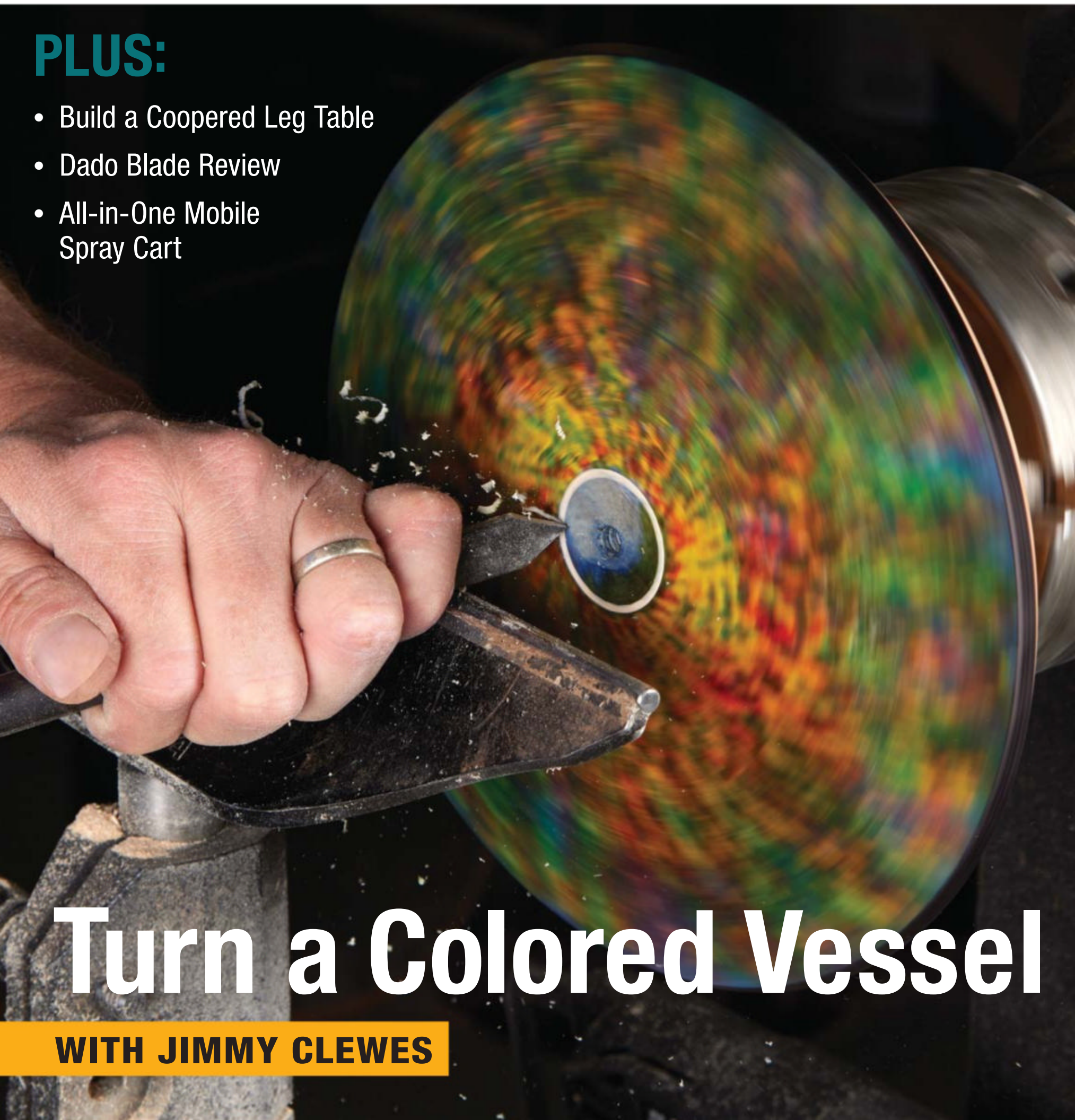


Popular Woodworking

JUNE 2023 | #272

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- Build a Coopered Leg Table
- Dado Blade Review
- All-in-One Mobile Spray Cart



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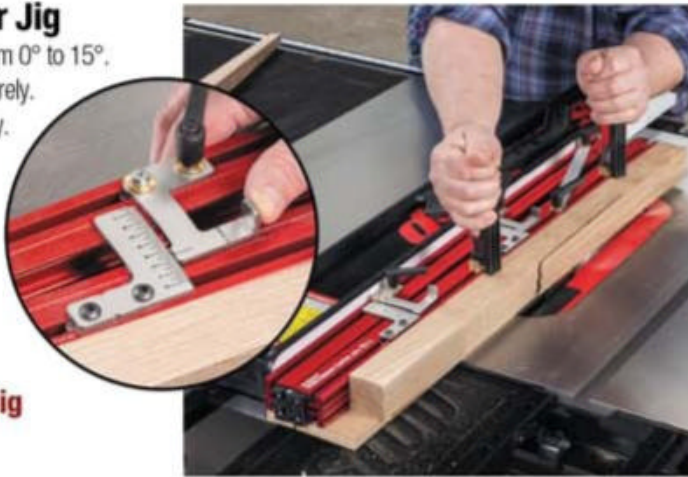
TS-12 12"....\$119.99

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- Clamps material securely.
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Precision Taper Jig

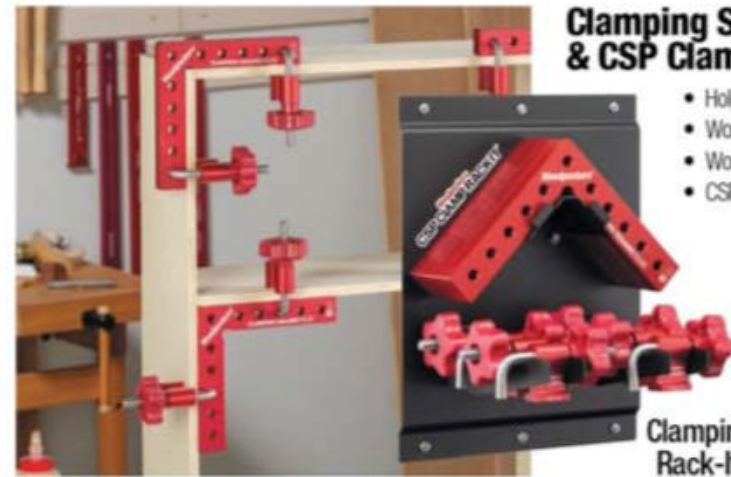
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- Sole is a perfect 90°.
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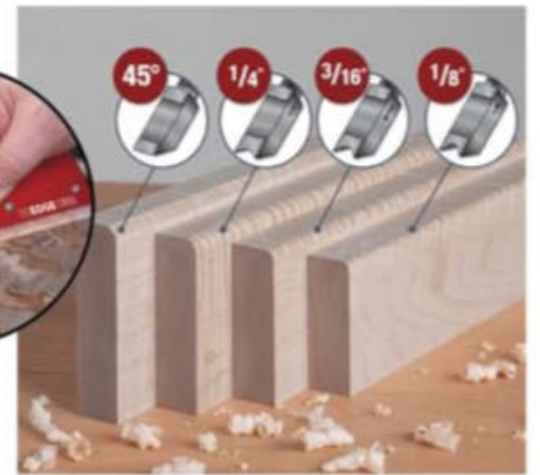
EZ Edge Corner Plane

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1/8", 3/16", 1/4" Radius

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Deluxe Set....\$569.99



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- Deluxe Kit includes extensions.



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Deluxe Kit....\$399.99



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Table Saw not included.

Exact-90
Miter Gauge....\$329.99
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AutoAngle Drill Guide
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Deluxe Kit....\$699.99



Drill not included.

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BY DOUG STOWE

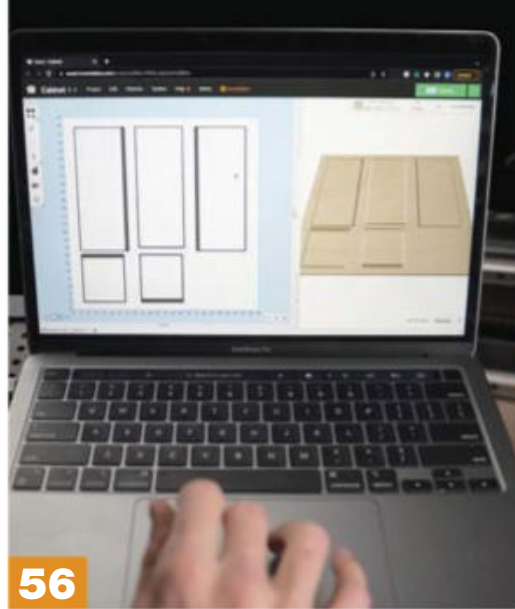
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FROM THE EDITOR

Woodworking Friendship

By Logan Wittmer

I've said it before, but I'll say it again (and keep saying it)—the people you meet in the woodworking community are some of the best around. Recently, I met a gentleman by the name of Larry—that's him in the Packers sweater. (I offered to send him a better sweater, such as a Miami Dolphins one... he declined!). I first got a hold of Larry through an AAW classified ad that he had posted about his VL300 Lathe he was selling. After chatting with Larry a bit over email and phone, I suckered my dad into making the 6-hour drive with me to pick it up—that's the three of us in the photo.

In my opinion, I feel as though Larry was asking a fair price for his lathe—it was in great shape and it was clear that Larry loved this lathe (as will I). But, being a shrewed negotiator, I had to sweeten the pot in my favor. I offered



Larry's asking price as long as he would include one of his turnings in with the deal. To my delight, he readily agreed.

Now, several months later, I'm the proud new owner of Larry's VL300 (he's buying a bit smaller lathe), and I'm hoping that my path crosses Larry and his wife Shirley's again. Hopefully if we do meet again, they'll let me buy them dinner to make up for the hole I put in their basement door as we carried this lathe out! In a few issues, I'll introduce you to my friend Norman, who may be the kindest, most interesting retired patternmaker you'll ever meet. Cheers!

Logan Wittmer

ABOUT THE AUTHORS



DOWG STOWE: *Coopered Leg Hall Table*—pg. 38

Doug Stowe started his career in woodworking in 1976. Since then, he's published thirteen books on woodworking, and teaches at various venues across the United States, including the Marc Adams School of Woodworking. Doug has often been referred to as the Master of Boxes, but his work expands far beyond these little beauties he makes. Doug resides in Eureka Springs, Arkansas with his wife Jean and golden-doodle Rosie.



WILLIE SANDRY:

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Living in the Pacific Northwest, Willie Sandry is a long time fan of Arts & Crafts furniture. He enjoys taking inspiration for his projects from antique furniture exhibitions as well as "old barn finds." Never one to do a job partway, Willie has developed a vast skill set to elevate his projects. From sawing lumber and kiln drying it to finishing a chair with top-notch upholstery, Willie sees a project through from the start until finish. YouTube: The Thoughtful Woodworker.



JIMMY CLEWES: *Textured & Coloured Form*—pg. 30

Hailing from England, Jimmy Clewes now resides in Las Vegas with his wife Mary and dog Seamus. Jimmy has spent the last thirty-five years traveling the world teaching and demonstrating woodturning. His quick wit and straightforward approach have made him a favorite of students from across the globe. When not hosting students at his home in Las Vegas, Jimmy's often found with a gold pan in hand, prospecting in the Vegas desert.

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May 16

**WorkTunes™ Connect
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May 17

**K-Body Revo Kit,
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May 21

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Base Router**
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May 22

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May 24

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May 25

Speed Set Wood Glue
Titebond.com

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**35 DAYS
FOR
DAD**

May 27

**HP-6FX Mini
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May 28

**Ken Onion Edition Knife and
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WorkSharpTools.com

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May 29

**1 3/8" 23 Gauge
Pinner**
Senco.com

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June 2

**GreenTec 5" x 8 Hole
Disc Assortment**
WoodworkingShop.com

**KLEINGORP'S
WOODWORKING SHOP**



June 3

**Mini-Mite 3
Platinum™
Model**
FujiSpray.com

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June 4

TailSpin Tetrad
TailSpinTools.com



June 8

Coping Saw
KnewConcepts.com

**KNEW
CONCEPTS**



June 9

**Granddaddy
of Epoxy**
WestSystem.com

**WEST
SYSTEM**



June 10

**Power Carving
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June 13

**WorkTunes™ Connect
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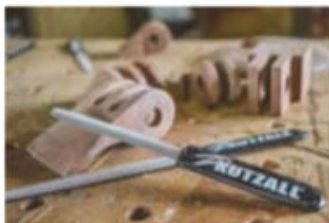
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June 14

**6" Half-Round,
Hand Rasp**
Kutzall.com

KUTZALL



June 15

**Knife & Tool
Sharpener Mk.2**
WorkSharpTools.com

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SHARPENERS**



May 18

**NGX Twin
Rail Rip
Guide**
BoraTool.com

BORA



May 19

D3605 Clamp Buddy
ShopFoxTools.com



May 20

**4 Contemporary
Mission Brackets**
OsborneWood.com



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Popular Woodworking Magazine and its sponsors will award one prize each day from May 15 through June 18. The prize pictured on each day in the calendar is the prize offered for that day. To register for a chance to win each prize, you must enter on the day the prize is offered, you may enter as many of the daily contests as you like but you are limited to one entry per day. All entries from the first 34 days will be eligible for the **Grand Prize: PantoRouter Pro Pack**.

Registration starts 12:01am, EDT on May 15 and ends 11:59pm EDT on June 18, 2023.

May 23

**CRB7 Mega
Bundle**
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May 26

**15 bd ft of
Ambrosia Maple**
WallLumber.com



May 30

**Rotary
Burr Kits**
Kutzall.com

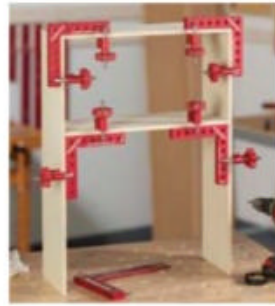


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May 31

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Woodpeckers



June 1

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SENCO



June 6

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June 7

**Pocket-Hole Jig®
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Woodpeckers

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June 16

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June 17

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June 18: Father's Day

**GRAND PRIZE
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PantoRouter



NEW TOOLS

MAXAIR eCAPR Respirator

If you've been a subscriber to *Popular Woodworking* for a while, you've probably noticed that I like to turn. A few issues back, I covered some of my top turning accessories—one of those was the *Sundstrom* SR500/700 respirator. I had many emails from people saying they loved the idea, but wanted a less expensive alternative. So, I started hunting and found one that I find extremely interesting—the eCAPR respirator from MAXAIR Systems.

MAXAIR has been manufacturing eCAPR (Controlled Air Purifying Respirator) units for nearly 20 years. Their main industries have been the medical, nuclear, and laboratory settings—in short, they've been designing units for people to wear for an entire work shift. They've got comfort covered. The entire filter and blower unit is within the helmet, and the only cord is lightweight and goes to a battery pack (you can clip it to your belt, or stick it in a pocket). It's by far the most comfortable powered shield that I've worn. And because of their background in the health-care field, MAXAIR has some other features which are unique to them.

The eCAPR Cuff (as they call their unit seen below) uses disposable face covers. The inside of the cover has a membrane (think of a thick cellophane) that is stretched out as you put the cuff on and forms the seal around your neck. The benefit is that it fits over glasses, beards—everything. The face cover is different than an impact shield, but MAXAIR has an impact shield that can be added over the face cover (impact shield is installed on the lower right photo).

So, why a powered respirator like this rather than a conventional one? Well—first and foremost is comfort. The air flow over your face as you work is... refreshing. It keeps the shield from fogging up, which is my biggest issue with a traditional face shield. And, as I mentioned, comfort. I hate to admit it, but I haven't had much time to turn since I've had the eCAPR, but I did stand in our new shop's attic and blow in cellulose insulation for about 7 hours with it on, and I must say... it was glorious. I quite literally forgot I was wearing it, and was able to breathe the entire time. The system comes in a hardhat version, or standard (shown here). If you're interested in learning more about the MAXAIR Systems eCAPR, I'll have a video on our YouTube channel going over some of its features, as well as its operation.

— Logan Wittmer

■ eCAPR CUFF
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PHOTOS BY THE AUTHORS





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NEW TOOLS

M18 Plunge Track Saw

Few tools in recent memory have been as hotly anticipated as *Milwaukee's* track saw, and the new M18 Fuel model does not disappoint. It's a well-built, thoughtfully designed saw that checks all the right boxes. On paper, the saw is right up there with (if not surpassing) the class leaders when it comes to cut depth, dust collection, and blade speed. The kit includes a high output 6ah battery that was more than adequate for what I was doing—I never managed to run it down in a single session.

Numbers aside, the saw was just a pleasure to use, cut after cut. The plunge mechanism as a whole was especially impressive—it featured fluid operation and adjusting the depth of cut was the easiest of any track saw I've used before. I was happy to see that *Milwaukee* choose to utilize a riving knife instead of relying on electronic kickback protection. Boards can carry tension, and a mechanical solution to prevent binding is just going to be more trouble-free long term. I did find it out they didn't include the correct



2831-21

Milwaukee Tool

MilwaukeeTool.com

Price: \$639.00

size of hex key to adjust the knife though.

The track (unofficially) shares basic compatibility with the *Festool/Makita* tracks, though it includes a lip for anti-tip when cutting bevels. And while there's nothing inherently wrong with the design as a whole, the *Popular Woodworking* staff has noticed that they're not particularly robust. A small deflection in the track is all it takes to move your cuts out of square. All of that being said, the compatibility is probably a fair trade off for many users. — *Collin Knoff*

OLIVER 10044 Planer

Oliver Machinery, a name recognized as a manufacturer of vintage woodworking machinery, has returned to the marketplace. *Oliver*, while no longer manufacturing in the states, has strong ties with their factory and is producing machines in smaller quantities. This allow them to quickly respond to customer feedback with design changes hitting production models quickly. While still producing large, industrial-quality machines, *Oliver* is responding to consumer demand or a home-line of tools.

The *Oliver* 10044 planer shown here is *Oliver's* version of a lunch-box style planer. The 10044 is a 12 1/2"-wide planer featuring a *Bryd Shelix* cutting head powered by a 2HP (15 amp) 110 (115)v motor. One of my first observations about this planer (planing 8" wide white oak) was that it left an unbelievable finish. My second observation was that the motor may be slightly undersized for the planer, as I was able to trip it taking a heavy, wide cut. That is, I believe, due to the helical cutting head drawing a bit more power than a traditional two or three knife cutter head. It's not that big of a deal, and I just have to make myself take lighter passes (staying under 1/8" per pass, which is good practice anyways).

