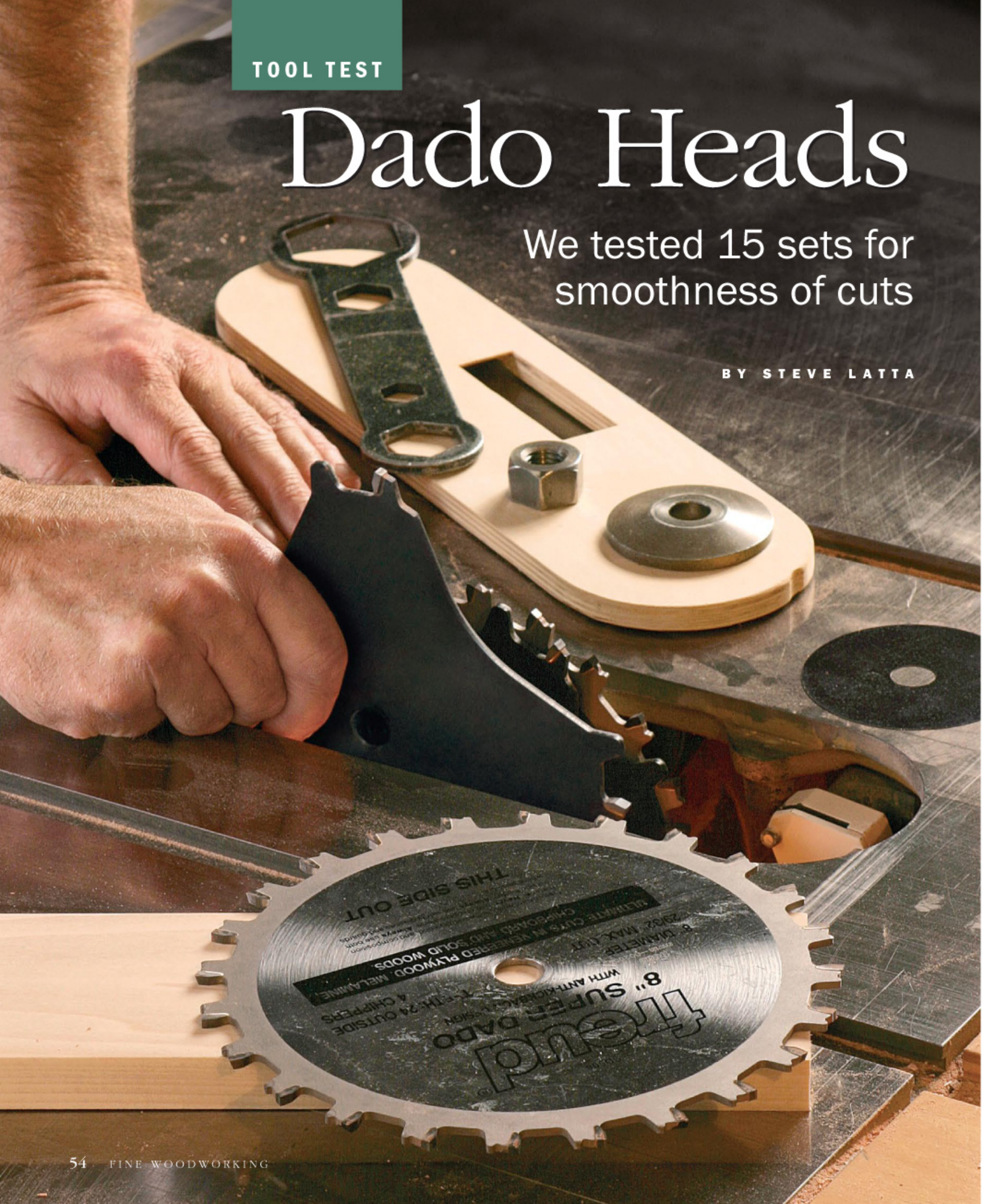
TOOL TEST

Dado Heads

We tested 15 sets for smoothness of cuts

BY STEVE LATTA



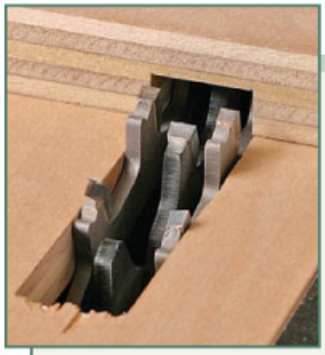
In many woodshops, you'll find dado heads being used to cut into sheets of veneer-core plywood and particleboard-core melamine for cabinetry casework, as well as solid lumber joinery (finger joints, lap joints, and mortise-and-tenons). I often use dado heads to cut tenons, dadoes, grooves, and rabbets. Because the cost of a good dado set can run more than $200, most woodworkers buy a single set and use it for a wide range of operations, regardless of the material being cut. Finding one that performs well and fits your budget is the trick.

