

# Another Lean Tool

## MAKING HEAT-TREAT INROADS

Anyone who attended the recent IMTS or National Manufacturing Week shows will tell you that lean manufacturing was on display in a big way. With lead time becoming one of the most important issues in getting and retaining business, companies are jumping into the lean pool in hopes of getting their products made faster and shipped earlier than their competitors.

And the heat treating sector is no exception, which is where the relatively unknown diode laser heat treat method enters the picture. CO<sub>2</sub> laser is the more commonly known method, but it has its drawbacks (more on that later). Bottom line, however, laser heat treating is a method that—while it isn't suitable for all applications—can eliminate two time- and cost-consuming extra steps in the heat treat process.

But first some background.

“CO<sub>2</sub> lasers are cheaper to buy but very expensive to run due to CO<sub>2</sub> cost,” says Sri Venkat, business unit manager/direct diode systems, for Coherent, Inc., a seller of diode lasers. “You have to frequently maintain them, and the chemical and maintenance costs are not cheap; you have to pay a lot more to keep them going. They are also very ‘tweaky’ in that you have to have a laser specialist on your shop floor who knows how to use them. It’s like buying a car that’s prone to breaking down, and you almost have to have a mechanic in the family.”

In addition, says Venkat, “CO<sub>2</sub> is more expensive to run than diode laser due to lower wall-plug efficiency.

continued

Typical hardness capability using HighLight direct diode laser system		
Material	Maximum Hardness (Rc)	Maximum Depth (mm)
<b>Carbon Steels</b>		
1080	68	2
1075	68	2
1045	60	1.5
1030	50	0.75
<b>Heat Treatable Alloys</b>		
4140	68	2
4340	68	2
<b>Heat Treatable Stainless Steel</b>		
420	65	1.6
410	50	0.5
<b>Cast Irons</b>		
Gray	65	1
Ductile	55	0.75



A saw tooth tip selectively hardened by a diode laser.



Typical heat treating results with the HighLight laser.

Diode lasers have much higher wall-plug efficiency.”

Diode lasers, according to Venkat, are something altogether different. He uses the analogy of coal vs. solar power to make his point.

“Diode lasers are more state-of-the-art; they’re a completely different kind

of technology. Diode is solid state—there’s no gas in there.”

He goes on to explain that diode was a process first used for fiber optic cabling and later in CD and DVD player applications. However, as is still the case with CO<sub>2</sub> lasers, diode lasers carried a big price tag as well. But things

changed after the telecom bubble burst. Now, the cost has come down, making the process attractive for specific types of part heat treating and other uses. The medical industry, for instance, is a huge market for laser; printing is another. And now, industrial manufacturing, according to Venkat. He explains that a major (unnamed) manufacturer of very large, heavy equipment approached his company some years ago with an application issue regarding heat treating of parts. The short version of the story is that Coherent was successful in meeting their needs and it’s been a glass half-full situation ever since.

Which brings us to the lean part of the story. Venkat explains:

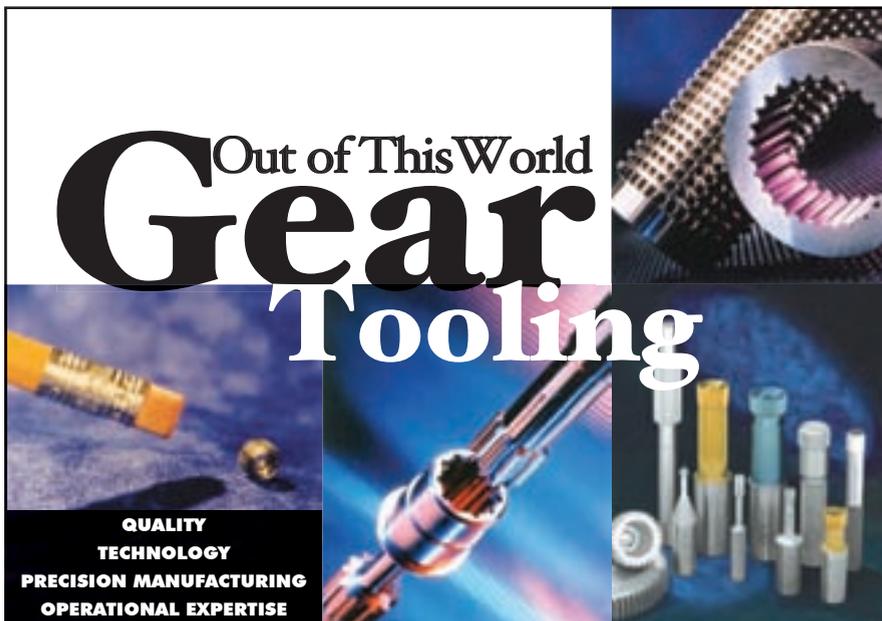
“They wanted to implement lean manufacturing, and they wanted to get away from having a large inventory of parts. Because when you have to process carburized heating, it relies on a batch of parts being put in a furnace, and then you put them on a shelf, so you have inventory buildup.”