Some features I appreciate on the 10044 are its 4-post design and locking head—a press of the locking lever locks the posts at your determined position. A built-in depth stop allows positive stops at four commonly used thicknesses. The dust collection port also has a blower to assist in chip extraction, which is much appreciated, especially with the helical head. If you're looking for a thickness planer for your shop or looking to upgrade to a helical head, in my opinion the *Oliver* should be at the top of your list. — *Logan Wittmer*



OLIVER 10044

Oliver Machinery

OliverMachinery.net

Price: \$999.00



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W1888

10" HYBRID TABLE SAW



- Motor: 2 HP, 115V/230V* (prewired 115V), single-phase, 16A/8A
- Rip capacity: 31½" right, 11½" left of blade
- Easy-glide fence with micro-adjustment

*This machine is prewired for 115V operation. 230V operation requires purchase and installation of conversion kit X1888224X.



Made in an ISO 9001 Factory

⚠ WARNING! †¹

M1113

18" 1½ HP 3-PHASE WOOD/METAL BANDSAW



- Motor: 1½ HP, 220V, 3-phase Power supply requirement: 220V, single-phase, 15A
- Variable drive speed control
- 18" x 24" cast-iron table

⚠ WARNING! †¹

W1848

13¼" OSCILLATING FLOOR DRILL PRESS



- Motor: ¾ HP, 110V, single-phase, 9A
- Drilling capacity: ½" mild steel
- Number of speeds: 12 (250–3050 RPM)
- Includes ⅞", 1⅞", and 1⅝" sanding drums

Made in an ISO 9001 Factory ⚠ WARNING! †¹

W1877

13" BENCHTOP PLANER WITH SPIRAL-STYLE CUTTERHEAD



- Motor: 2 HP, 120V, single-phase, 15A
- Portable and easy to store
- Plane stock up to 6" thick
- Repeat cut selector with 6 preset heights



Made in an ISO 9001 Factory

⚠ WARNING! †¹

W1685

1½ HP DUST COLLECTOR



- Motor: 1½ HP, 110V, single-phase, 16A
- Air suction capacity: 1280 CFM
- Collection capacity: 40 Gallons

Made in an ISO 9001 Factory ⚠ WARNING! †¹

W1875

2 HP BENCHTOP TABLE SAW WITH STAND



- Motor: 2 HP, 120V, single-phase, 15A
- Maximum rip capacity: 31½"
- Table Size: W/Ext. 28½" – 35½" W x 23" D
- Offers easy portability and quick setup at job sites

⚠ WARNING! †¹



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WORKSHOP TIPS

Spray Can Storage

I'm a great fan of aerosol finishes, especially now that many of them have adjustable tips that make much less splatter. But my shop got so cluttered with half-used cans that I had trouble finding the color I wanted, so I built this simple storage rack for all the cans. Now I can instantly find just the color I'm looking for. The shelves need to be 5" deep, but the angle isn't critical. Anything between 45 to 75° will work. Mine is 70°.

— Tim Johnson



Clamp Extender

You're in the middle of clamping up your dream entertainment center and you discover your clamps are too short. What do you do? You stay calm and get creative. Screw a wood block to the edge of your cabinet case. This gives your clamps something to pull against. Do the same on the other side of the cabinet. As for the screw holes, don't worry. They get covered with the face frame.



PHOTO BY MIKE KRIVIT

Kicker Chock Block



PHOTO BY RAMON MORENO

I love the convenience of mobile bases, but I hate it when they wobble on the floor even when they're locked down. I got my chock block idea at the airport where the ground crews use something similar for parked aircraft. My chock block locks the fixed casters on my mobile bases so they don't budge. It's a great improvement. — Jeff Gorton

Drum Sander Dust Collector

Suck up the fine dust that flies off a sanding drum with this simple setup. All you need is your shop vacuum, a 3" by 2" PVC reducing coupling and a pot magnet. Bolt the magnet to the coupling and put the coupling over the end of the vacuum hose. A 2¼" diameter shop vacuum hose fits snugly inside the coupling's smaller end without clamps or glue. You can use this magnetic dust hood on any power tool with a metal table. — Bill Zeuhlke



PHOTO BY MIKE KRIVIT PHOTOGRAPHY

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WORKSHOP TIPS

Instant Dewaxed Shellac

Take the wax out of shellac and you've got a great sealer that's compatible with most other finishes. It's best to get this "dewaxed" shellac as dry flakes that you mix with denatured alcohol. Usually you have to order the flakes through the mail. But in a pinch, can you decant (draw off one layer of liquid from another) dewaxed shellac from the canned shellac you will find at the hardware store.

Bring a clean can or lidded jar with you to the store. With the okay of a salesperson, carefully carry a can of shellac to

the counter and open it. If the liquid looks creamy, like cappuccino, put the can back and try another one. A good candidate for decanting will contain a clear, deep amber-colored liquid with a creamy-colored layer of residue at the bottom. This indicates that the wax has settled out. You can decant between two and three cups of dewaxed shellac from a quart of liquid shellac. After decanting, pay for the shellac and ask the clerk to dispose of the can with the waxy residue. — *Paul Kantor*



PHOTO BY MIKE KRIVIT PHOTOGRAPHY

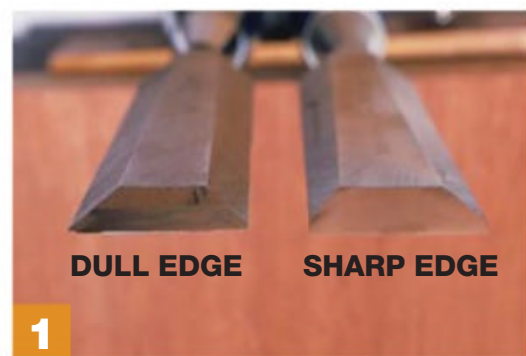
1. DECANT DEWAXED SHELLAC

Find a can in which the wax has settled to the bottom and pour off the pure shellac from the top.

2. THIN DECANTED SHELLAC

Add an equal amount of denatured alcohol for use as a sealer.

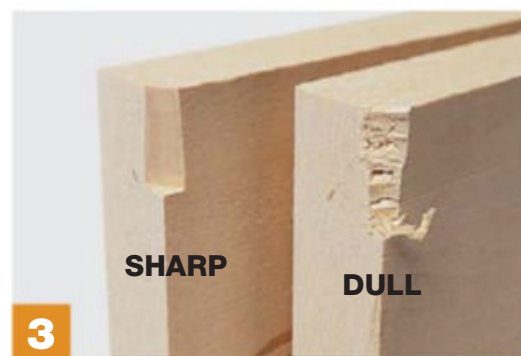
3 Ways to Test for Sharpness



If you can see light on the edge, it is not sharp. A sharp edge is too fine to reflect light.



A sharp edge catches easily on the side of a plastic pen barrel. A dull edge slides right off.



A sharp blade slices softwood end grain cleanly. A dull blade tears the end grain. — *Ed Krause*

PHOTOS BY MIKE HABERMANN

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Dado blade stacks, comprised of two outer blades and a series of inner chipper blades, may have not changed much in the past 15 years, but recently new features have appeared, promising quicker and easier dado stack setup. So, I set out to compare all of the premium dado blades from number of popular manufacturers. Instead of creating strict guidelines for what qualifies as “premium,” such as tooth count or price, I simply compared the best offering(s)

from each company. While most manufacturers consider higher tooth count premium, that wasn’t true across the board. So, if you’re in the market for a new dado blade, let’s sort out the details to find what might be right for you.

Test Limitations and Procedures:

To determine how each blade performed, it’s important to set some parameters and tests for each. Remember, that some of these are

subjective, but here are the metrics we used in this test:

Procedures

A. General blade test: A series of grooves and dados were made in domestic hardwood and cabinet grade plywood.

B. Visualize “bat ears” or the scoring lines left by the outer blades: Intersecting grooves were milled at the same depth.

C. Exit chipout to further evaluate

BLADE SHOWDOWN



We set out to compare 11 premium dado blades to help you sort out which might be right for you.

By Willie Sandry



PHOTOS BY THE AUTHOR

the scoring line: A double-wide pass was cut across the grain in hardwood.

D. Blade accuracy: Finally, a $\frac{23}{32}$ " groove was milled in plywood to test how accurate each set is, compared to stated widths.

Test Limitations

Since not all of the blades could be used on a *SawStop* table saw, two different table saws were used for testing. Blade run-out and fence alignment was carefully measured for each table saw with a digital

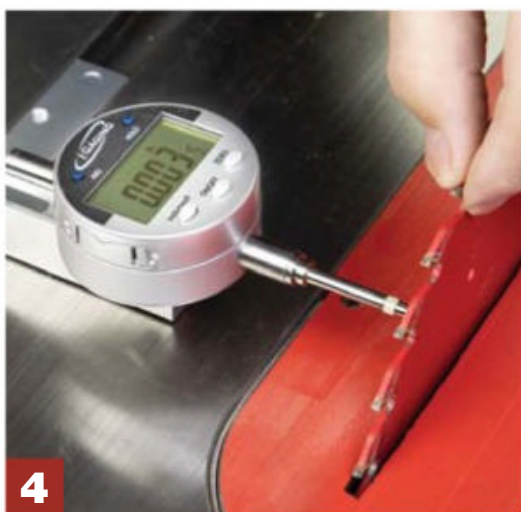
indicator. Since the horsepower of the two saws varied, no formal feed rate assessment was made, as the table saw itself would influence the test. Non *SawStop*-compatible blades were also cross-tested on the *SawStop* with the safety feature disabled. No significant differences in cutting performance were noted between the two saws. Lastly, be sure to check your table saw owner's manual to make sure it's recommended for use with a dado blade.



Most of the dado sets made clean grooves in plywood and hardwood. The following 3 cuts help to further evaluate exit chipout and scoring lines.

- 1** Grooves with the grain
- 2** Intersecting cuts
- 3** Double-wide dado

The best in the bunch left truly flat-bottom cuts, with only faint scoring lines on passes wider than $\frac{3}{4}$ ".



4 Arbor runout was tested with a *DigiAlign* digital gauge, measuring 0.003" on both saws. In a similar test, rip fence position was parallel within 0.001."

5 Some sets include a $\frac{3}{32}$ " wide chipper for easier setup of undersized plywood grooves. With chipper width, the blade body is the key dimensions, not the teeth.

SawStop Compatibility

Before we get started, I want to note something very important. If you use a *SawStop* table saw, or plan in the near future, you'll have a few more things to consider:

- *SawStop* representatives have previously expressed concerns about several blade features that may not work well with the automatic braking system on their saw. These include anti-kickback projections behind the teeth and overall weight of the set, which may impact the saws' ability to safely stop the dado blade.
- I tested dado stacks that weigh in excess of 8 pounds, however *SawStop* seems to prefer a dado blade weight of 6 pounds or less (weight of a $\frac{3}{4}$ " nominal stock) based on their previous list of approved blades.
- Blades need to be very nearly 8" diameter to work on a *SawStop* so we limited the test to 8" sets.
- Finally, excessive blade coatings should be avoided, as it may hinder the current-sensing *SawStop* technology.

Observations:

General Blade Design

Each manufacturer has a unique approach to building and packaging their dado set(s) to achieve the best results possible. Looking at several features like the shape of the blade and tooth count of both the outer blades and chippers help

to classify each entry in the group.

As you browse the tables on pages 20 and 21, one pattern quickly becomes evident—24-tooth outer blades and 4-tooth chippers has become the most common dado blade layout. And that's for good reason I think because the 24-tooth outer blades usually out-perform the 12-tooth blades that comes with entry level sets. 4-tooth chippers generally perform better than their 2-tooth counterparts in terms of exit chipout.

Whiteside Plus had the highest outside blade tooth count at 44 and the *Dadonator XL* and *Tenryu Gold Medal* posted the highest chipper tooth count at 6 each. The general pattern we expect is higher tooth count which produces a finer cut. Sometimes this comes at the expense of feed rate, but I didn't

notice any objectionable slowdown with any of the dado blades tested.

New Feature

One new and interesting design feature is the use of one or more extra-wide chipper blades. This has a purported benefit of easier dado stack setup because there are fewer blades to reach a full $\frac{3}{4}$ " wide stack. Depending on the design of your table saw, you may actually see improved cutting performance with these new $\frac{1}{4}$ " wide chippers because they register more accurately on the arbor threads. Two sets in the test offer these extra width-chippers: the *SawStop* which includes one thick chipper and the *Infinity Dadonator XL* which includes two. If your target dado width is $\frac{3}{4}$ ", normally you'd have to mount 6 blades on



6

6 The *Infinity Dadonator XL* has a pair of $\frac{1}{4}$ " thick chippers, allowing setup of a $\frac{3}{4}$ " dado stack in just 4 blades, compared to 6 blades with traditional sets.



7

7 The *SawStop* set has 1 thick chipper allowing a $\frac{3}{4}$ " stack with 5 blades.

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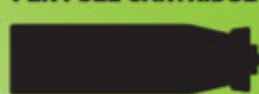
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Dado Blade Showdown

the saw. With the *SawStop* set you can accomplish that with 5 blades and the *Dadonator XL* can manage a full stack with just 4 blades. If you switch between a standard blade and dado stack 5-6 times in a typical project, quicker blade changes are a big benefit.

Tooth Geometry

Beyond tooth count, there are a few things to look for when evaluating the dado blades. But remember, what ultimately matters is how well the set works together for the intended purpose.

HOOK ANGLE:

This angle is seen as a forward or backward tilt of the tooth, as viewed from the side. Generally, a positive hook angle is good for quick or aggressive cutting, and a neutral or negative hook angle will produce a finer cut. Outer blade hook angles ranged from -5° to -12° and hook angles for the chippers feel between -12° and $+15^{\circ}$. If the hook angle is too soft, there's a risk of slowed feed rate, but it's really only evident with deep dados. Since most dado cuts are about $\frac{1}{4}$ " deep, feed rate

didn't become much of a discussion in the test. The bigger risk in my estimation is exit chipout with cabinet work or hardwood joinery. For those tasks, a slightly negative hook angle usually excels.

BEVEL ANGLES:

Note, this angle only applies to the outer blades. Bevel angle is best visualized by looking at the blades from the front or edge-view. Standard bevel angle for outer dado blades is 20° , but brands varied by some using a high-ATB of 30 - 35° . Higher bevel

PREMIUM DADO BLADES

	Amana Tool® Prestige™ #658060C	CMT Locked Pro 230.312.08	DeWalt DW7670	Forrest Dado King DK08244	Freud® FRE-SD508	Freud® FRE-SD608 Dial-A-Width
WEBSITE	AmanaTool.com	CMTorangoetools.com	DeWalt.com	ForrestBlades.com	FreudTools.com	FreudTools.com
COST	\$273.35	\$129.00**	\$191.64	\$447	\$199.97	\$289.97
WEIGHT OF $\frac{3}{4}$ " STACK	6 lbs, 4.4 oz	5 lbs, 12.5 oz	5 lbs, 2.0 oz	4 lbs, 15.3 oz	7 lbs, 3.6 oz	7 lbs, 11.0 oz
# OF BLADES INCLUDED	8	5 blades, 2 spacers	8	8	8	7
# OF BLADES REQUIRED FOR $\frac{3}{4}$ " STACK	6	5 blades, 2 spacers, two 0.008" shims	6	6	6	6
# OF TEETH, OUTER BLADES	24	12	24	24	24	24
# OF TEETH & SHAPE, CHIPPERS	4-wing humpback	2-wing	4-tooth pinwheel	4-wing	4-wing	4-wing
SHIM SET	Color-coded plastic	Magnetic & plastic	Steel	Magnetic	Steel	NOT required
$\frac{3}{32}$ " CHIPPER INCLUDED?	Yes	No	Yes	Yes	Yes	Yes
$\frac{1}{16}$ " CHIPPER INCLUDED?	Yes	No	Yes	Yes	Yes	No
CHIPPERS LABELED?	No	No	Yes	Yes	No	No
HOOK ANGLE, OUTER BLADES	-10°	-12°	-12°	-10°	-12°	-12°
HOOK ANGLE, CHIPPERS	-10°	-12°	-12°	-10°	-12°	-12°
BEVEL ANGLE	$+25^{\circ}$	$+20^{\circ}$	$+20^{\circ}$	$+20^{\circ}$	$+20^{\circ}$	$+20^{\circ}$
$\frac{23}{32}$ " or 0.719" GROOVE VS. ACTUAL GROOVE	0.737"	0.723"	0.738"	0.719"	0.719"	0.728"
FLAT-BOTTOM RATING WITH A SINGLE PASS	8 / 10	8 / 10	7 / 10	8 / 10	9 / 10	8 / 10
CASE INCLUDED OR OPT?	Included	Included	Included	Included	Included	Included
SPECIAL FEATURES	Electro-Blu coating	UNI compliant	Strong case, metal hinges	Nicely machined	Silver I.C.E. Coating	Dial-a-Width
SawStop COMPATIBLE?	No	Yes***	Yes	Yes	No	No

Red = best in comparison, ** Estimated MSRP —on-sale date of May 2023, *** Manufacturer states it is SawStop compatible and tested, but it is not officially endorsed by SawStop

CHIPPERS COME IN ALL SHAPES & SIZES



2-WING
Whiteside Plus



**4-WING
MANTA RAY**
Freud SD508/SD608



**4-WING
PINWHEEL**
Ridge Carbide



**4-WING
HUMPBACK**
Amana Tool® Prestige™



**6-WING
WAGON WHEEL**
Infinity Dadonator XL



6-WING STAR
Tenryu Gold Medal

The **4-WING “PINWHEEL”** shape is the most common among premium sets with *DeWalt*, *Forrest*, *Ridge Carbide*, and *SawStop* using a similar chipper design.

	Infinity™ Dadonator XL SDB-825	Ridge Carbide Super Dado North Woods	SawStop BTS-DS8-2403	Tenryu Gold Medal GMD-20324	Whiteside Plus 8443DADO
WEBSITE	<i>InfinityTools.com</i>	<i>RidgeCarbideTool.com</i>	<i>SawStop.com</i>	<i>Tenryu.com</i>	<i>WhitesideRouterBits.com</i>
COST	\$299.90	\$330	\$299	\$374	\$265.80
WEIGHT OF 3/4" STACK	5 lbs, 7.4 oz	4 lbs, 14.8 oz	4 lbs, 13.2 oz	5 lbs, 1.0 oz	4 lbs, 4.1 oz
# OF BLADES INCLUDED	7	8	7	8	7
# OF BLADES REQUIRED FOR 3/4" STACK	4	6	5	6	6
# OF TEETH, OUTER BLADES	24	24	24	24	44
# OF TEETH & SHAPE, CHIPPERS	6-tooth wagon wheel	4-wing pinwheel	4-wing pinwheel	6-wing star	2-wing
SHIM SET	Color-coded plastic	Non-ferrous metal	Steel	Magnetic	Color-coded plastic
3/32" CHIPPER INCLUDED?	Yes	Yes	Yes	Yes	No
1/16" CHIPPER INCLUDED?	Yes	Yes	Yes	Yes	Yes
CHIPPERS LABELED?	Yes	Yes	Yes	Yes	No
HOOK ANGLE, OUTER BLADES	-5°	-5°	-5°	-5°	-6°
HOOK ANGLE, CHIPPERS	-8°	-5°	-5°	-5°	+15°
BEVEL ANGLE	+30°	+20°	+20°	+20°	+35°
23/32" or 0.719" GROOVE VS. ACTUAL GROOVE	0.723"	0.745"	0.736"	0.727"	*
FLAT-BOTTOM RATING WITH A SINGLE PASS	10 / 10	8 / 10	8 / 10	9 / 10	8 / 10
CASE INCLUDED OR OPT?	Optional: +\$22.99	Optional: +\$35	Included	Included	No case available
SPECIAL FEATURES	Two XL chippers, 6-tooth chippers	Pinwheel chippers	One 1/4" wide chipper, best case	6-tooth chippers, resin filled slots	Highest outer blade tooth count
SawStop COMPATIBLE?	Yes	Yes	Yes	Yes	Yes

Red = best in comparison, * Actual groove unable to be determined without shims being added..