I teach furniture making to young people who are interested in pursuing the trade as a career. When *Fine Woodworking* asked me to conduct a review of dado heads, I thought it would be a good idea to involve my students. Most of them will purchase a dado set at some point in their careers, and with the number of brands and designs out there, I knew they would benefit from investigating what separates the good from the not-so-good tooling.

Test setup ensured objective results

From the get-go we decided to limit the review to 8-in.-dia. (the size most commonly used in small shops) stacked dado sets with carbide teeth. You also can purchase stacked sets in 6-in. and 10-in. sizes and wobble-style dadoes. I never use a wobble dado, and I wouldn't recommend one because the cut is not as clean as that from a stacked dado set and does not have a flat bottom.

We tested each set by cutting wide dadoes in melamine and red-oak veneer plywood (cutting perpendicular to the grain of the face veneer). Experience has taught me that it is essential to use a sharp, top-quality blade when making cross-grain cuts in



Three ways to fine-tune the dado width

SHIMS

A standard design for stacked dado heads uses individual blades to build the correct width of cut. Fine-tuning is accomplished by adding shims between the blades.

Outside blades score the material and cut the dado at the shoulder line, usually with alternate-bevel teeth.

Chippers remove the waste between the outside blades.

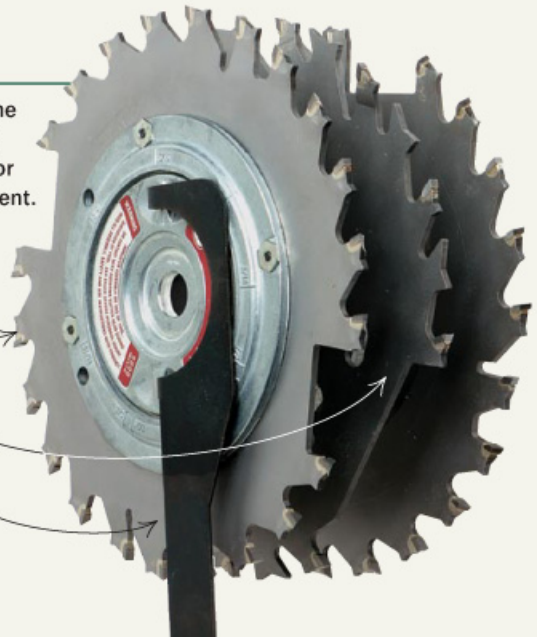
Shims (paper, plastic, or metal) are used to fine-tune the width of cut.

DIAL

A large dial allows the user to fine-tune a built-in shim on the inside face of the outer blade (inset).

WRENCH

A special wrench changes the distance between the outer (and inner, if used) blades for an infinite range of adjustment.



Only the outside blades are used for cuts between ¼ in. and ½ in. wide.

Add the center blade for cuts up to 13⁄16 in. wide.

Wrench

Testing the dado heads

Latta and his students cut and compared more than 500 ¾-in.-wide samples of each dado cut cross-grain in red-oak veneer-core plywood and particleboard-core melamine. For consistency, all samples were made with a power feeder.

POOR CUTS

Tearout in both the oak and melamine varied considerably among the many dado sets tested. Ratings are based on averages of the number of tearouts visible, taken from inspections of the multiple samples cut.

EXCELLENT CUTS

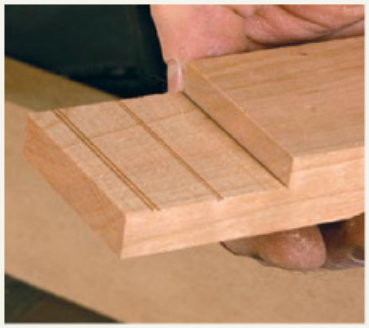
Many of the dado sets tested cut cleanly through the samples, showing very little—if any—tearout. Almost half of the dado sets were rated "Excellent" for the quality of cut in both the red-oak plywood and the melamine.

