Strength meets speed

Maker of carbide circular sawing equipment wins patents, advances sawing technology, conducts cost studies

BY CORINNA PETRY

Like many quandaries in business, owners and operators of metal processing enterprises always have to calculate whether their investment is going to pay off—whether the juice is worth the squeeze. Upfront costs may appear to be somewhat daunting, but the results can lead to a big long-term payoff for the service provider and its customers.

That is exactly the promise offered by Advanced Machine & Engineering Co. Inc. (AME), Rockford, Illinois, builder of carbide circular saw machines.

Like any self-respecting metal-cutting machinery builder, AME spent many years researching, developing and testing different materials, mechanisms and methods to arrive at the systems that work best for the heavy-duty applications that its customers require.

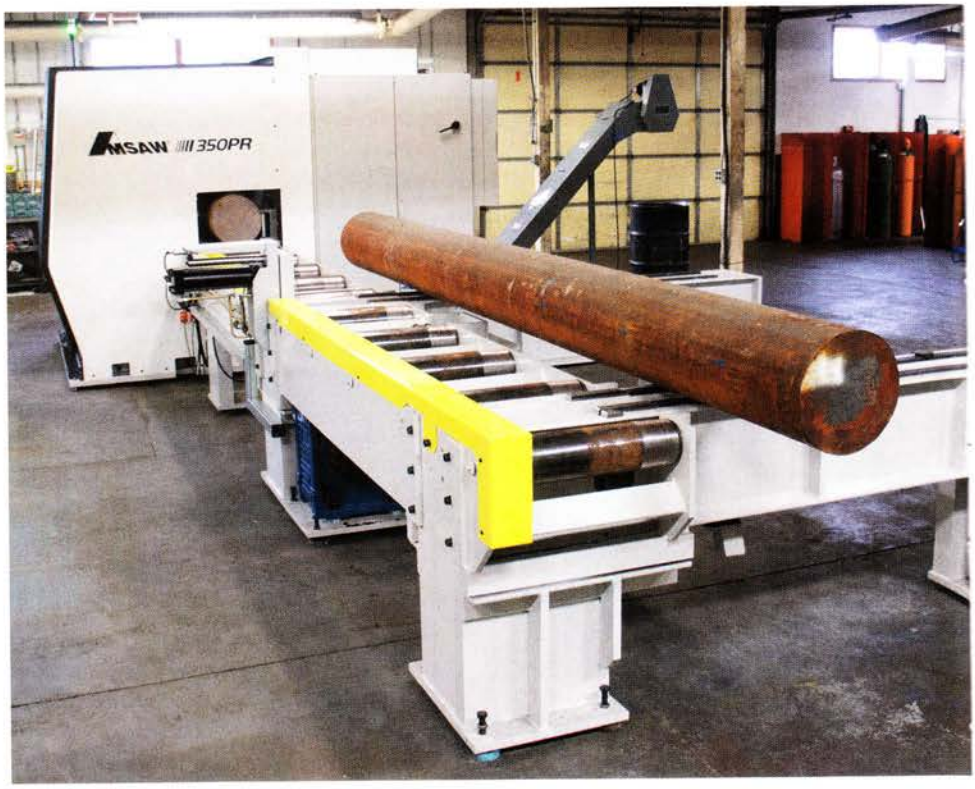
Technology ladder

AME developed the first billet saw using carbide-tipped circular saw blades in 1969, patented the technology and built the machines for Metalcut Inc., also in Rockford, under the name Metalcut 12.

Claiming the machine was eight times faster than band saws and four times faster than high-speed-steel circular cold saws, it revolutionized production sawing, according to AME founder and chairman Willy Goellner.

Fast forward 15 years, and Goellner patented a type of carbide tooth geometry he called Notch Grind, which split chips with one V groove per tooth. Also designed to saw steel billets, this new technology again accelerated sawing speed.

In 1994, AME developed a pivot saw, AmSaw 200, followed up with successive models (now at AmSaw 600).



Carbide circular saws have to be a calculated investment for heavy-duty cutting operations, according to AME's Willy Goellner.

In 2011, the company developed a machine on which the pivot axis of the gearbox was fixed on the lower end of the machine bed. Because the base for this unit, AmSaw 350, is made to be very rigid, the force flows from the pivot of the gearbox to the ball screw feed system in a closed loop, and the cutting force engages in the approximate middle between rotation point and ball screw. This substantially reduces lost motion and improves stiffness in the feed system. Chip flow was also improved as the chips were thrown directly onto a chip conveyor. The AmSaw 350 model cuts billets up to 14 inches thick.