8



9

angles typically do a good job of preventing surface splintering and lifting veneer on plywood.

Lastly, Cases

Having a spot to store your nice dado blade is important. A chipped tooth here and there from rattling around in a drawer and your premium dado blade won't be cutting that great anymore. When it came to cases with the blades, it was hit and miss. Of the 8 dado sets that came with cases, some of them looked the part, but weren't up to par. The *Amana Prestige*

case stores chippers on a plastic post, but doesn't secure them, so if you open the case upside down they'll tumble out. Neither of the *Freud* cases secure the blades very well either. The *Infinity Dadonator XL* and *Ridge Carbide* dado sets are shipped in a cardboard box. However, there are universal cases available separately such as the wooden *Infinity* case and the 10" blade runner case. The best two cases hands down are the *DeWalt* and *SawStop* ones which are sturdy purpose-made cases that allow fairly easy access to the blades and



10

8 *DeWalt* and *SawStop* come with sturdy, purpose-made cases.

9 *Amana Prestige* and *Freud* cases store the blades but don't secure them.

10 Universal cases like 10" blade runner case are sold separately.

adequately protect them when not in use.

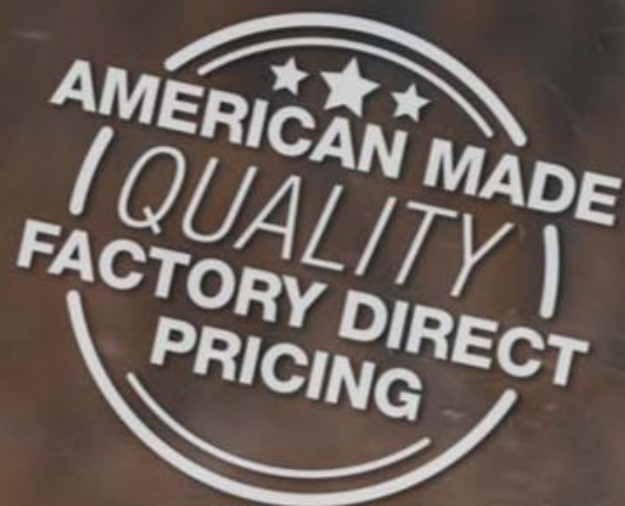
Final Thoughts

What did we learn after all of our testing? Well, if you own a dado blade that was manufactured pre-Netflix, it's probably time to look at upgrading to a new one. These premium dado blades of today are head and shoulders above dado blades of the past. Now of course, as I mentioned, our testing can be subjective, but I don't think you can go wrong with any of these blades. For my money, however, I'd be hard-pressed to not equip my saw with a *Dadonator XL* from *Infinity*. If you're in Europe, make sure to take a look at the *CMT*, as you now have a dado blade available to you. Hopefully our testing here gives a good side-by-side on the dado blades, and which ever of these blades you choose, you'll end up with a quality, great-cutting blade.

PW - Willie Sandry

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Amana Prestige: *Belle of the Ball*

With perhaps the best-looking outer blades in the test, these Electro-Blu coated blades are something to behold. The coating is non-stick to prevent pitch and resin buildup. The Prestige™ line features 24-tooth outer blades and 4-wing "humpback" chippers and weighs 6lbs, 4.4oz.

In testing, the bottom of the grooves showed 2 light ridges, just enough to catch a fingernail on. Overall, it produces a pretty flat bottom cut, appropriate for cabinet making and most woodworking task. The "bat ears," as viewed from the exit of the groove, were modern in depth. Likewise, the scoring lines left by the high ATB outer teeth were moderate in test cuts wider than $\frac{3}{4}$ ". Very clean, crisp top corners were noted with dadoes and grooves in plywood, with no lifting of the surface veneer. There was some exit chipout in hardwood tenon cuts when the fibers were unsupported, however this improved with a fresh sacrificial fence on the miter gauge. With a $\frac{23}{32}$ " stack installed, groove width measure 0.737", compared with 0.719" expected width. This was an oversized groove for most plywood so expect to use the $2\frac{3}{8}$ " diameter color-coded plastic shims to dial in specific widths.

Lastly, I'm glad to see Amana uses a purpose-made case, however its bend-to-open plastic tabs are very difficult to use. Also, the case doesn't secure the blades very well. Overall, it's a nice package that most woodworkers or cabinet shops would be satisfied with.

CMT Locked Dado Pro: *European Compliant*

Designed to meet European regulations, this dado set is different than the other. It's the first ever dado set to be EU compliant, because it has patented interlocking plastic discs that you install between the chippers to keep the blades in position.

A basic but functional open case is included with the set, along with a magnetic and plastic shim set. Cutting performance is on-par with other 12-tooth dado sets I've used in the past. The *Locked Dado Pro* produced flat bottom cuts, with only one or two faint ridges that you can catch a fingernail on. Moderate exit chipout was noted in plywood and hardwood dadoes with unsupported cuts, but hardwood grooves showed a clean exit. Light lifting of surface veneer was evident on some cuts, but nothing that a routine sanding wouldn't take care of.

The blades are somewhat tedious to install with the spacers, but I suppose this gets easier with practice (the blade can also be assembled before putting it in the saw). There are alignment spikes on the interior of the blade cutouts that make them uncomfortable to handle. Probably the biggest negative for me is the need to use two plastic spacers and two 0.008" shims for a basic $\frac{3}{4}$ " setup. If you need a $\frac{23}{32}$ " groove for plywood, the setup is even more elaborate with one plastic spacer, two 0.008" shims, one 0.012" shim, and one 0.020" shim. $\frac{23}{32}$ " test grooves measures 0.723" for a good fitting plywood joint. "Bat ears" and scoring lines on passes wider than $\frac{3}{4}$ " were moderate. I'm certainly glad our European friends get to use a dado blade again, and at a great price. While falling outside SawStop compatibility guidelines, CMT states the Locked Dado Pro has been tested and works with the SawStop safety system.



DeWalt: *Best Value Contender*

This set has been a best value contender since it was released. For someone stepping up from an entry-level dado set, this nicely packaged set just may be the ticket. The included case is a little top-heavy due to the chippers being stored in the lid, but they're well secured by the plastic stud and wing nut. The case also wins points for the sturdy metal hinges that will stand up to repeated use. The 3" diameter steel shims are standard fare and, like most metal shims, will likely need to be replaced with something better. Luckily, plastic or magnetic shims are easily sourced. The included $\frac{1}{16}$ " and $\frac{3}{32}$ " chippers are always appreciated and reduce the likelihood of needing shims at all. Sporting the typical 24-tooth outer blades and 4-tooth pinwheel chippers, this dado blade is easy to get familiar with. Cuts with this blade showed 3 distinct ridges along the bottom, that couldn't be remedied by removing and reinstalling the blade or changing the order they were installed.

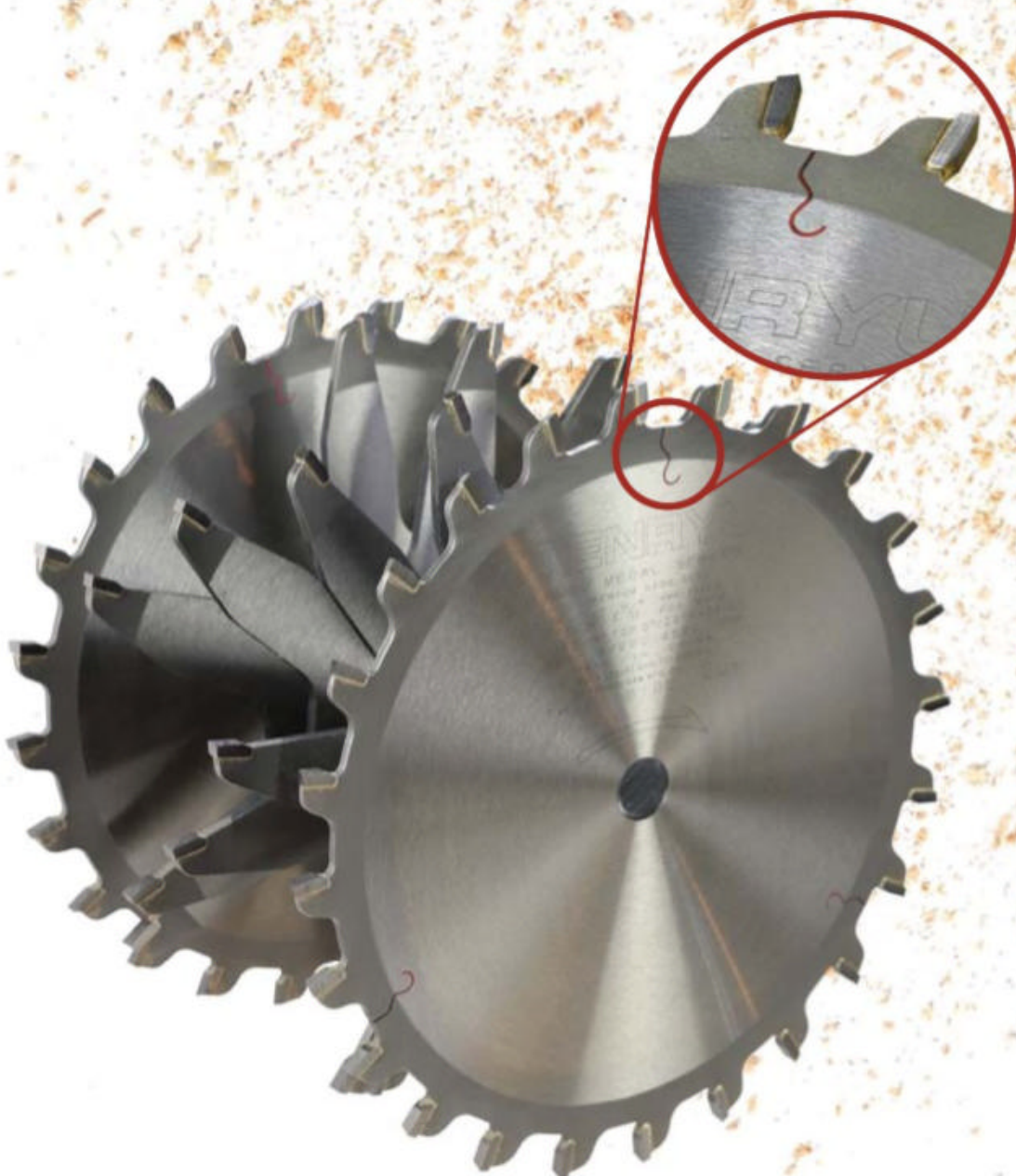
Wondering if it was a peculiar hiccup between the blades and the arbor threads, I repeated the tests on the *Fusion F2* table saw, but identical results were obtained. Minimal exit chipout was observed on hardwood dados. There was little to no veneer lifting, for quite acceptable cuts in plywood and cabinetry projects. "Bat ears" and scoring lines were moderate, but acceptable for most work. Test cuts were with a $\frac{23}{32}$ " stack produced oversized 0.738" grooves for a loose fit. The weight of a $\frac{3}{4}$ " nominal stock is 5lbs, 2.0oz and this blade is *SawStop* compatible.



Tenryu Gold Medal: *Polished Performer*

This all-new dado blade from *Tenryu* replaces the original dado blade by the same name. The fit and finish of this blade set is exceptional and it's clear that painstaking attention was paid to every detail, such as the resin-filled laser-cut slots to reduce cutting noise and vibration. The *Gold Medal* dado set is one of only two in this test with 6-wing chippers. The extra teeth translate to finer cuts, with little to no exit chipout in plywood or hardwood. The *Gold Medal* set was one of the very best dado blades in that regard.

The *Tenryu* blade weighs a spry 5lbs, 1oz for a $\frac{3}{4}$ " nominal stack. Despite having 6-teeth on each shipper, this dado blade set is easy to setup. "Bat ears" as viewed from the exit of a cut had moderate depth and scoring lines were moderate on cuts wider than $\frac{3}{4}$ ". A $\frac{23}{32}$ " stack made a 0.727" wide groove, which is slightly oversized for $\frac{3}{4}$ " plywood, but a premium magnetic shim set is included in the gold and purple wooden storage case. The *Tenryu Gold Metal Dado* is *SawStop* compatible. Whether you build cabinets or hardwood furniture, this set is sure to become a shop favorite.



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Freud SD508 Super Dado: *Best Non-SawStop Compatible Value*

An easy pick for best value. This blade isn't new on the block, but it's renowned and for good reason. The *SD508* has the classic layout of 24-tooth outer blades with 4-wing chippers. Cuts were very clean with a flat-bottom cut $\frac{3}{4}$ " wide or less in plywood. Some very light exit chipout was noted in hardwood dados, if not backed up. However, this improves with a sacrificial fence on the miter gauge. Minimal "bat ears" as viewed from the exit of a groove and minimal scoring lines noted on intersecting grooves or dados wider than $\frac{3}{4}$ ".

Fit and finish of the outer blades is excellent. The chippers of both *Freud* sets were painted black, with some of the carbide teeth partially painted as well. This is a minor knock on the fit and finish of the chippers only and didn't affect performance. The *SD508* is like a Jeep, in that it's sturdy and rugged and hasn't changed much over the years. And with these Silver I.C.E. coated outer blades, it still looks handsome after all these years. Test cuts with a $\frac{23}{32}$ " stack produced accurate 0.719" grooves, for snug plywood joinery. The case liner is flimsy plastic and there's no threaded rod to secure the blades, making damaged carbide teeth a possibility in transit or just banging around underfoot. That seems like a fair compromise, considering the substantially lower price tag of their set. If you're not using a *SawStop* table saw, this dado blade would be a great choice.



Freud SD608 Dial-A-Width: *Simply Shimless*

Novel or interesting features are first to catch your attention and the dial on this dado stack definitely qualifies. One point of clarification, this isn't an old-school wobble blade because the blades always remain parallel. The dial adjusts the effective width of the outer blade, thus eliminating the need for shims. Just loosen the arbor nut and turn the dial to fine-tune the width. There's a spring-loaded ball bearing inside the hub, with corresponding detents. Each "click" of the dial represents a 0.004" adjustment. Follow the manufacturer's chart for specific setup guidelines, as it's not always intuitive. For instance, you turn the dial 8 clicks for a $\frac{23}{32}$ " wide groove, even when using the undersized $\frac{3}{32}$ " chipper. The outer blades of the *SD608* are both two-piece assemblies, which can create compatibility issues with some saws. The arbor on the *Fusion F2* test saw wasn't long enough, so all testing for this blade was done on the *SawStop* with the brake deactivated. Even so, the arbor on the 3HP *SawStop* PCS wasn't long enough to fully thread the nut, even when omitting the arbor washer. There's a special wrench that comes with the blade set, but it didn't fit either saw. Furthermore the dial will limit depth of cut to approximately $1\frac{7}{8}$ ". Weight of this set was a concern as well at 7lbs, 11oz, which affects spindown time and therefore shop safety.

Cutting performance didn't quite match that of the *SD508*. This set produced one slight ridge in dados and grooves that you could catch your fingernail on. Surprisingly, the scoring lines left by this set were moderate, compared to the minimal scoring left by the *SD508*. There was light exit chipout on unsupported dados, which could be easily sanded away. A clean visible shoulder was noted with hardwood dados and virtually no splintering of surface veneers in plywood cuts. Testing a $\frac{23}{32}$ " stack produced 0.728" groove for a loose fit with plywood. The final analysis on this unique blade may depend on how it fits your particular table saw.





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Ridge Carbide North Woods Super Dado: *The Ringer*

Revised from an earlier version called the *North Woods Dado Master*, the fit and finish of the *Super Dado* has improved from good to great. With 24-tooth outer blades and 4-wing pinwheel chippers, this full complement of blades is ready to tackle any cabinet making or woodworking task. In testing plywood exit chipout was better than average among this elite group of dado blades. With hardwood cuts, exit chipout could be almost completely eliminated when backed up. There was very light lifting of plywood veneers on cross-grain dados, that I would describe as “peach fuzz” and easily sanded away. Slight ridges in the bottom of the cut are just deep enough to catch a fingernail on, but really only visible on cross-grain cuts in coarse hardwoods. “Bat ears,” as viewed from the exit of the cuts are average among this group and scoring lines on cuts wider than $\frac{3}{4}$ " were minimal.

Loading a $\frac{23}{32}$ " stack produced a 0.745" wide groove, which is oversized for $\frac{3}{4}$ " plywood. I cleaned and reinstalled all the blades but reproduced identical results. The 8-blade set comes with a full set of 3" non-ferrous metal shims. The *Ridge Carbide North Woods Super Dado* is *SawStop* compatible. A large blade runner case and nice set of magnetic shims are available separately.



Forrest Dado King: *Hometown Hero*

This well-machined blade set uses a traditional layout with 24-tooth outer blades and 4-wing chippers. The fit and finish is very good and the kit included a *Blade Runner* open case and magnetic shim set. Minimal exit chipout was observed for both grooves and dados in all material types tested. Moderate “bat ears” as viewed on exit and moderate scoring lines on double-wide passes were noted. *Forrest* representatives state the *Dado King* was designed so the beveled outer teeth cut 0.010" deeper at the sides of the groove to prevent splintering of the surface of the cut. This philosophy proved to be true and surface veneer cuts were clean and splinter-free.

The large diameter magnetic shims felt more secure and less “spongy” than small diameter shims. Since magnetic shims can only be produced down to about 0.010" thick, you'll likely need to add some thinner shims to your collection. Luckily, the included $\frac{3}{32}$ " and $\frac{1}{16}$ " undersized chippers mean you'll be less reliant on shims for perfect plywood setups. $\frac{23}{32}$ " test cuts made 0.719" wide grooves for snug joints in plywood. There were just a couple faint lines in the bottom of the cut that would catch a fingernail. Lastly, the *Forrest Dado King* is *SawStop* compatible and made in the USA..



Infinity Dadonator XL:

Editor's Choice + SawStop Compatible

The *Dadonator XL* is a completely new design with two extra-wide $\frac{1}{4}$ " chippers. This, as it turns out, is a real time saver because you can load a full $\frac{3}{4}$ " dado stack with just 4 blades. The overall layout of this new set is 24-tooth outer blades with 6-tooth wagon wheel chippers. Cutouts remove unnecessary weight from the chipper bodies and a $\frac{3}{4}$ " stack weighs in at 5lbs, 7.4oz.