MAKE/MODEL NO.		PRICE
Amana 658030 (for wood and plywood)		$150
Amana 658040 (for melamine)*		$190
BC Saw & Tool 3008400		$225
CMT Precision		$200
Craftsman Excalibur 32608 (right or left)		$90
Delta 35-535		$90
DML Thoroughbred 73500 or 73504 (right or left)		$268
Everlast DS840		$185
Forrest Dado King		$250
Freud SD508	AUTHOR'S BEST OVERALL CHOICE	$200
Freud SD608		$250
Infinity Dadonator	AUTHOR'S BEST VALUE CHOICE	$180
Promax 07-80145		$40
Ridge Carbide NW8-DM-DS		$170
Systimatic 37160		$200

*We found this set was also suitable for plywood.

SMOOTHNESS

Taking multiple passes with some of the blades resulted in visible scoring marks (left). Other blades left a smoother surface (right) because the height of the raker teeth more closely matched the height of the scoring teeth on the outside blades.



TEETH ON OUTSIDE BLADES	NUMBER OF CHIPPERS	TYPE OF SHIMS	STORAGE CASE	VISIBLE SCORING MARKS	FLAT-BOTTOM CUT	QUALITY OF CUT	
						PLYWOOD	MELAMINE
24	4	Plastic	Yes, plastic	No	Yes	Fair	Not applicable
46	4	Plastic	Yes, plastic	No	Yes	Excellent	Excellent
40	4	None	Yes, plastic/ foam inserts	Yes	Yes	Good	Excellent
24	6	Plastic	Yes, plastic	No	No	Excellent	Good
22	1	None; wrench adjusts width of cut	Yes, plastic	No	Yes	Fair	Fair
24	5	Paper	No	Yes	No	Poor	Excellent
22	1	None; wrench adjusts width of cut	Yes, plastic	No	No	Fair	Fair
40	4	None	Yes, plastic	Yes	Yes	Excellent	Excellent
24	6	None	Yes, plastic	Yes	Yes	Excellent	Excellent
24	6	Metal	Yes, plastic	No	Yes	Excellent	Excellent
24	5	None; adjustable dial	Yes, plastic	No	Yes	Excellent	Excellent
24	6	Plastic	Yes, cardboard	No	Yes	Excellent	Excellent
24	4	Brass	No	Yes	No	Poor	Poor
24	6	Plastic	Yes, plastic	No	Yes	Good	Excellent
42	5	None	Yes, cardboard/ foam inserts	Yes	Yes	Excellent	Excellent

plain-sliced red-oak veneer. The surface veneer on veneer-core plywood will always tear out more readily than lumber.

To prepare for the survey, we mounted a power feeder to a cabinet saw in the shop. A power feeder guaranteed that each sample was cut at the same feed rate and that it was held down under the same pressure. We also equipped the tablesaw with a new insert to minimize tearout on the outside edges of the dado cuts.

We prepared three test samples (12 in. by 16 in.) each of red-oak plywood and melamine to use on each dado set. We set up each dado head to cut a ¾-in.-wide by ¼-in.-deep dado and made six passes in each sample, using the power feeder and adjusting the fence setting for each cut. One run consisted of repeating that process for one sample of plywood and one sample of melamine for all 15 dado sets. Because we did a total of three runs, we had to set up and break down the tablesaw setup nearly 50 times. It was tedious, and we were methodical about keeping track of each sample.

To evaluate the cuts, we looked at tearout, whether the bottom of the cut was flat and smooth, and how deeply the outside blades cut a visible scribe into the corners of the dado.

Details of dado-blade designs

In some tool reviews, you'll often find a dozen clones. Not so with these dado sets: Many of the blade profiles and tooth configurations are very different. But with all of them, the two outside blades—where a clean cut is most essential—have beveled teeth ground away from the outside of the cut line alternating with straight raker teeth for removing the material. The beveled teeth score the material and define the scribed cut in the bottom corners of the dado; some are more prominent than others. This

Photos, except where noted: Kelly J. Dunton; facing page (top left and bottom right two): William Duckworth

detail matters only if the profile of the dado cut will show in the finished workpiece, such as the front of a bookcase.

Some but not all of the outside blades have expansion slots that help to keep the blade from warping from the heat generated by extensive use. And many of the outside blades and some of the chippers are made with antikickback fingers, a safety feature.

Chippers, stacked between the two outside blades to build up the width of cut and to hog out most of the material, vary from wing cutters with two teeth to almost full-size blades with six teeth. The number of chippers in each set varies from one to six, and their cut width from 1/16 in. to 1/4 in. Most dado sets include plastic, metal, or paper shims that you also can use to adjust the width of cut.

Tooth geometry matters

One curious difference among these dado sets is the hook angle of the tooth configuration. A slight majority (seven of 15) feature a negative hook on both the outside blades and the chippers; six of them have a positive hook on both the outside blades and the chippers; and two of them include a negative hook on the outside blades and a positive hook on the chippers.

