA tolerance. They have a single start and a class "AAA" line of action.

Gear blanks are machined in-house using 4150 pre-hardened steel with a Rockwell C of 34-38. All machining is done after heat treating.

To simplify workholding, custom gear blank arbors are made in-house and use slip-fit collars to fit the various blanks and allow fast changeover.

Turke said, "In six months' time, we've made about 2,000 gears, of which there are about 300 different types. We do up to eight part changes per day on the hobber. In fact, we're so confident of its precision and performance, we no longer do trial cuts. The first gear off, we use."


"Our quality from this machine has been so good that we've produced unbelievable tolerances. We've consistently manufactured AGMA class 10 gears and up to an AGMA class 14 gear on some elements with just a finish hob."

Bruce Colosimo, the machine's operator, said that he usually runs the hobber a bit slower than its capabilities to save wear and tear on the hob. If a gear can be cut in 30 seconds, he'll do it in three or four minutes, which, he said, is still faster than most other hobbing machines he has worked with.

Because of the simplicity of the machine's operator-friendly software and the Fanuc 32-bit, 15-megabyte controller, he can program a new gear in about five minutes. A standard storage capacity exists on the machine for up to 100 previously developed part programs. The part summary number is entered, and the gear manufacturing data is downloaded to the CNC. Summary data can be transferred to and from a 3.5" floppy disk.

The Fanuc controller allows automatic setup and control of axial feed, radial feed, hob position, hob speed and hob swivel angle setting. This gives Colosimo fast setup times. Plus, to change hobs, he simply presses two buttons to chuck and dechuck the tool. The hob is automatically aligned and the first part off is a good one. Hob changes take less than a minute.

The added efficiency of the new machine has also opened up other opportunities. According to Turke, "Since we have the production capability . . . , I can easily slot in outside work when I don't need the machine for our gears."

While producing gears in-house may not be the choice for every operation, the flexibility, production control and new business opportunities it can create make it an option worth exploring. 

Ray Mackowsky

is a Michigan Regional Manager for the Gleason Corporation.

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