Producing an extremely flat bottom, with no ridges to catch a fingernail on, this new offering from *Infinity* scored well in performance testing. Exit chipout was almost nonexistent, even when the cut wasn't backed up. This is perhaps due to the 6-tooth chipper design with unique -8° hook angle. Surface cut quality was excellent without any splintering of delicate plywood veneers. Additionally, a $\frac{23}{32}$ " stack produced a 0.723" wide groove, which fit $\frac{3}{4}$ " wide plywood well. Where this blade stands out is passes wider than $\frac{3}{4}$ " which shows very minimal scoring lines making this set great for through tenons or exposed half-lap joints. Also included are a set of color-coded 4" diameter plastic shims, a $\frac{1}{8}$ " chipper, a $\frac{3}{32}$ " plywood chipper, and an undersized $\frac{1}{16}$ " chipper. In addition, *Infinity* will continue to offer the original 8" Dadonator and 6" Dadonator, Jr.



Whiteside Plus by Dimar:

The Clean Cutter

With the highest tooth count in the test, at 44-teeth per outer blade, this dado stack gives a good surface finish and crisp shoulders in plywood and hardwood alike. The high tooth count outer blades feature clusters of 11-teeth and are paired with traditional two-wing chippers. Hook angle for the outer blades is -6° , while hook angle of the chippers is a fairly aggressive $+15^\circ$. This dado blade also had the highest outer blade bevel angle of the bunch at 35° . Grooves and cross-grain dados looked good in a variety of materials. The *Whiteside Plus* dado earned points for very minimal to no exit chipout in hardwood. Exit chipout in plywood depended on feed rate and whether the cut was backed up with a sacrificial board. “Bat ears” were acceptable as viewed on exit and scoring lines on passes wider than $\frac{3}{4}$ " had moderate depth.

The 7-blade set doesn't come with a $\frac{3}{32}$ " chipper but supplies a $\frac{1}{16}$ " chipper and a set of plastic color-coded shims. *Whiteside* calls for carbide teeth wide enough to allow a fair amount of shimming as needed. Since I was unable to test a $\frac{23}{32}$ " groove with blades alone, I made a $\frac{3}{4}$ " groove which measured 0.745". There's no case included with the set, but two-wing chippers tend to fit well in generic aftermarket cases. Weight of a $\frac{3}{4}$ " stack comes in at 4lbs, 4.1oz, which is the lightest of the group. The *Whiteside Plus* is *SawStop* compatible.



SawStop: *New Kid On The Block*

This all-new offering from *SawStop* is one of two dado blades with an extra-wide $\frac{1}{4}$ " chipper. Packaged as a 7-blade set in a plastic case, this dado made a nice showing. Fit and finish of the blade is very good. A steel shim set is stored in the case, but they're difficult to remove without damaging. The *SawStop* dado set is one of two packages that include a decent case, but I wondered how long the thin plastic latches would last in a shop environment. The 24-tooth outer blades and 4-wing pinwheel shaped chippers plow a reasonably flat bottom groove. The inside blade cut slightly shallower than the chippers and outer blade, making a slight ridge that you could catch a fingernail on. Size of the “bat ears” as viewed on exit were moderate in size and moderate scoring lines were visible on cuts wider than a single pass. Some exit chipout was observed in plywood when unsupported but hardwood cuts were clean in this regard.

The outer blades feature a 24-tooth clustered design, with wider gaps every 6 teeth. In theory, this seems like it would make offsetting the carbide teeth easier when installing a stack. I'm sure personal preference factors in here, but I found it a little more tedious to install this style of blade. Because the teeth are crowded in sections, you need to find the larger opening when placing a chipper next to an outer blade. A $\frac{23}{32}$ " stack produced a 0.736" groove, which is a loose fit for $\frac{3}{4}$ " plywood. This set includes one $\frac{1}{4}$ ", two $\frac{1}{8}$ ", one $\frac{3}{32}$ ", and one $\frac{1}{16}$ " size chippers. Lastly, the nominal $\frac{3}{4}$ " stack weighs 4lbs, 13.2oz and of course is *SawStop* compatible.



■ Textured Coloured Form with Metal Leaf

Create a beautiful showpiece by power carving on the lathe and adding a splash (or a wave) of color. **By Jimmy Clewes**

PROJECT #2309

Skill Level:
Intermediate
Time: 1 Day
Cost: \$100

PHOTOS BY LOGAN WITTMER

Looking to create a unique, statement? Look no further—this piece is sure to give you that WOW factor! To get started, I used a beautiful maple blank measuring 3" thick and 10" in diameter and a screw check for mounting. I like the screw chuck as it's an easy way to mount a bowl blank—one drilled hole and just screw the blank on. The other advantage is that as you are turning the resistance actually tightens up the blank. Just make sure that the screw hole is longer than the screw, otherwise the screw will strip the wood in the hole if it bottoms out. Secondly, make sure that the blank is tight up against the fence of the screw chuck. If not, you will experience a harmonic from the vibration.

Let's Get Started!

I always true up the edge of the blank first using a push cut with my $\frac{1}{2}$ " bowl gouge. If the bevel is positioned in the right place and "floating" behind the cut, the result will be a smooth polished surface. Failing to place the bevel in the right position will result in a rough surface. Also note that you should never use a spindle roughing out gouge for this cut as it is not the right tool to use for this

grain direction and can be dangerous! Just remove enough wood to true up the edge otherwise you are making the blank smaller.

My next step is to true up the face of the blank, again using the $\frac{1}{2}$ " bowl gouge but using a draw or pull cut this time. It's a great, ergonomic cut (after-all, the Japanese use a pull cut for their tools). Again, using a shallower angle of approach will result in a smoother cut.

The Back of the Form

It's at this stage that I mark and cut the tenon. There are several ways of achieving this. I use a pair of dividers and set them to measure the inside diameter of the chuck jaws that I am going to use. In this case, I set it to approximately 2" and use the *Vicmarc VM 120* chuck. Holding the dividers in a trailing fashion and using only the left leg of the dividers, I scribe a line making sure that the line I scribe with the left leg matches up

with the right leg. Do not let the right leg touch the surface of the blank otherwise the dividers will flick out of your fingers.

After scribing the line with the dividers, I use a $\frac{1}{8}$ " parting tool to cut to a depth of about $\frac{1}{4}$ " and then another right next to it to widen the cut to a $\frac{1}{4}$ " (Photo 4). Then using the draw cut, I remove the excess wood, basically leaving a flat surface with a proud tenon. This tells us exactly what we have left to produce a beautiful simple curve.

Again, using the $\frac{1}{2}$ " bowl gouge and draw cuts, I shape the outside of the form. I prefer the draw cuts as for me it's generally quicker than the push cut. Also, because of my body and head position, the draw cut lets me look at the profile of the blank as I am cutting it allowing me to make very subtle cuts to refine the curve (Photos 5-6).

Before moving onto the front side, I like to sand and finish the wood. I usually begin sanding with a 180 grit and use the *Skilton* sand-

1 Make a push cut along the edge of the vessel to true up the edge of the blank.

2 Draw cuts from the center to the outside will true up the surface of the blank and reveal the grain.



Textured Coloured Form

ing pad and abrasive discs available from www.turningwood.com. The reason for this is that using a coarser grit could result in unnecessary scratches and finer grit may not be enough for the initial sand. I can make decisions after using the 180 grit. Any tear-out or disturbed grain should be removed with the first grit, even if you have to go coarser. After that, you sand to the desired finish.

I find that on most woods 400 to 600 grit for the final sanding is sufficient. One of the many options to finish the piece (and my preferred option) is the *Zinsser's* clear coat shellac thinned down 25%. I use this first to seal the wood before I finish with Danish oil. The reason for thinning it down slightly is that it will penetrate further into the wood. When dry, and providing the wood is closed or tight grained, I use #0000 steel wool to cut back the shellac and then apply a thin coat of Danish oil. You will see that the oil will “pop” the grain ... beautiful!

Preparing the Front

After finishing the back of the form, the piece was removed from the screw check and held tightly in the jaws of the chuck. The face is trued up using the draw cut, and I turned a slightly convex curve in the surface. From an aesthetic and ergonomic point of view, the



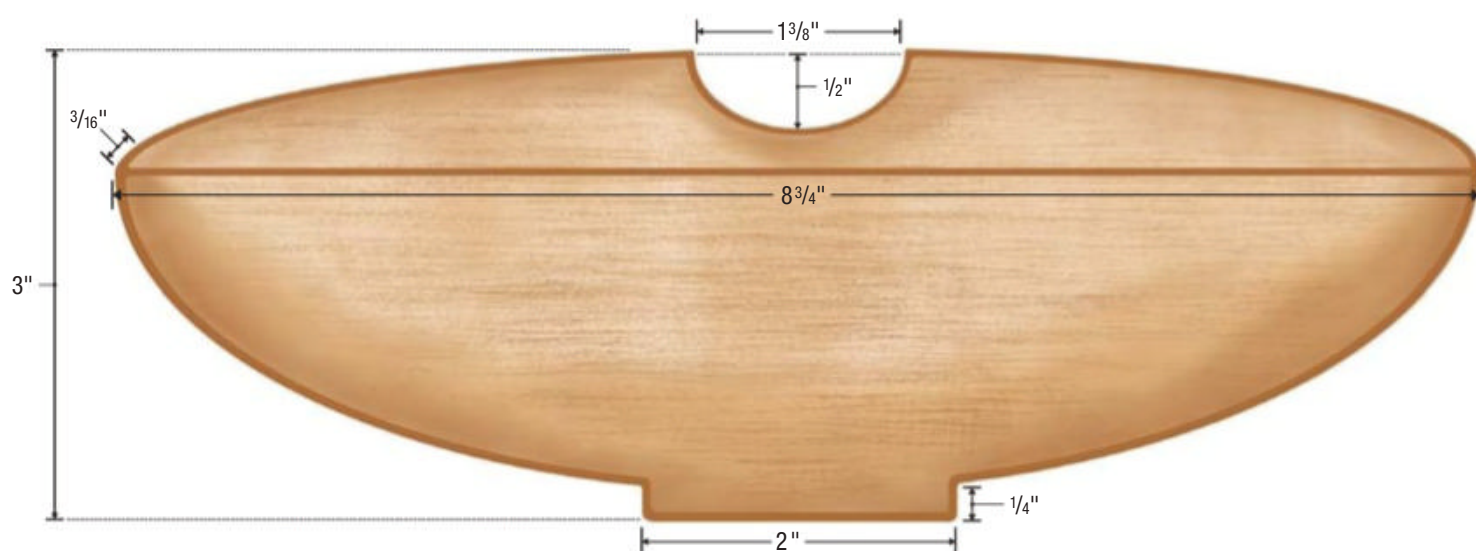
3 Use dividers to mark a tenon sized to match your chuck.

4-5 With a parting tool, form the tenon and remove the waste with a bowl gouge using pull cuts.

form benefits from a curve on the top rather than a flat. The curved surface does not need to be sanded as the surface from the *Arbortec*

cutter will remove a small amount of wood and cut clean. I use the *Arbortec* three times during the colouring process.

Textured & Coloured Form





6

6 A draw cut will allow you to watch the “horizon” and achieve a good shape on your vessel.

7-8 Power sand the bottom of the vessel. Seal it with shellac, then apply a coat of Danish oil.



7



8

9 Start to form the top of the vessel. Here, I’m going for a slightly domed top.

10 With the blank spinning, texture the top with a circular cutter.



9



10

Initial Texture

Before getting started with the Arbortec, there are a few things you’ll want to keep in mind:

Cutting angle: The *Arbortec* has two really sharp carbide cutters which have a slightly round edge. When using it to texture, I present the cutting head at an angle of about 45° to the wood. I found when I tried cutting with the cutters in a horizontal position it was more difficult to control the depth

of cut and it was quite aggressive!

Many factors alter the pattern:

Factors include the lathe’s speed, how quickly the passes are made, and the pressure of the *Arbortec*.

Start in the middle: When making a pass over the surface, I start in the middle of the blank. A couple of reasons for this are that I can feel how the *Arbortec* is going to cut before I make the pass and the middle will be removed later anyway to apply the gold leaf.

Always practice first: My advice would be to try a few light practice passes before you shape the top and attempt to texture the finished curve of the form.

Be vigilant at outer edge: Make sure not to drag the cutter around the edge of the form, otherwise the cutters will badly damage the wood and possibly the finished bottom.

With these things in mind, make the first pass. If you’re happy, it is time to apply the colours.



11 Starting with the darkest colour first, apply a layer of dye over the entire textured top.

12 Once again, texture the top of the blank.



13 Apply a new layer of dye, this time a lighter shade of blue.

14 This time, texture the blank slightly less.

Applying the Colours

I use *Chestnut* coloured stains. I find those stains to be bright, vibrant, and fade resistant, which for an aesthetic piece like this is very important. I only use 4 colours and chose them specifically. They are (variations of) primary colours and mix together to form other colours. For example, red and blue produce purple, yellow and blue produce green, etc. When the piece is finished, you will see so many different hues.

COLOUR #1: Royal Blue

I apply the first colour stain, royal blue, with a piece of paper towel and sometimes a Q-tip for detail. The paper towel is soft enough to allow the dye to get into the texture. You could consider using a piece of sponge as well. I use a “stippling” technique of small dabs and cover the whole surface. As the stain is alcohol based it dries very quickly.

Switch back to the *Arbortech* for another round of texture. It’s

difficult to describe in words how much wood to remove on the second pass as I tend to make aesthetic decisions. However, I would say that I leave about 50% of the royal blue colour.

COLOUR #2: Teal Blue

I then use the same stippling technique to apply the teal blue colour to only the newly textured surface or the white natural wood spots.

Now another pass with the



15



16

15 Working into different colours, apply a layer of red. Now, start to apply the colour in selective areas, trying to appear random.

16 Make a light skim pass with the *Arbortech*.



17



18

Arbortech—this time I remove a little less wood and leave approximately 60% of the royal blue and teal blue colours.

COLOUR #3: Red

Using the previous stippling technique once again, I now apply the red in the newly textured lighter areas. Don't worry if you leave the odd white bare wood spot as this will be dealt with later.

The final pass with the *Arbortec*

is another light pass with the goal to keep maybe 70% of the colours with a little more from the center and working outwards.

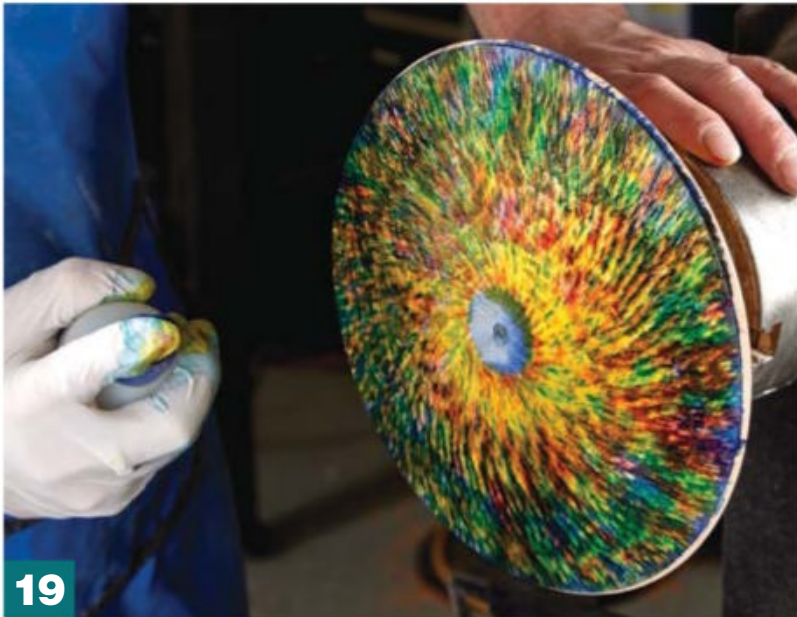
COLOUR #4: Yellow

The final color stain is yellow. Again, using the same stippling technique, cover any of the newly cut textured surface. You will start to see purple, green, orange, and other hues begin to appear as the four colours mixed together.

17-18 The final coat is with yellow, and it will start to blend together.

BLEND ALL 4 COLORS

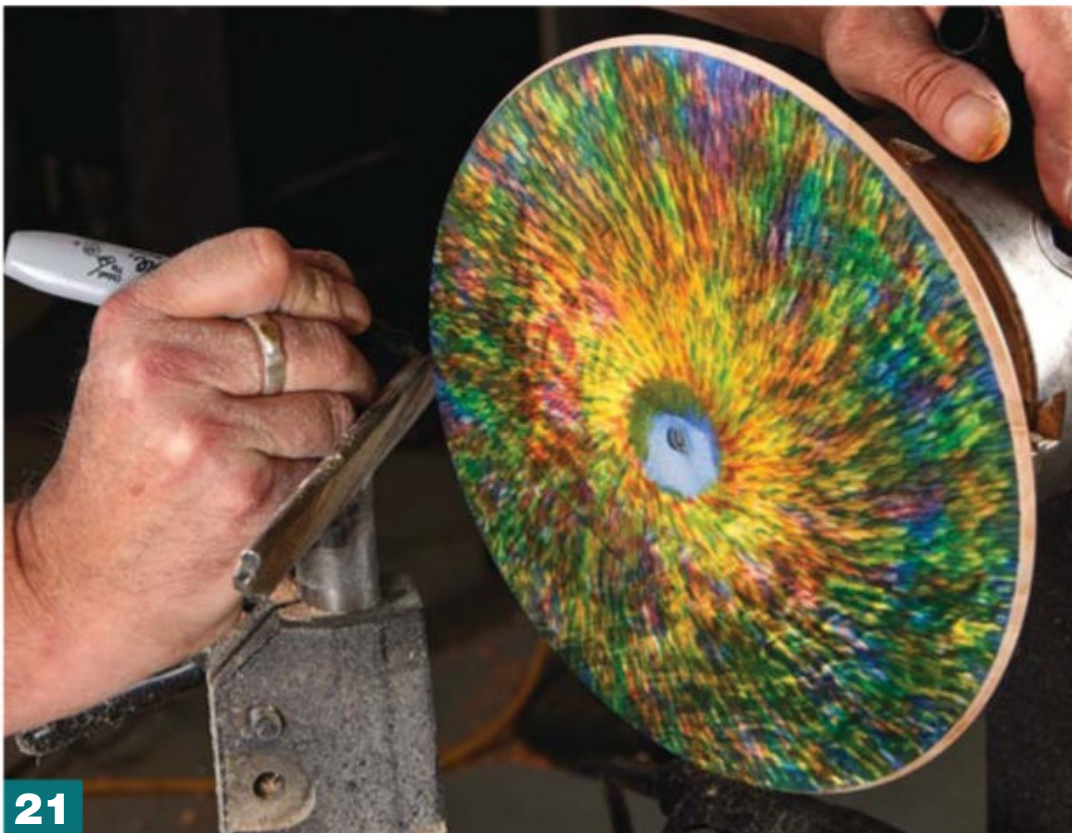
The final technique I employ is to lightly mist the surface with denatured alcohol in order to get all the colours to blend in nicely and cover up any tiny area of the texture that did not cover with stain. When misting the surface, be sure to keep the piece moving



19



20



21



22

19 Spray a coat of gloss spray lacquer over the coloured surface.

20 Slightly bevel the edge of the top.

21-22 Colour the bevel black.

as you want to avoid a “curtain” of alcohol flowing across the surface dragging the colours together and when dry, forming a “tideline”.