A positive hook cuts more aggressively with less effort, and a negative hook is supposed to cut more cleanly. With the samples that we processed, it appears that a negative hook, on average, did cut the plywood veneers a little more cleanly, but it was difficult to come to any similar conclusion with the melamine.

As with regular sawblades, one other factor that affects how cleanly the dado heads cut is the number of teeth on the outside blades. Most of these dado sets have outside blades with 24 teeth, which is enough for an 8-in. blade to make sharp, clean cuts. Two of the sets (DML and Craftsman) have 22 teeth on the outside blades, and they tended not to cut as crisply. But the design of those two brands, which are virtually identical, is also quite different from all of the other brands. Other sets have 40, 42, and even up to 46 teeth; in general, the more teeth on the outside blades, the cleaner the cut. Amana offers dado sets for wood and plywood (24-tooth) as well as a melamine set (46-tooth). We used the wood dado set on only plywood but tested the melamine set on melamine and plywood. (For all of the test results, see the chart on pp. 56-57.)

Storage containers protect blades from damage

Obviously, the container the dado blades come in has no effect on how well they cut. But over time, it will affect the life of the blades. Every time you set up a dado head, install it on the saw, take it off, and put it away, the teeth are at some risk of getting banged into and nicked. A sturdy storage case is simply a welcome extra, so we took note of this detail with each set. Most of them come in plastic cases, some with plush foam liners; others are less elaborate but still protect the blades fairly well. A couple of the sets come in cardboard and plastic packaging that, once opened, must be discarded. But it would be easy to make your own storage container to keep the dado set from getting banged up. □

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Using dado blades safely

If you've never used dado blades before, one important thing to remember is that you have to be careful not to attempt to remove too much material at once. The wider the cut, the shallower the first setting should be and the slower you should move the workpiece through the cut. With a 3-hp cabinet saw, you can comfortably hog out a 3/4-in.-wide by 1/4-in.-deep dado. But if you need to cut the same width at 1/2 in. deep, you should consider doing the work in two passes with two depth setups. If you're working with a 1 1/2 -hp contractor-style saw,

CROSSCUTS

Use a dedicated sled to cut dadoes for case work made with either plywood or lumber. Push down firmly on the workpiece and hold it tightly against the back fence of the sled as you make the cut.

RABBETS

To cut rabbets along the edge of a workpiece, mount more dado blades than you'll need for the full width of cut, clamp a piece of plywood to the fence, then raise the dado setup into the plywood.

Photos, this page and facing page (top right): William Duckworth

you might want to run some tests in scraps first, just to get a feel for whether a dado setup is going to work before plowing into a valuable workpiece. Keep steady pressure on the workpiece against the top of the sawtable and feed the workpiece steadily through the cut. If you have a problem with tearout, you usually can get a cleaner cut by slowing down the rate at which you pass the workpiece through the dado blade.

I keep various jigs on hand for different dado cuts. For crosscuts, whenever possible I use a sled to keep the workpiece from being held captive between the fence and the dado blade.

To cut rabbets along the edge of a workpiece, always use a sacrificial fence clamped or screwed to your regular saw fence, and bury part of the dado setup in the sacrificial fence. Never cut the rabbet joint along an edge with the workpiece trapped between the fence and the dado blade, because the workpiece can bind easily and cause a dangerous kickback.

If I'm cutting a lap joint in lumber, I'll use a miter gauge with a stop block clamped to the fence to index the shoulder cut.

To cut tenons, I use the two outside blades of a dado set to cut both cheeks at once, and I reverse the intended left and right order of the two blades so that the scribed score cut removes a little more material at the shoulder line. The blades are held apart by metal washers or a shopmade wood washer, milled to the thickness of the tenon I want to cut. For this operation, I use a zero-clearance throat plate penetrated only by the two sawblades—the material between them remains intact and helps to keep the workpiece from falling down into the blades.

LAP JOINTS

Multiple passes will be necessary for lap joints that span fairly large areas. Use a miter gauge with a stop block clamped to the fence to index the cut.

TENONS

With enough care during the setup, you can cut both of the cheeks of tenons for doors and face frames in one pass. Make wood spacers (above) the thickness of the tenon to be used in place of the chippers. Use the two outside blades that come with the dado set and reverse them on the arbor (inset), leaving a scribed score cut at the corner where cheek meets shoulder. Make a special throat plate to use with this jig, keeping the material in the space between the blades intact so that it supports the workpiece as it's moved through the cut.