The company looked at both methods: CO<sub>2</sub> and diode. But, as Venkat points out, “One of the problems (in addition to unit cost) with CO<sub>2</sub> is that you have to pre-coat the part with black oxide—an extra step—whereas with the diode laser you don’t need to do that.”

In addition, “They were looking for a much more compact heat source and the diode laser is very small—you can literally mount it directly onto a robot for heat treating.”

And as for gear-specific applications, “Gear hardening requires localized heat treating without distortion,” he says. “Diode lasers are ideally suitable for both these attributes due to their small beam size and low thermal input to achieve required hardness.”

Another important advantage of laser is that there is “no post grinding or surface modification, period,” according to Venkat. Also, it is easy to use, with few learning curve issues.



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It is useful to point out that laser heat treating is designed for case hardening only. Also, it is for part-by-part, not bulk, hardening. But if you have parts with complex geometry and profiles, diode heat treating can be effective.

The other caveat is that laser heat treating is uniquely conducive to automated manufacturing. Obviously, heat treating on a manual basis is not an option. But if your part handling is automated, laser is a viable option. Automotive comes immediately to mind, among other high-volume, automated processes.

**For more information:**

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The Model 1100 has special application features that include a highly efficient dust collection system for stand-alone or plant-wide system integration operations. A sump-based liquid cooling system is available to deal with high-temperature applications.

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The maximum cutting capacity of the SL-20 APL is 10.3" x 20", and the maximum swing is 23" over the front apron with a 2" standard bar capacity. The machine uses a 20 hp vector dual-drive spindle with 4,000 rpm providing 154 ft-lb of torque. Constant surface-feed cuts are achieved by fast wye-delta switching that provides a wide constant-horsepower band.

The SL-20APL has an A2-6 spindle nose, an 8" hydraulic three-jaw chuck and a 10-station tool turret. If long-part machining is necessary, Haas offers a programmable hydraulic tailstock as an extra option.

Two gripper configurations are standard with the lathe: a shaft gripper deals with parts up to 5" diameter, while a disc gripper handles parts up to 7" diameter. Each configuration is capable of parts up to 15 pounds. The automated parts loader (APL) loads raw pieces and removes the complete parts; it also flips pieces for second operations and lingers until long shaft pieces are machined before bringing them back to the table.

The APL, programmed through the lathe's control, operates in the background of the lathe operations, so the machine functions unattended and almost continuously.