The Final Touches

You may notice that the edge of the piece has some stain on it—don’t worry! There are two great ways to clean up the edge. One way is to take a small cut with the bowl gouge and sand it. Another great fix is to use a black marker to cover the edge. This achieves two things: the black line frames the colours from an aesthetic point of view

and masks the stain. I hold my hand and marker steady on the tool rest and move the piece with the other hand. This is far more accurate than freehand! I choose to use both methods.

Now we have to attend to the hole left from the screw chuck in the center. Using a small bowl gouge, hollow out a hemisphere about the size of a quarter in the center. You could also use a round nose scraper if this is easier. Make sure the hollow is deep enough to remove the screw hole. The hemisphere is then sanded to 400 grit and sealed using the

same thinned down shellac as earlier. This is an important step to do as if you don’t, the adhesive size will soak into the wood and be ineffective. Once the shellac is dry, use #0000 steel wool to smooth out the surface before applying the size.

I use the *Mona Lisa* brand of size/adhesive and apply it with a soft brush. A course brush can leave ridges in the glue which will show up through the leaf. The adhesive goes on as a milky colour and turns clear when it is ready to apply the leaf. This only takes a few minutes.

THE FOCAL POINT: Gold Leaf Center



23

23 Use a parting tool to form a clean entry for the center.



24

24 A bowl gouge will slightly hollow it.



25

25 Paint on a water-based leaf size.



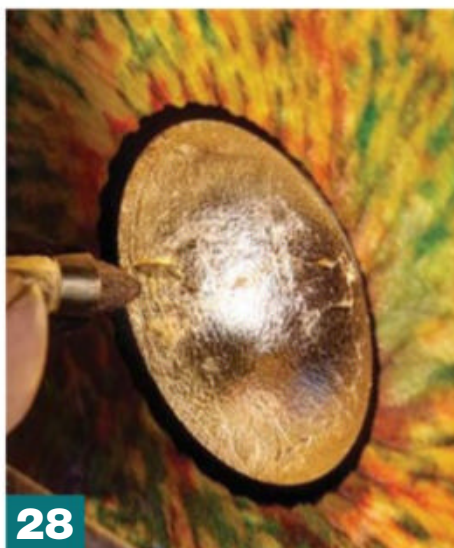
26

26 Press the leaf into the hollow and use a tissue to press it down.



27

27 A soft bristle brush is used to brush away the leaf.



28

28 As with the top, bevel and color the transition to the center.

The *Mona Lisa* brand is also the brand I use for the gold leaf. It's not real gold leaf although it appears very similar to the real thing. The reason that I like it (apart from cost) is that it is a lot thicker than real gold leaf and handle much easier. I believe that the exact metal they use is a mixture of tin and copper that they colour through a heat treatment process. To apply the leaf, I tear off small pieces and carefully apply them to the glued/sized area. Make sure that you do not overlap the pieces of the leaf as it will not stick to itself unlike real gold. When the entire area is covered, get a clean semi-soft brush and gently brush away the excess overlapping leaf. To smooth the surface of the metal leaf, I use a soft tissue and gently wipe the surface again. Note that I do not seal the leaf with anything as you tend to lose the bright sheen when you do.

As I mentioned earlier, I feel the black line on the outside rim frames the texture and colour. To balance the piece and to clean up any excess leaf, I turn a small chamber about $\frac{1}{16}$ " at an angle of about 45° on the edge of the hollow and again use a black marker. I then use a gold marker to sharpen any of the edge of the gold leaf that might have lifted away. This now frames the coloured texture and the gold-coloured leaf.

Remember that not every piece of woodworking or wood turning needs to be practical. Sometimes, a piece can simply be a decoration and have no real practical use, other than to make you smile when you look at it. This piece is a relatively easy piece to turn and the curve is very simple and easy on the eye and hand. The textured, coloured embellishment really sets it off from an aesthetic point of view. I hope you enjoy having a go at this piece! **PW** – *Jimmy Clewes*



PROJECT #2310

Skill Level:

Beginner

Time: 3 Days

Cost: \$150

Coopered Leg Hall Table

Coopered legs and tusk tenons build the structure of this beautiful hall table.

By Doug Stowe



PHOTOS BY LOGAN WITTMER

During the start of the Covid pandemic and as things were shutting down, my wife, Jean, gave me a list of things to do, one of which was a small bench for the bathroom to sit upon while getting dressed. I made one out of ash, with coopered legs that gave it a great deal of stability. I was impressed by my own success and realized that the simple design could be easily adapted and applied to making a hall table, which you see here, also made of ash. The stability of this table comes in part from the shape of the legs, that can stand alone, even without the trestle standing between the two. In addition, the trestle and tusk tenons give it amazing strength and the tapering of the legs as they rise, give a sense of lightness to the solid plank top, while also giving visual weight to the base.

Why use Ash?

For a time, ash lumber was on the market cheap as foresters attempted to save material from the steady advance of the emerald ash borer, a beetle infestation ravaging American forests just as other deadly invasions had done to chestnuts and elms in generations past. I work with the firm belief that woodworkers have a responsibility to the environment that's fulfilled in part by making people aware of the beauty of natural woods and our duty to protect our forests.

Form the Trestle Mortise

First form the mortise for the tusk tenons to fit the trestle. Take your trestle part, see page 44, and cut it in half. Next, use a dado blade on the table saw to hollow the tenon on both parts. Then glue the two halves of the trestle together, leaving the full mortises at each end. I chose to use hide glue giving me just a bit more open time to make adjustments as the parts were glued. Let dry.



- 1 Rip the trestle parts to width.
- 2 Set up a dado blade and position the first notch for the tenon mortise.
- 3 Remove the remainder of the waste from the mortise.
- 4 When complete, the pair of notches form a mortise.

Coopered Legs

Begin by planing the parts for the legs to thickness and cut them to length. Lay them next to each other while taking into account the direction of the grain. Cut the center pieces in half so that the mortise for the tusk tenon can be formed. With a dado blade in the table saw, form one half of the mortise on each side of all four center leg sections. Then glue the sections together making certain that the mortise edges are aligned.

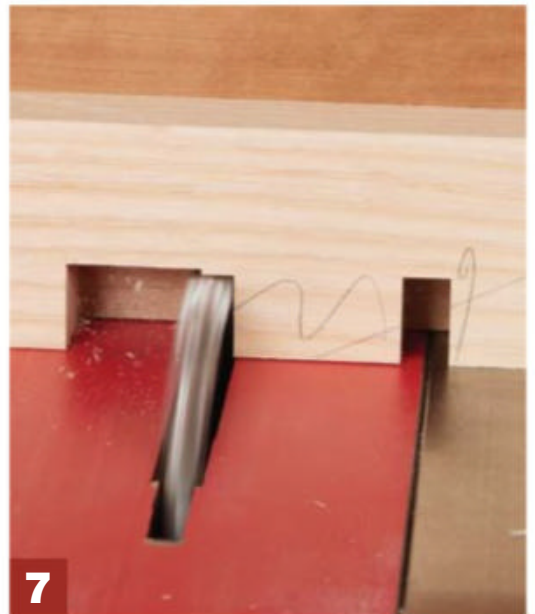
Next cut the angles on the coopered leg sections. I chose a 9° angle on each part so that the summary angle between the parts would be 18°. To prepare for cutting, apply masking tape along the edges of the stock, which will come in handy later in preventing glue being in all the wrong places. After making table saw cuts on each part, follow up on the jointer with the fence set at 9° to make certain the parts will come together with no space between them.



5 Carefully check the height of your dado blade.

6 As with the tusk tenon mortise, form the mortise for the trestle by defining the initial position using a stop block.

7 Carefully measure and move your stop block to define the over all length of the mortise, and nibble away the waste.

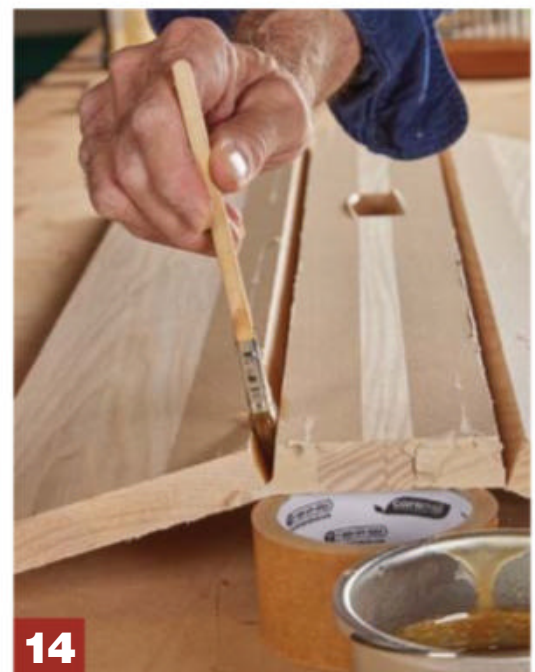


8 After forming the notch to make the mortise, you can glue the center leg section together.

9 Hot hide glue will give a good open time and a subtle glue line.

10 After clamping the center leg section together, make sure to double check the mortises to ensure that nothing slipped and they're still aligned.





Tape the parts in relation to each other, holding them tight to each other on the convex side. Do not be stingy on the use of tape. A successful glue up is not a matter of how much pressure is applied, but is a matter of how well parts are held in relation to each other. With the concave side of the legs facing up, spread glue between the parts and then lift the edges to close the joints. Clamps can be used with great caution to apply very little force. Tape can also be used, but with care to not open the joints on the opposite side. Using hide glue can allow for second chances in case this operation doesn't yield best results on the first attempt.

11 To create the coopered leg, bevel the edges of the leg parts at the table saw. The center piece is beveled on edges.

12 Joint the edges to clean them up and achieve a tight glue line.

13-15 Use masking tape to contain squeeze out and hinge the joint.





16-18 To form the trestle's tenon, use a dado blade at the table saw. Use the rip fence to position the length of the tenon and remove the waste, scotching the workpiece a little bit each pass.

Finish Trestle and Create Tusk Tenons

Once the glue has set, form the tenons at each end to fit the mortises formed earlier in the coopered leg unit. I, once again, use the dado blade on the table saw to form the tenons by moving the stock over for a series of cuts.

Now, form the tusks to lock the trestle tenons into the leg units. I chose walnut for the tusks due to the walnut color tone of the pattern seen in the top.

Lastly, Shape the Parts

Once the glue on the trestle and coopered legs have cured, taper them using a band saw. The trestle is shaped on the underside while the legs are tapered on the sides.

The last piece is shape is the tabletop, which is an exceptional wide piece of ash with a lovely brown heartwood pattern on the top side. While this could have been made with narrow boards, the use of wide materials can impart greater beauty and value. To continue to capture the angularity of the overall design, angles are cut on the ends of the tabletop and as well as a slight angle in the center of the top help to reflect the angular elements in the legs.



19-20 A tusk tenon is formed at the band saw and is driven home to fit. You may need to adjust the fit with a spindle or drum sander.



21

21-22 Use a straight edge to draw guidelines on how you'll shape the trestle. Then, cut away the waste at the band saw.

23 Taper the sides of the glued up legs. The band saw is easiest here, but you could probably get away with a taper jig at the table saw.

24-25 At this point, shape the top as you desire as well. Here, I've rounded the ends slightly and added a shallow V-cut to the front edge of the table.



22



23

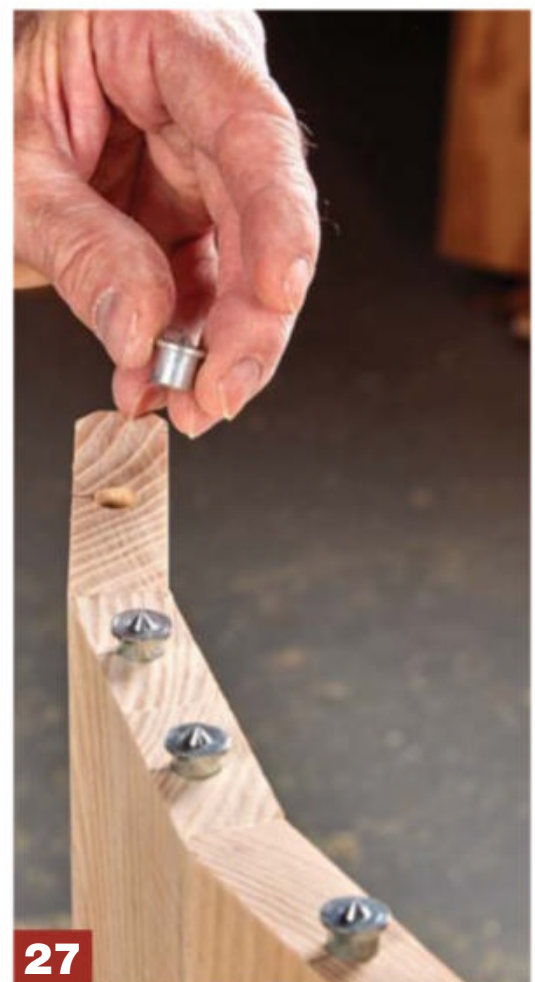
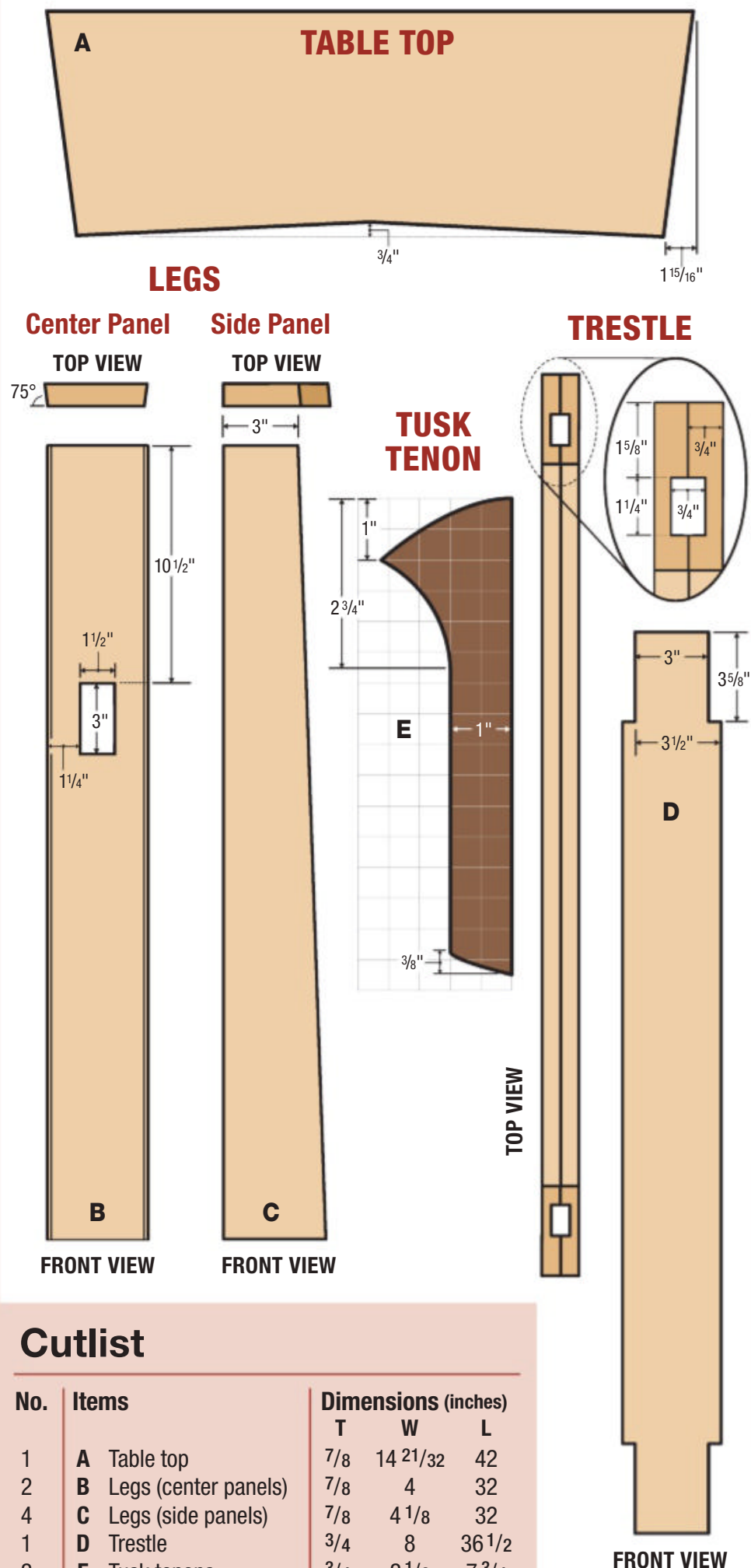


24



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Coppered Leg Hall Table





28

28 Carefully measure and position the assembled legs on the top.



29

29 When you're happy with the positioning, use a large wacker to smack the bottom the legs. This will transfer the dowel positions via the dowel centers so the top may be drilled.

30 Finally, soften all of the edges of the legs and top with a 45° chamfer bit. A palm router allows you to get inside the curve of the leg parts.



30

Assemble & Finish

To attach the tabletop, use dowels. An old Stanley doweling jig is perfect for these operations as it fits into the spaces between the coopered parts. The position of the dowels isn't critical. What I've done here is to drill a pair of dowels in the center piece of the leg, and one on each side part. A block of wood stuck on the drill bit acts as a depth stop.

With the dowel holes drilled into the leg units, use dowel center to mark the dowel hole locations on the underside of the top. The dowel centers fit tightly into the already-drilled holes and have a spike on the top side. When you position the leg unit on the top, you can smack the bottom of the leg, transferring divots to the underside of the top. It's important to make one hard wack to avoid double-marking the top and then having to guess which holes are the right ones. Drill the dowel holes in the underside of the top but make certain not to drill too deep. Once again, I use a stop on the drill that prevents it.

Routing comes next. Rout all the edges of the leg units with a 45° chamfering bit, except those edges that met the top. The small footprint of a palm router works well for this, as you can fit it on the inside "curve" of the leg parts. Form a small chamfer along the edge of the top and then a large chamfer on the underside of the top.

With the routing complete, carefully sand all the parts. It makes sense to me to sand and apply finish to all the parts before assembly. I use a variation of Sam Maloof's formula that I mix up in my own shop. After final assembly, I give additional protection to the top with a clear coat of satin urethane sprayed from a can. Once dry, place in the hallway for a beautiful asymmetrical touch for your home. **PW**—Doug Stowe

Mobile Spray Station

Keep all your spraying equipment and finishing supplies in one convenient mobile spray station.