Standard, custom models

"We build standard off-the-shelf carbide circular sawing machines under the AmSaw trade name, cutting any shape of ferrous and nonferrous metal from 1-inch to 24-inch stock size," Goellner says.

In addition, "many of our saws are special systems costing up to $1.5 million." These production sawing lines include all the necessary loading, in-feed and unloading equipment and any customer-specified special assemblies such as gaging and weigh stations.

"We build 10 to 15 standard machines or large systems per year. The tendency for customers to adopt carbide circular sawing is rising higher every year," he says.

AME also offers custom design-and-build versions of its carbide circular saws.

Options proliferate

There are many types of cutting machines available to cut many types of materials, from circular carbide saws and band saws to high-speed-steel cold saws, abrasive saws, friction saws, laser cutters and waterjet equipment. Each option features different designs, heavy or light construction, various head guidance methods such as box ways, linear ways and pivot-type saws. The most complex designs feature hydrodynamic or hydrostatic guides, according to Goellner.

"In the past, the weight of the machine was a deciding factor for many buyers. The heavier machine was usually the better machine, though it was also higher priced," he says. But engineering tools used today, such as Finite Element Analysis, make it possible to design lighter machines with structural ribbing and vibration dampening that perform very well and at a lesser price.

Types of carbide saws

Closed-loop vertical slide saws are the stiffest, compared with other types of carbide saws, but are also the most expensive machines. They require less floor space than horizontal or angular slide saws, but it is also more difficult to control the horizontal chip flow, Goellner says, elucidating the options available today.

Horizontal and angular slide-type saws must be more rugged and built to maintain the same stiffness as vertical or pivot saws. The chip flow is downward and therefore better to control.

Horizontal cutting pivot saws are the most cost efficient machines. They require fewer parts and less floor space and have suitable downward chip control. The closed-loop system increases stiffness and therefore can be built lighter, while maintaining a high amount of rigidity.

Results of analysis

For carbon steel cutting, buyers typically choose between a band saw and a carbide circular saw. As buyers tease apart their options, it makes economic sense to conduct some careful analysis, or work with an equipment vendor that is willing do so.

Circular carbide sawing has significant advantages over band sawing when used for high-volume production cutting, says Goellner, "but the advantages of the carbide saw are often obscured by its higher initial purchase price."

AME developed a comprehensive program to test the results of band saw cutting against carbide circular saw cutting. In a case study, AME sampled 500 pieces per shift of 14-inch-diameter, grade 4340 round steel bars.

The study proved the carbide circular saw gave operators a faster feed rate and cutting speed, along with a longer blade

COST ANALYSIS OF SAWING

Circular carbide saw versus band saw
Material: Grade 4340 carbon steel round bar, 14-inch diameter

Specification	Unit of measurement	Circular carbide saw	Band saw
Required cuts per shift	Pieces per shift	500	500
Average blade life	Per square foot of cuts	208	56
Cost of new blade	Dollars	$780	$245
Total cost of blade life	Dollars	$5,140	—
Cost of blade per square foot of cut surface	Dollars per square foot	$0.75	$4.41
Cutting speed	Square feet per minute	450	120
Feed rate	Inches per minute	7.8	1.1
Total cycle time	Minutes per piece	1.9	13.1
Total time per square foot of cut surface	Minutes per square feet	1.8	12.3
Number of machines required	Machines	3	18
Cost of machine	Dollars	$300,000	$120,000
Cost of operating equipment, per square foot of cut surface	Dollars per square foot	$0.73	$1.99
Cost of floor space used, per square foot of cut surface	Dollars per square foot	$0.01	$0.08
Cost of maintenance, per square foot of cut surface	Dollars per square foot	$0.06	$0.15
Machine power requirement, averaged	Per kilowatt hour	32	1.5
Number of workers required	Per shift	2	3
Cost of labor per square foot of cut surface	Dollars per square foot	$0.40	$0.69
TOTAL COST	Per square foot of cut surface	$2.00	$7.35

Source: Advanced Machine & Engineering Co.

life. Although the circular carbide blades themselves are more expensive, as measured on a cost-per-square-foot basis, they are more economical because they can be sharpened and reused. When band saw blades wear out, they must be replaced, Goellner explains.

"The stumbling block for many buyers is the upfront investment for a carbide saw, which is two to three times the cost of an off-the-shelf band saw. But, as our example shows, one would require 18 band sawing machines to do the identical volume of work performed by just three carbide circular saws."

After totaling up all the relative advantages and disadvantages, the circular saw handles this large-diameter bar sawing job at about $2 per square foot of cut surface, compared to $7.35 for a band saw, AME's study found (see table, left). ■

Advanced Machine & Engineering Co. Inc., Rockford, Illinois, 815/962-6076, www.ame.com.