**For more information:**

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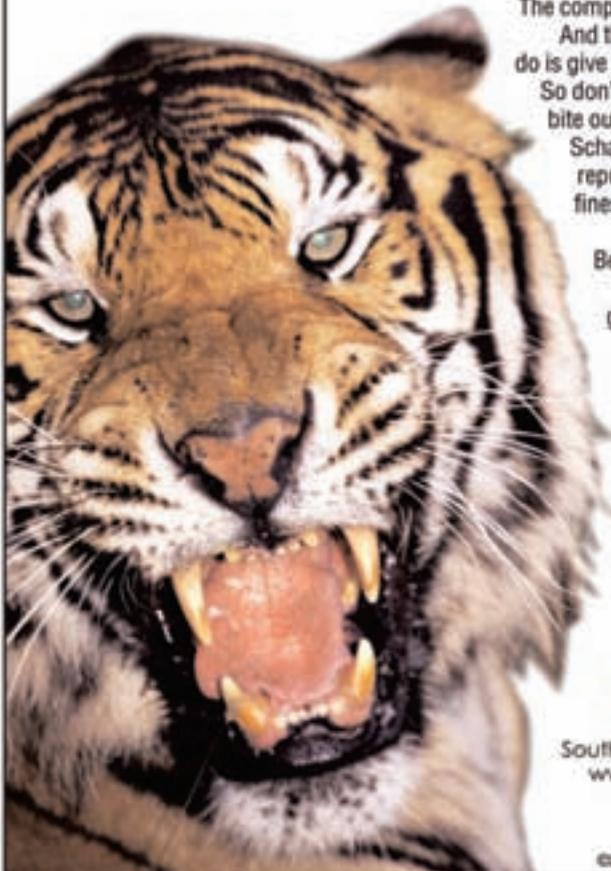
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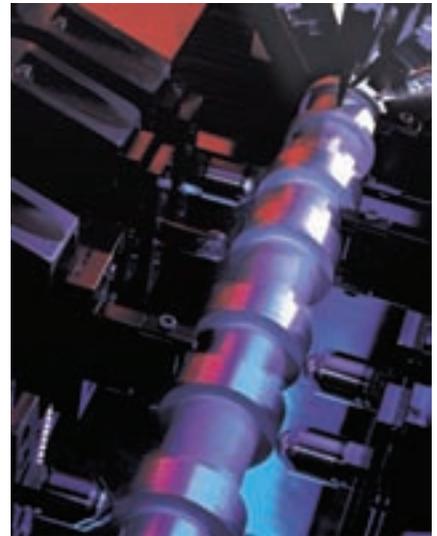
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R12.6. The release contains two new modules as well as updates and extensions to existing modules. An advanced spherical roller bearing module takes into consideration the profiling effect of the bearing rollers and raceways. The second is a new gearbox efficiency module that includes gear drag analysis used to determine the power losses from individual gears.

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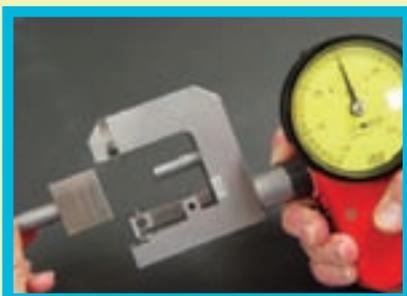
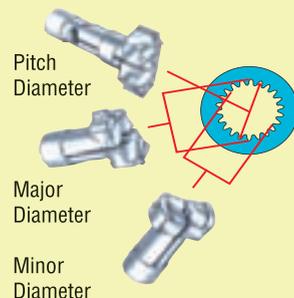
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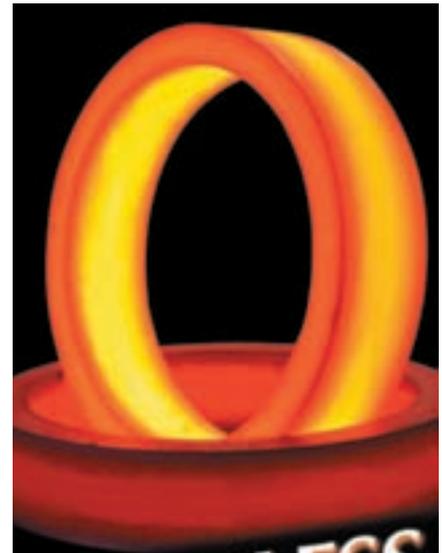


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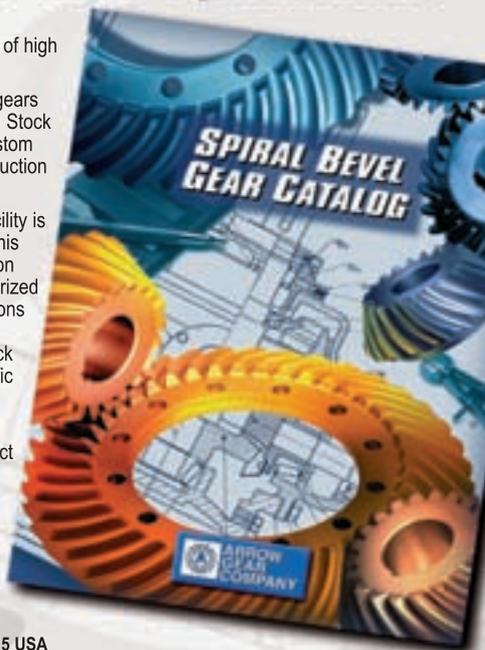
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