By Willie Sandry



PROJECT #2311

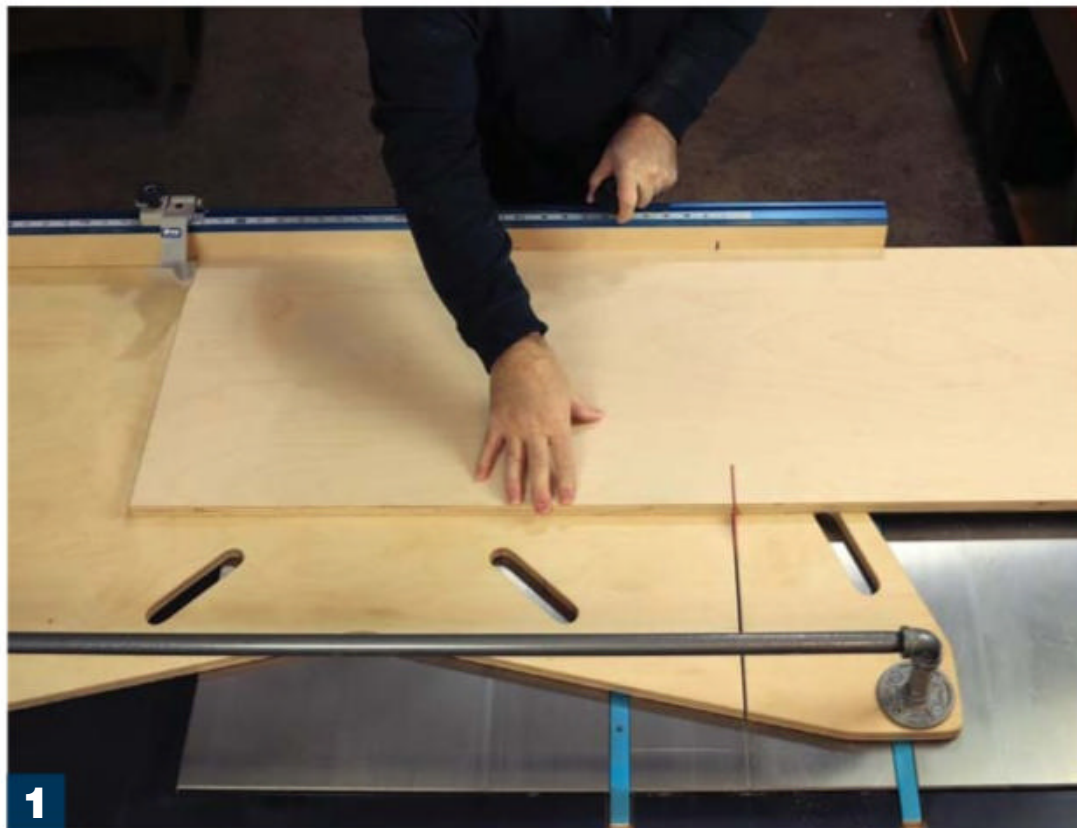
Skill Level:
Intermediate
Time: 5 Days
Cost: \$350

I'm getting to the point that I don't build general purpose shop carts anymore. I'd rather build a cabinet for a specific purpose. Something functional with handy access prioritized above all else. I've been spraying woodworking finishes since the 1990's with a variety of compressor powered spray rigs and recently, upgraded to a 5-stage turbine powered spray system. So, I needed a place to safely store the turbine, wrangle the hose, and stow related accessories. A turbine sprayer represents a significant investment, so I didn't want it kicking around the shop.

Turbine units draw air into an internal filter and require unrestricted airflow when in operation. This creates an interesting design challenge when building a cabinet to enclose a sprayer. One option is to leave the lower compartment open. That would actually work pretty well, except I plan to store the cart under the wing of a table saw. In a dusty environment, it's ideal to keep the turbine enclosed when not in use. The only real hang-up with open cabinet doors while you're using the sprayer — they tend to be knee knockers. To solve this predicament, I installed "5-knuckle" cabinet hinges that swing open a full 270°. This places the cabinet door flat against the sides of the cabinet when open and you're free to work around the cart, without the doors getting in the way.

Time for a Breakdown

Start by ripping and crosscutting the 3/4" plywood sides to final size. Make sure your cuts are square coming off the crosscut sled. You can also cut the remaining plywood parts but leave the two cleats extra-long for now. Their length is dependent on the exact depth of the dado you will cut next, so it just easier to measure for cleat length directly from the cabinet.



1 Breaking down full sheets of plywood can be a challenge, but a large crosscut sled makes the job a little easier. Here, my "X-Cut" sled helps trim the sides to length. If you want to skip full sheets of plywood, this project could actually be build with 24" x 48" pre-cut handy panels.

2 A setup gauge quickly helps you dial in the dado width.

Onto the Dado Blade

Next switch to a dado blade for cutting the dado and rabbet in each side panel. I keep a handy setup gauge for my frequently

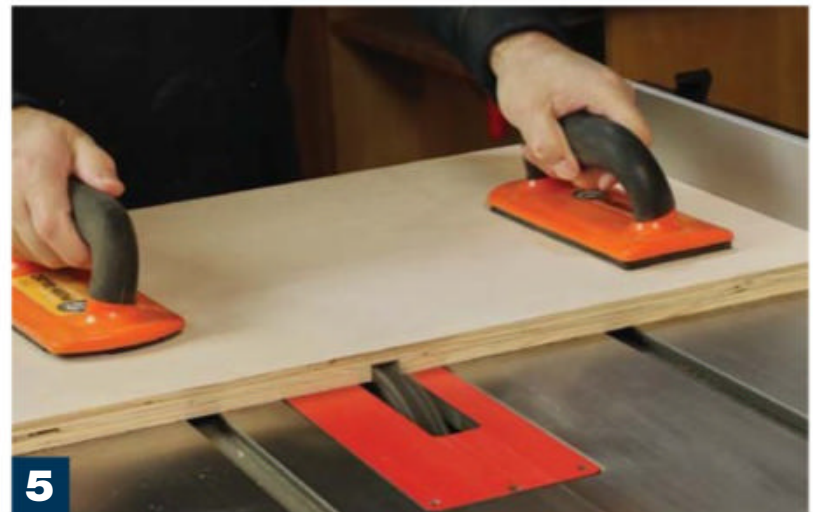
used dado sets, with common groove sizes cut into it. That way I can grab the intended shelf stock and tell at a glance what shims are required.

While the sacrificial fence is still on the saw, take a minute to cut a rabbet in the mid-divider. That rabbet needs to be at the back of the dividers and runs the full width of the shelf. There's also a stopped rabbet on the back edge of the side panels. This forms a nice recess for the back of the cabinet, which is a small piece of $\frac{3}{4}$ " plywood.

3 Use the actual shelf stock to set the rip fence for the rabbet cut.

4 Mill a $\frac{3}{8}$ " deep rabbet in at the bottom of both side panels. With the same setup, rabbet the back of the mid-dividers shelf as well (not pictured).

5 Adjust the rip fence and cut a through dado in both side panels.



Assembly

I like to build cabinets with a combination of rock-solid joinery and simple pocket hole screws. The two cleats atop this cabinet are one place where pocket hole screws make sense. I've used this construction technique on several cabinets, and they've proven

durable in an unforgiving shop setting over the years. If you like this quick and sturdy method of assembling cabinets, look for my **Mobile Assembly Table** article in the December 2020 issue of *Popular Woodworking*.

Like most cabinet designs, this mobile spray station relies on

6 Glue the basic cabinet together. Snug fitting dado joints make the assembly process easier.

7 Draw the cabinet parts together with clamps and let it cure for a few hours. Vertical clamping pressure helps seat the bottom shelf in the rabbet.





8



9



10



11



12

8 Reinforce the rabbet joint with 18 gauge or larger brad nails.

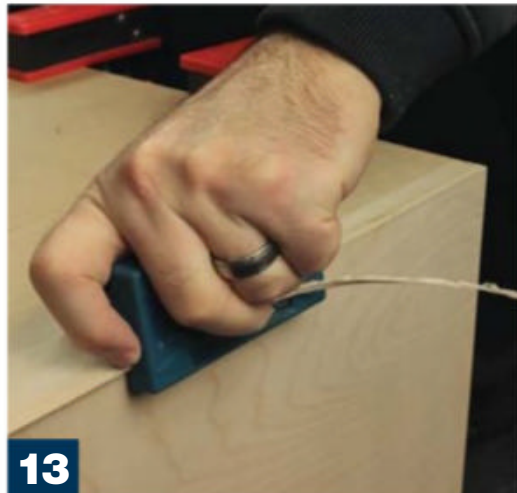
9 The stopped rabbet in the side panels leaves a bit of waste to be removed by a chisel.

10 3 pocket hole screws secure each end of the cleats. The rear cleat aligns with the rabbet.

11 Install the back panel into the recess. Note the shallow dado that will accept vertical maple edge banding. Reinforce the back panel with 1 1/4" brad nails, which can be hidden under the edge banding.

12 Apply iron-on maple edge band. Start with the vertical runs and press the veneer firmly in place with a scrap of wood. Then trim pieces of edge band to fit between the vertical pieces and complete the horizontal runs.

13 Use a special edge band trimming tool to slice the veneer flush with the cabinet. Whenever possible, align the edge band with the inner edge of the cabinet and trim off the outer edge.



13

the back panel to lock it square. Before you install the back panel, cut a shallow dado across the left and right edges. Make the dado 3/8" wide and as deep as your edge band veneer. While this detail is purely optional, I find it makes the edge banding easier to install on the back of the cabinet. Glue and

brad nail the back of the cabinet in place and plug in your iron. Let me make myself perfectly clear... **YOUR IRON.** Not your spouse's iron or your in-laws' iron. I've learned that every shop needs an iron, an electric turkey knife, and maybe even a blow dryer. Just don't steal the one out of the

house. You have been warned! Edge band the vertical runs first, then come back and cover the horizontal parts like the shelves and cleats. Don't worry about edge banding the thin strip of exposed plywood on the back of the mid-divider shelf. It will soon be covered by a door anyways.

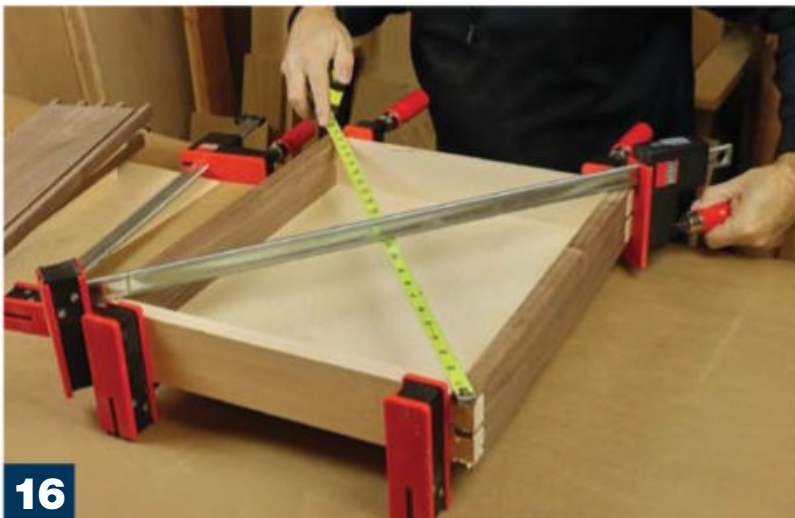
Drawer Boxes

Despite the interesting look, the drawer boxes feature typical through dovetail construction. The plan calls for walnut fronts and backs and maple sides. A shaped, false drawer front will be added later. Once the $\frac{3}{4}$ " thick drawer parts are ripped and cut to length, pull out a dovetail jig to form the

joinery. I find through dovetails easiest to cut, as you don't have to account for any offsets or setbacks. If your drawer boxes are 15" deep, simply make 15" tail boards. The drawer bottoms are $\frac{1}{4}$ " plywood set into a groove. The false fronts have curves that can be cut at the bandsaw initially, then cleaned up with a template bit.

14 Grab a jig and go to work. Use your favorite dovetail jig to cut through dovetail joinery for the two small drawers.

15 With a combination blade, make a groove just above the bottom pin. Size the groove to fit the plywood you intend to use.



16 Assemble and clamp the drawers using 3 clamps on the small drawer, 2 to set the tail boards, and one to draw the box square.

17 Make a template for the curved drawer fronts from $\frac{1}{4}$ " thick MDF. For a smooth curve, use a large diameter compression bit with bearing.

the acrylic, but I found a moderate feed rate works best to avoid melting the edges. Now that the grooves are cut, the doors are built with simple stub tenon joinery. Form $\frac{1}{2}$ " long tenons on all the rails and test fit the parts with the acrylic sheets. Sand the interior edges of the rails and stiles and proceed with gluing the doors together.

Tackle the Doors

The doors are next on the list to tackle. You could probably use any material you like for the three doors, but I chose hardwood frames with acrylic plexiglass windows. Start by grooving all the door parts on one edge to fit the $\frac{1}{4}$ " thick acrylic sheet. I purchased an

18" x 24" sheet from a big box store, which was enough for all three doors. Plexiglass is often undersized from the nominal dimension and my $\frac{1}{4}$ " sheet measured 0.22" thick. Acrylic sheets cut well with a 50-60 tooth carbide tipped blade at the table saw. The tendency is to cut very slowly to avoid chipping

Top Surface

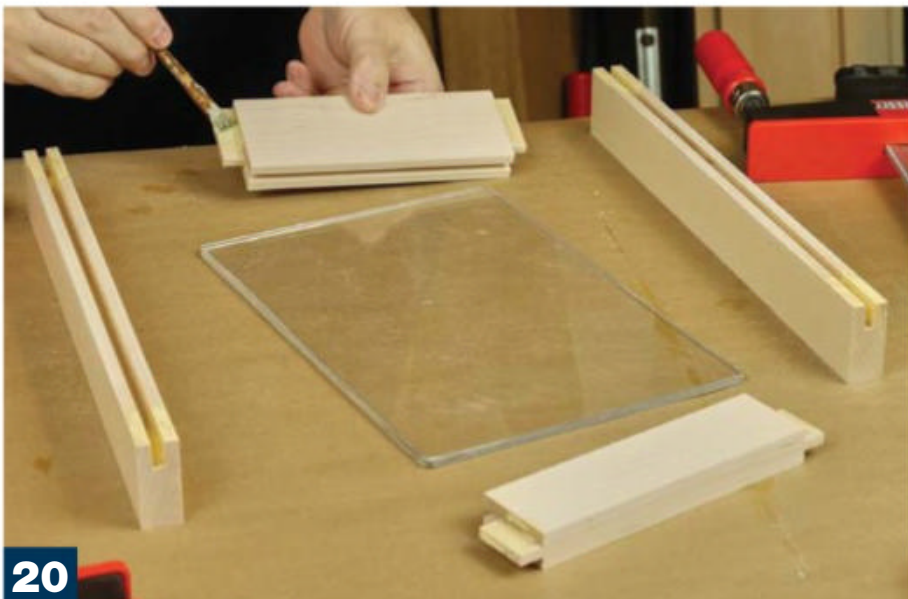
While the doors are drying is a great time to make the surface of the cart. Start with a full 1" thick piece of MDF and trim it to the



18



19



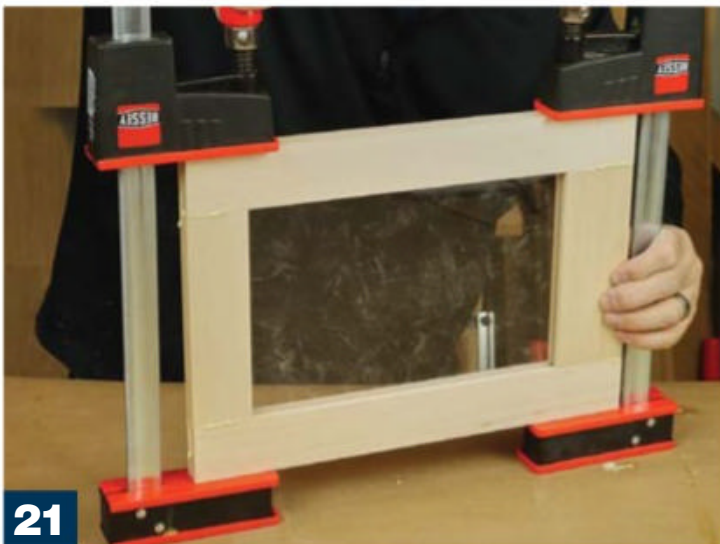
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18 Form stub-tenon joinery for the doors using a miter gauge and dado blade partially buried in an auxiliary fence.

19 Acrylic sheets cut well with woodworking tools. I found a 50-60 tooth table saw blade with moderate feed rate worked best.

20 Apply glue to the tenons and the ends of each groove to assemble the 3 cabinet doors. The plexiglass is friction fit in the groove.

21 The glue-up only requires 2 medium-duty clamps per door. Check the door for flatness and set it aside to dry.



21



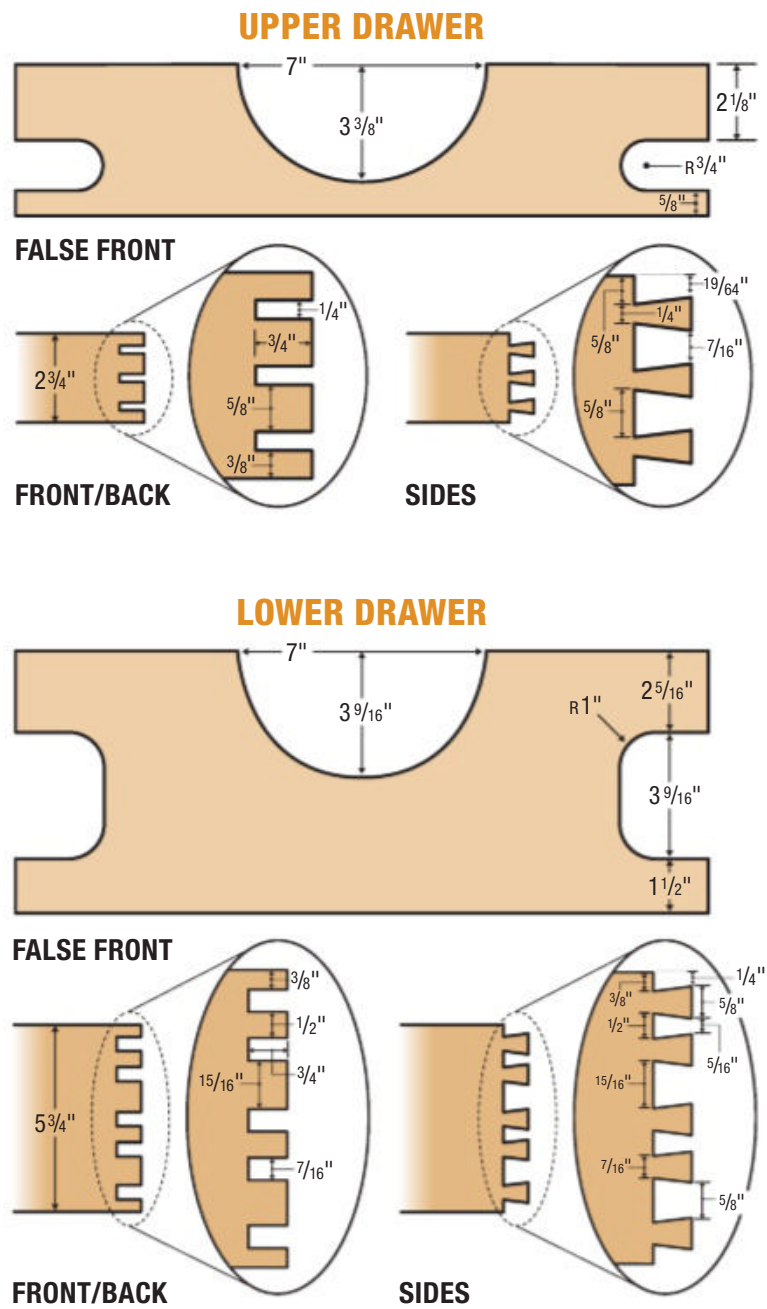
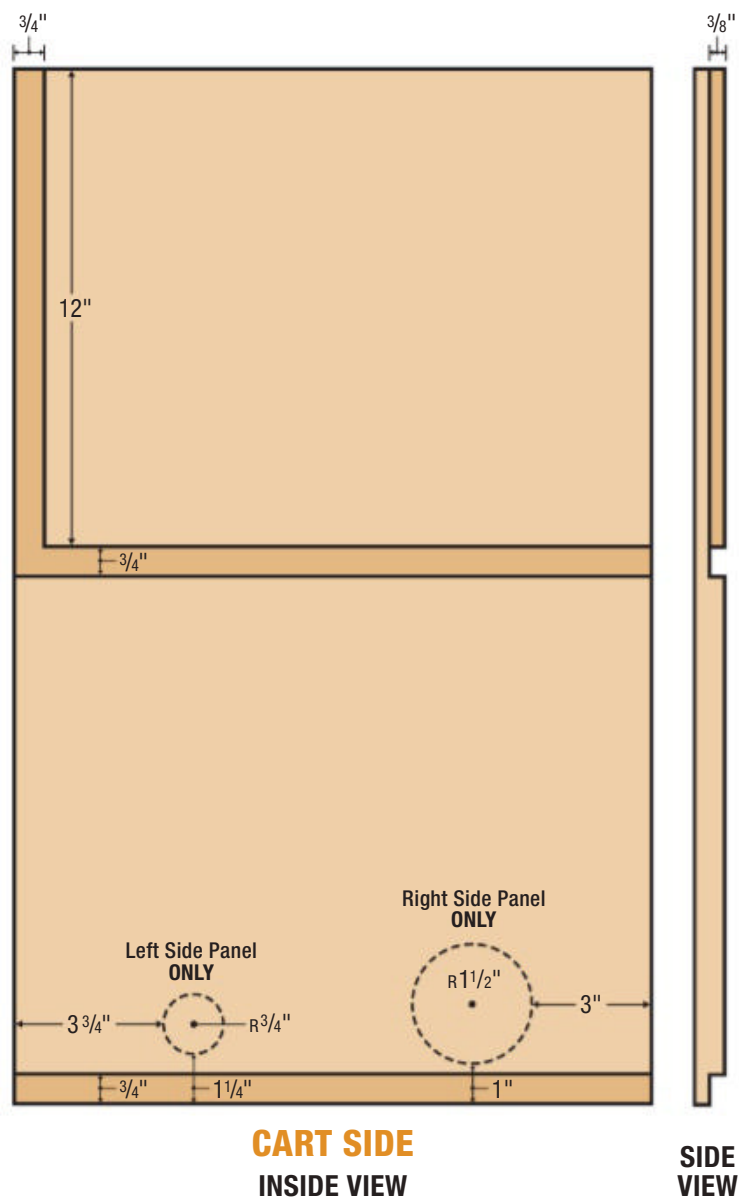
22

finished size. Round the corners of the MDF and apply a plastic laminate like *Formica* or *Wilsonart* (a 1-quart can of adhesive is recommended). I selected a simple matte black laminate to match my outfeed table. To edge the top, T-molding is tough to beat. It is easy to install and protects the edges from typical shop abuse. The key to installing the T-molding perfectly flush with the top of the table surface is to make a scrap with plastic laminate as well.

Take the laminated scrap to the router table and make a test cut with the appropriate slot-cutting bit. Usually a 0.0625" or 0.080" slot will be required but check with the T-molding manufacturer to make sure. Adjust the bit height until the T-molding sits flush with the top of the plastic laminate. Once your slot-cutter height is confirmed, rout the perimeter of the top at the router table. Then just tap the molding in place with a rubber mallet and trim it to length.

22 The key to installing T-molding is to laminate a scrap of MDF the same way as the top to use as a test piece to fit the T-molding perfectly. Place the scrap laminate-side down on the router table to make test cuts with a 3-wing slot cutting bit. Adjust the bit height until the T-molding sits perfectly flush with the laminate.

Mobile Spray Station



Cutlist

No.	Items	Dimensions (inches)		
		T	W	L
2	A Sides	3/4	16	26
2	B Shelves	3/4	16	19 1/4
2	C Cleats	3/4	4	18 1/2
1	D Back panel	3/4	12 3/8	19 1/4
1	E Top panel	1	20	24
1	F Hose reel board	3/4	9 1/2	12
DRAWERS				
2	G Upper drawer (F/B)	3/4	2 3/4	17 1/2
2	H Upper drawer (Sides)	3/4	2 3/4	15
1	I Upper drawer false front	3/4	4 1/4	19 1/2
2	J Lower drawer (F/B)	3/4	5 3/4	17 1/2
2	K Lower drawer (Sides)	3/4	5 3/4	15
1	L Lower drawer false front	3/4	7 3/8	19 1/2
2	M Drawer bottoms	1/4	14	16 1/2
DOORS				
4	N Door stiles	3/4	1 3/4	13 3/4
2	O Door upper rails	3/4	1 3/4	7 1/4
2	P Door lower rails	3/4	2 1/4	7 1/4
2	Q Flip-up door stiles	3/4	1 3/4	13 3/4
1	R Flip-up door upper rail	3/4	1 3/4	17
1	S Flip-up door lower rail	3/4	2 1/4	17

Components **A-D**, and **F** are plywood. Top panel (**E**) is MDF. Upper and lower drawer fronts and backs (**G/J**) are walnut. All others are maple.

Material List:

- 1/4" thick **acrylic sheet**, 18" W x 24" L
- Matt black **plastic laminate**, with adhesive (*Formica* or *Wilsonart*)
- 1" **T-molding**, 8' length
- **Square drive screws**, 1 1/4" long to secure to the top
- 5-Knuckle 270° **hinges**, 3 pairs
- 3 **Magnetic** push-to-open **door catches**
- 1 Standard mechanical **cabinet door catch**
- Four 3" **Caster wheels** with total lock, #14 x 3/4" **pan head screws**
- Three 3/4" **threaded pipe/pipe flanges**, #12 x 3/4" **wood screws**

23-25 Shown here are the many features this mobile cart has to offer:

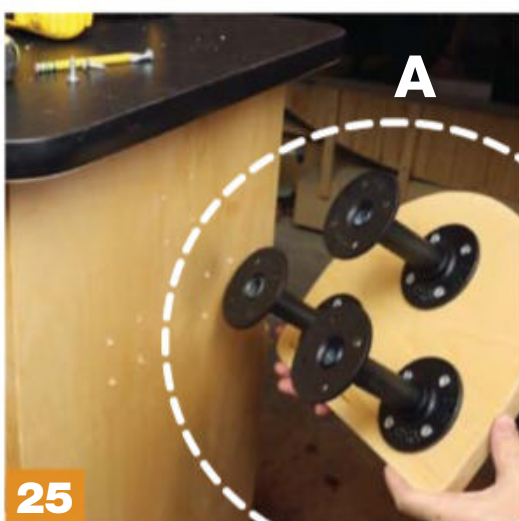
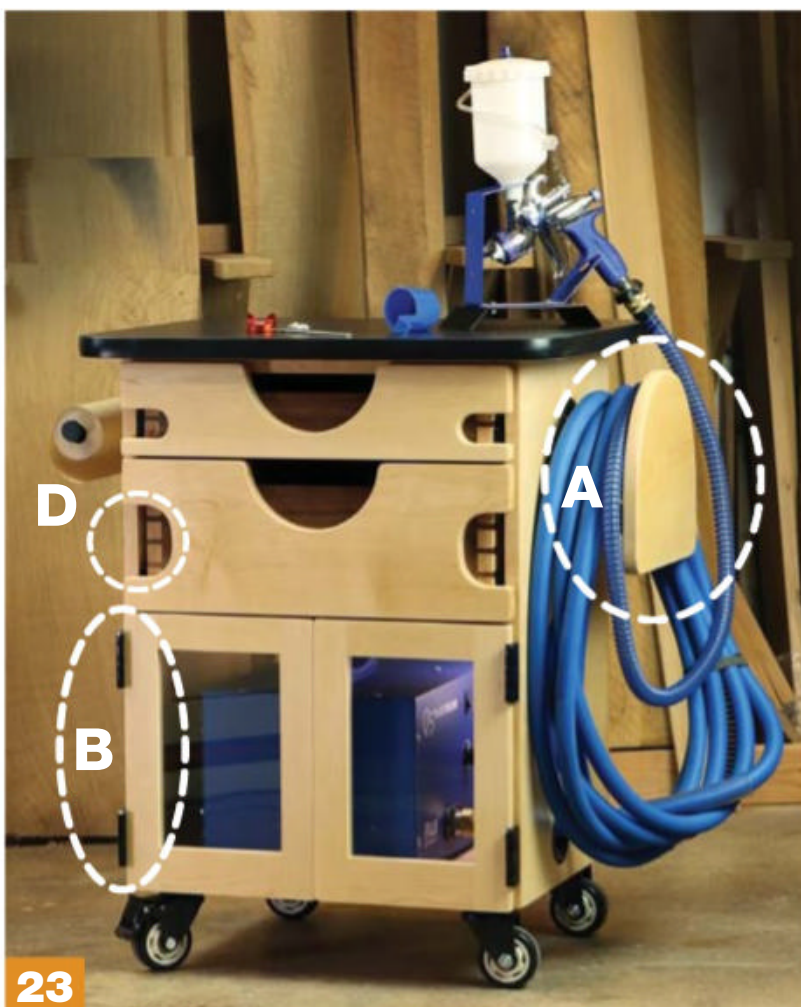
A. A piece of maple hardwood, short lengths of black pipe, and threaded flanges create a great hose keeper.

B. 5-Knuckle 270° hinges give good access to the turbine in the lower cart compartment.

C. The flip-up door with a routed finger-pull is secured in the open position with a standard cabinet latch.

D. Full extension drawer slides maximize the storage space of this small spray cart.

E-F. A masking paper holder and hooks to wind the turbine power cord around add functionality.



Finishing Touches

Just some final hardware details stand between you and purpose-made turbine spray cart. Install the drawers on full extension ball bearing slides. Add the false drawer fronts with double-sided carpet tape initially, then permanently secure with screws from inside the drawer. Hang the doors on “5-knuckle,” 270° hinges for unrestricted access to the lower cabinet. A standard

cabinet catch works well to secure the rear flip-up door in the open position. You’ll also want something to manage the air hose on one side of the cart. I came up with a simple solution using 3/4" black pipe, a couple of flange fittings and a plywood face piece (detail A). Other optional accessories include a masking paper roll holder and hooks to wind the power cord around.

PW – Willie Sandry

■ In the Shop

Hide Glue

By Logan Wittmer

This traditional glue takes a little bit of preparation and planning, but is still a valuable asset in today's shop.



“Ought a turn you to glue.”

It was a saying that I heard my great-grandfather tell his mules as he was out working. Roy was a muleskinner — a mule trainer. That phrase was one that I never fully appreciated, or understood until much later in life.

Now, I don't think today's hide glue is necessarily made from Grandpa Roy's mules — but animal protein glue (hide glue) is still made from the left overs from processed cattle. And, while not as popular as it once was, hide glue still has a ton of benefits in the shop — so many that it's still a go-to choice for a lot of craftsmen in their daily work.

Benefits of Hide Glue

Hide glue, while one of the oldest adhesives known, still has some benefits over modern PVA (yellow

glue. First and foremost, hide glue is reversible. You can add heat and water to a hide glue joint and take it apart. On the same token, you can easily repair an old hide glue joint—simply apply more glue and it will re-wet the original glue. This also makes it extremely easy to clean up — some hot water and a tooth brush will clean up even dried squeeze-out. And, if you've ever applied a finish only to find a bright streak of glue across the surface that you didn't notice — well, hide glue doesn't do that under most finishes.

Of course, there's nothing that doesn't come with a trade-off. Modern pellet style hide glue (such as you see to the right) takes a little preparation and planning to use it. In general, you can order glue in different gram-strengths and

clarities. The higher the gram strength, the less open time but the stronger the bond. For most everything in the shop, a 192 or 251 gram strength is just fine.

The hide glue pellets need to be softened with water and heated to dissolve the glue. Many manufacturers used to make glue pots (I'm searching for an Oliver one, if anyone has a lead), or you can buy modern double-boiler ones such as you see above.





1



2

1 Glue is heated in a double boiler with a water jacket around the glue pot.

2 The dry glue is poured in the glue pot.

3 Cold water is poured over the glue granules. Cover the top of the glue, and the glue will quickly absorb the water.

4-5 As the glue is heated, it will melt. Add water to keep it at a runny consistency.



3



4



5

The double boiler ones are smaller and perfect for a home shop. To make the glue, you first fill up the double boiler with water, then fill the glue chamber with pellets. The pellets are topped with cold water and allowed to absorb it. Once the water's been absorbed, the glue will be gelatinous and you can put the pot on the heat. The target temperature for most hide glue is about 140°F. As it heats, the glue will melt down, and you may need to add additional water. The consistency you're looking for (as a rule of thumb) is a runny syrup. This also means that you need to monitor it as you're working during the day to keep it at the right consistency (as the water evaporates).

When it's warm, using hide glue is easy. Simply brush it on with a glue brush (such as the hog-hair shown), and then apply clamps. With hide glue, you can often get away without clamps by rubbing the two parts together until the glue starts to tack up — this is called a “rub joint”. At the end of the day, excess glue should be stored in a fridge until you use it again (though, you're probably fine overnight).

Hide glue might not be something that you currently use every day in your shop, but I'd wager once you start to use it, you'll start using it more and more.

PW — *Logan Wittmer*

What, Why & Hows of CNC Machines

By Danielle Lowery

What is a CNC? Why might I want one & How does it work?

Over the last decade, CNC machines have become a common topic in woodworking. Most know that they cut things out, but that's the extent of their knowledge. If you had a stronger understanding of what CNCs are, how they can be used, and the basics of their operations, I guarantee that you too will agree why this tool has become a topic of interest.

What is a CNC Machine?

CNC stands for *computer numerical control*. Simply put, it's a computerized process in which software is pre-programmed with code to tell the machine the exact movements to make. CNC machines can include routers, lathes, milling machines, 3D printers, vinyl cutters, and much more and break down

into two categories: additive and subtractive. As the name suggests, additive CNCs add material to create the design. A good example of this type is a 3D printer. For our purposes, we will be talking about subtractive machines, which remove material with cutting tools.

Why Might I Want One?

Believe it or not, CNCs can be used to create not only more accurate and complex projects, but improve traditional woodworking as well. How? Well, CNCs provide higher accuracy as the machine moves exactly as instructed. This leads to more reliability and repeatability than we can do by hand. They can easily make intricate cuts or carve advanced shapes. And, most importantly, you can re-

view or simulate how the machine will move before it cuts the digital file. This allows you to make corrections or edits before beginning the project.

As for improving traditional woodworking, think of a CNC like an almost unlimited jig. This jig can be used for different needs and once a task is complete, it can be repeated over and over again. Let me give you a few examples:

- Accurately cut mortises in complex parts
- Make jigs and fixtures for other tasks (for example, create a steady rest for the lathe)
- Quickly create new throat plates for the band and table saw
- Save money by batching out custom hold-down clamps, push sticks, or even guards

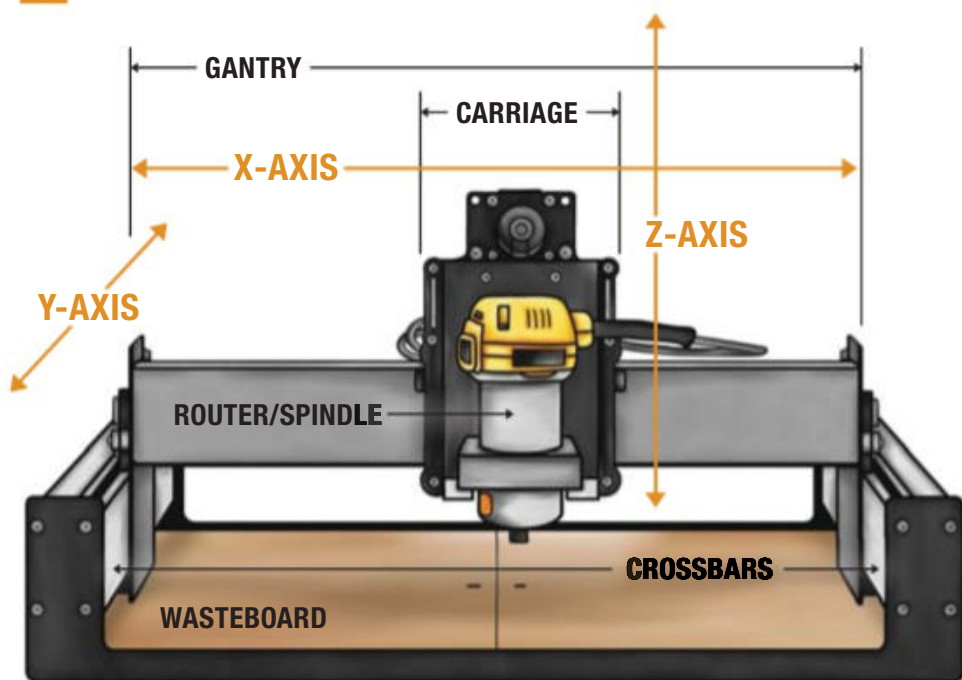
How Does a CNC Work?

CNCs work through a process called *Digital Fabrication*: a design and manufacturing workflow that results in program-generated instructions given to a computer to ingest and inform the CNC controller on how and what to do. Before we break down this process, we need to review the X, Y, and Z axes on the Cartesian Coordinate System and how it relates to the CNC machine. This will make understanding the process of digital fabrication much easier!

CARTESIAN COORDINATE SYSTEM:

The Cartesian Coordinate System defines points or coordinates on a 2D or 3D space. The coordinate is described numerically (such as 10, 10). To define coordinates on a 2D space, we need two axes: the X-axis which runs left to right and the Y-axis which runs from front to back (perpendicular to the X-axis). The third axis or the Z-axis allows us to create a 3D space as this axis runs up and down (vertically). It represents depth, which allows us to lower

■ CNC Router Parts



or raise the cutting bit when applied to a CNC machine.

HOW DOES THIS RELATE TO THE CNC?

Let's think first about how the machines creates a 2-dimensional space. As shown in the diagram on the previous page, the gantry spans from left to right. This entire gantry travels from front to back along the crossbars, allowing the bit to move in the Y-axis.

To move the bit along the X-axis, we need to look at the carriage. The carriage holds the motor (a router, spindle, or laser) and travels left to right along the gantry. This moves the cutting bit along the X-axis. The Z-axis, or depth, is also controlled via the carriage. On most CNC machines, a lead screw will raise or lower the cutter motor in relation to the rest of the carriage and gantry.

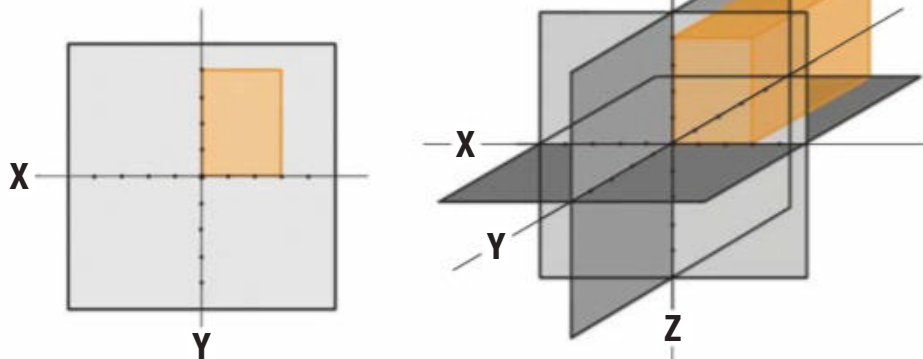
Now, let's talk about how all of this relates to the Cartesian Coordinate System. In the CCS, the starting point is 0,0,0—where the X, Y, and Z axis all converge. Often, you can have a point in one of the negative planes, however, for CNCs, we only work in the positive space. Therefore, the home point (0,0) on most CNC machines will be at the lower left position. You can see this as the orange area in the illustration above.

The Z-axis is a little different however. The Z-axis home (or zero point) is set based on your project's workpiece. Most of the time, you'll lower the Z-axis until the bit touches your workpiece and set that as "0." In the instance of cut depth, we do work in the negative space. For example, to make a 1/8" cut, the Z-axis point will be set as -0.125".

DIGITAL FABRICATION

Let's jump back into the workflow of the CNC. There are 4 main steps to take an idea and turn it into a CNC program:

2D vs. 3D Grid



1. **Create Design** (using CAD)
2. **Generate Toolpaths** (using CAM)
3. **Translate to G-Code**
4. **Send to Post-Processor** to run on each specific CNC

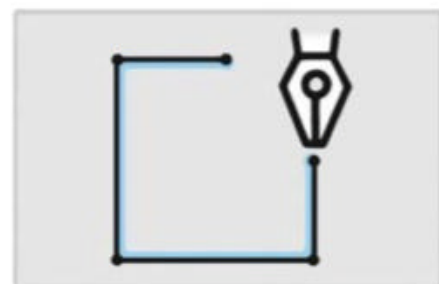
I'll go into a little more detail about each step, but first let's sum it up. You begin by designing a project in 2D and then transition it into a 3-dimensional space. Those details are then converted to a language that the computer can share with the CNC. Lastly, a post-processor reviews that information and reformats it to the specific machine you are using and sends it to the machine.

1. Create Design

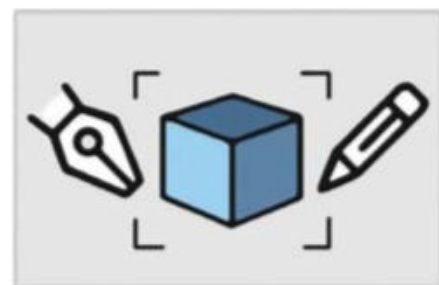
Most commonly, this is done in a program that runs using CAD, *Computer-Aided Design*. Programs include *V-Carve*, *Easel Software*, *Carbide Create*, *AutoDesk*, and more. (More on these programs in a future article.) The goal is to create a design made up of a series of points (X, Y) that form a drawing. That drawing is then exported to a CAM (*computer aided manufacturing*) file such as .dwg, .dxf, .svg, .eps, or .ai. These are all vector-based files. At this point, the 2D drawing can guide the bit in X, Y directions to trace a shape.

2. Generate Toolpaths

The CAM file is now uploaded into a CAM-based program. For



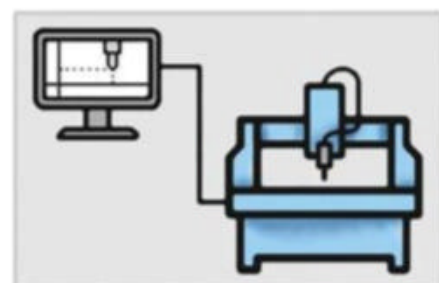
1. CREATE DESIGN



2. GENERATE TOOLPATHS



3. TRANSLATE TO G-CODE

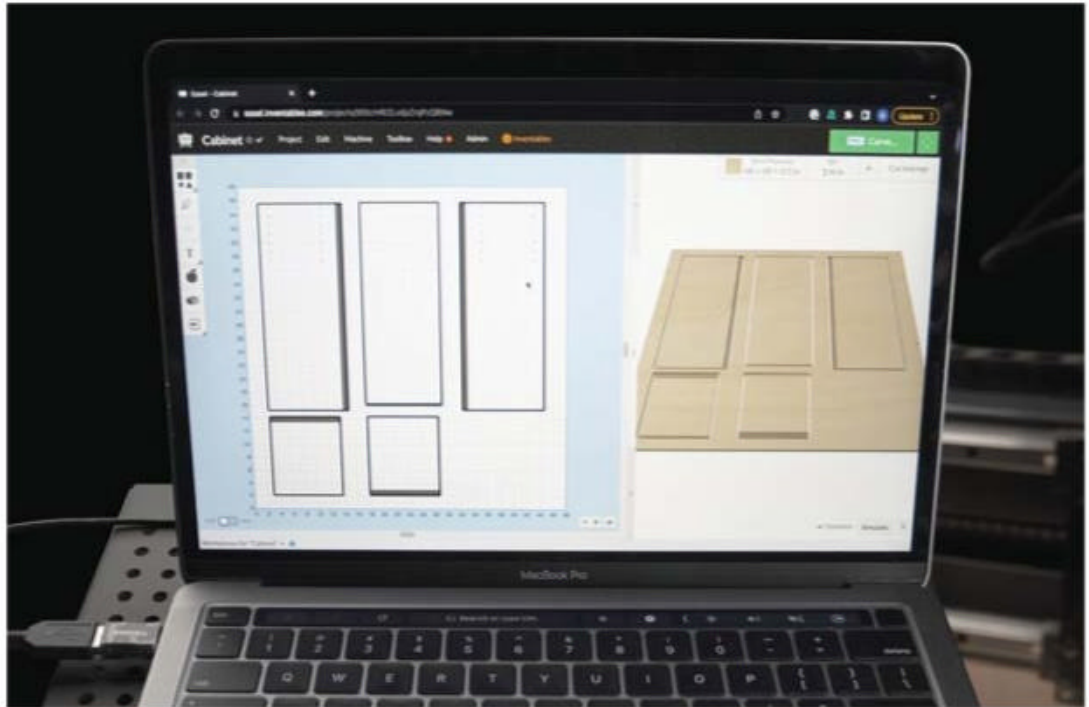


4. SEND TO POST-PROCESSOR

most programs, including those stated above, the CAD and CAM programs are the same program. So, once you complete the drawing you can jump right into generating toolpaths without switching software. Toolpaths are instructions given to each line (or series of lines) such as the type of cut, the tool needed, and depth of cut. Type of cuts can include simple cuts, pockets, holes, engraving, and carving. As the toolpaths are generated, a 2-dimensional drawing is transformed into a 3-dimensional shape.

3. Translate to G-Code

In order to make these precise cuts, the toolpaths created in step 2 has to be translated into a computer language called G-Code. The G-code is sent to the controller which runs the CNC machine. This language (G-code) contains hundreds of lines of code that specifies the necessary movement of the router or spindle from point to point. Each line of code begins with a G followed by a number to instruct a change in geometry.



Above is an example of *Inventables Easel Program*. The left side is the 2D of cabinet pieces while the right side is the 3D design.

Today, we have programs available to create this G-Code for us. However, not that long ago, programming the G-code was completely manual and time consuming. It's still useful to know at least a little bit about how it works though.

There is two parts in each line of G-code. The first part tells the

machine how to move and the second tells it where to move, how fast, etc. Check out two examples to the left.

4. Send to Post-Processor to Run on the CNC

This last step simply uses a post-processor, which is specific to each CNC manufacturer, to adjust the G-code. The post-processor simply alters the code just a little bit so that it can be read by the controller, which is the brain of the CNC.

Now that you know what a CNC is and the basics of how they work, I hope that you may see why many people have chosen to add one to their shops, and hopefully it's a little less mystifying and scary. To be honest, they're not as complex as people think they are, and I think that adding one to your shop is something that a lot of people should consider. Be on the lookout for our next article in this series where we will discuss a few of the CNCs available on the market, and what accessories that are handy to keep on hand in your shop for use with your CNC.

PW – Danielle Lowery

■ G-Code Examples

G00. X0. Y10.

G00.

Rapid movement to a specific coordinate

X0.

Move to 0" on X-axis

Y10.

Move to 10" on Y-axis

More on understanding feed rate and other CNC math in a future article.

G01. X23.25 Y11.75 Z1. F4.

G01.

Linear feed movement (move in a straight line to a specific position)

X23.25

Move to 23¼" on X-axis

X11.75

Move to 11¾" on Y-axis

Z1.

Cut at a depth of 1"

F4.

Move at a feed rate of 400mm per minute



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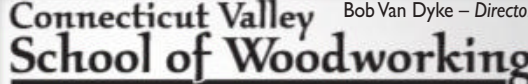
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FIVE

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Woodworking Education

ESSA

By Logan Wittmer

Situated in a picturesque Ozark town, the *Eureka Springs School of the Arts* has something for everybody.



ESSA

EUREKA SPRINGS SCHOOL of the ARTS

About an hour south of Branson, Missouri is the small town of Eureka Springs, Arkansas. It's home to about 2,100 people and it has a rich history. Walking down the historic main street, you'll be surrounded by a dozen amazing coffee shops, boutique stores, local crafts, and the occasional trolley that passes by. When I first traveled there to shoot photos with Doug Stowe (Coopered Table, page 38), I instantly fell in love with the small Ozark town. As quaint and beautiful as Eureka Springs is, it's also a popular destination for

motorcyclists, downhill mountain bikers, and fly fishermen (seriously, you should see the streams here). But, in my opinion, the real hidden gem here is ESSA — the *Eureka Springs School of the Arts*.

The Campus

The Eureka Springs School of the Arts is a 55 acre campus, catering to both locals and students traveling in from across the United States. Founded in 1998, ESSA received its 501(c) status as a non-profit in 2001. Built upon grants from the Arkansas Art

Council, the classes hosted at ESSA have grown from a couple of weeks a year to now offering year-round classes, ranging from one day-courses to five-day workshops.

The school itself is tucked in the hills on the western side of Eureka Springs, the entrance to ESSA is marked by a sign (above) in front of what appears to be a small house. Upon further inspection, there are a group of three houses—these house ESSA's administration, the 2D studio (for painting, drawing, etc.), and a small metals studio for jewelry making, enam-

PHOTOS BY LOGAN WITTMER



1 ESSA building 4 is the home of the woodworking, turning, and metal studios.

2 The architect designed building brings in natural light and seems at home in the surrounding mountains.

3 A series of studio apartments offer housing to guest instructors traveling in from across the world.

eling, and the sort. If you turn down the drive and continue past the houses, you'll be entering the remainder of the campus. Back behind the unassuming facade, amongst the white oaks and loblolly pines is building 4—and that's where the woodworking magic happens.

Building 4

Building 4 is a newer addition to ESSA, and it houses the woodworking, wood turning, and heavy metal studios. ESSA worked with architect David Mckee to design building 4, and the care and consideration shows. The butterfly-wing-roof above a portion of the blacksmith studio allows rain water to be collected and directed into irrigation for the landscaping. I even believe some of it is stored for use inside the blacksmith studio. The design also allows the front of the blacksmith studio to be opened up to allow cool air to



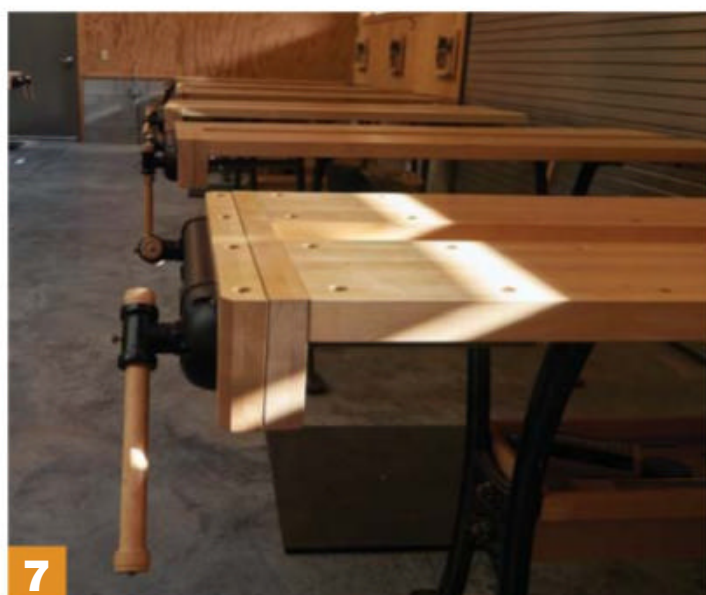
circulate around the hot forges.

Within the woodworking studio, the tall ceilings allow windows to be set high-up on the walls, flooding the interior space with natural light. The carefully thought out cedar and pine beams, trusses, and wall coverings blend beautifully with the steel and cinder block exterior, and the building itself emits an air of good vibes and quality craftsmanship.

If you continue down past building 4, you'll come across a small row of cottage-like buildings. These are the recently (as of this publication date) completed campus cottages that will house instructors as they travel into town to teach at ESSA. The final building is currently under renovation, and will be used as a com-

munal meeting space for people attending residencies at ESSA.

Of course, this is a woodworking publication—so, let's talk a bit about the woodworking studio at ESSA. The woodworking space is broken up into two areas—a machine room that is approximately 1,600 sq. ft. and a bench room adjacent to the machine room, which is around 1,000 square feet. Not only does ESSA have the space, but they also have the equipment to fill it. The machine room is equipped with two *SawStop* table saws, a pair each of *Grizzly* jointers and planers, several miter saws, drill presses, band saws, and sanders (including thickness and edge/belt sanders). The bench room is loaded with *Veritas* workbenches, and each station has a set of layout tools and chisels.



4 The turning studio houses nine Robust Scout lathes, as well as a large Oneway for the instructor.

5 The wood shop is fully equipped with everything from table saws to thickness sanders.

6 Stepping across the hall, you'll find a metal studio full of anvils, forges, and welding equipment.

7 Finally, the bench room has nine benches ready for students to work on.

Walking into the lathe room for the first time made my turning heart flutter. The turning studio is loaded with *Robust* lathes — which, if you're familiar with lathes, are considered one of the best. Each

turning station is equipped with scroll chucks, drive spurs, live centers, along with a complete set of tools.

Down the hall in building 4 is a blacksmith studio. The heavy metals shop as they call it, is host to a line of anvils, forges, and welders. Here, metal artists, blade smiths, blacksmiths, and others teach their craft to incoming students.

Unfortunately, ESSA was shut down pretty much entirely during the pandemic (as was most of the world). Now, as of early 2023, the schedule for spring and summer classes have been announced. The prices for each class varies, based on the subject, length and materi-

als necessary, but all of the prices appear to be very reasonable for what you're getting.

Now, here is my plea to you. If you've ever been interested in taking a class in woodworking (or any other of the offerings from one of these schools), there's no time like now. Craft schools like ESSA, are opening back up after the pandemic and looking to fill their classrooms. Bring your family. Make a vacation out of it. The worst case scenario is that you'll have a relaxing weekend in a picturesque little town. Heck, you might even learn something. You can view ESSA's class offering at www.essa-art.org.

PW — Logan Wittmer

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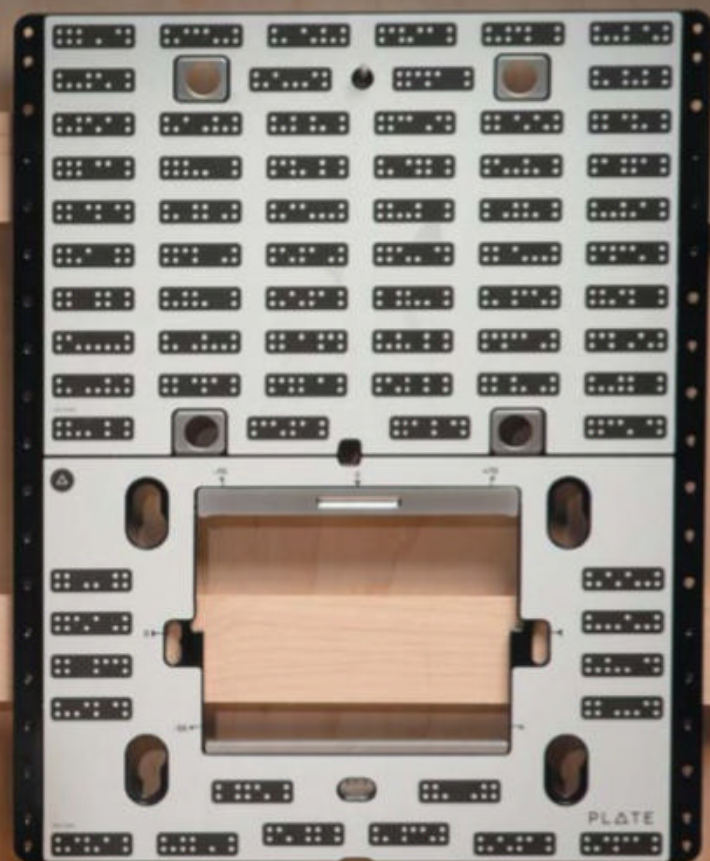
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