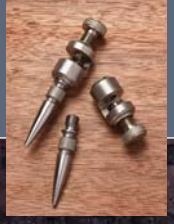
Make a 3D Marquetry Panel

Veritas Trammel Points



# POPULAR WOODWORKING MAGAZINE

October 2015 ■ #220

# Slat-Back Chair

## Craft Comfortable Curves with 2 Techniques for Bent Laminations

Drawer Slips 3 Ways

Mid-Century Modern Cherry Bookcase

Turn Shop Scraps Into A Simple, Solid Vise

popularwoodworking.com

US $6.99

10

0 74808 01355 5

Display until October 12, 2015

# Grizzly Industrial®

PURVEYORS OF FINE MACHINERY®, SINCE 1983!

## 10" CONTRACTOR-STYLE TABLE SAW
### with RIVING KNIFE

- Motor: 1½ HP, 110V/220V, single-phase, prewired to 110V, 11.5A/5.7A
- Precision-ground cast iron table with wings: 25¼" x 40"
- Arbor: ⅝"
- Arbor speed: 4000 RPM
- Capacity: 3⅛" @ 90°, 2¼" @ 45°
- Rip capacity: 30" R, 12" L
- Approx. shipping weight: 208 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G0732** ~~$795.00~~ SALE **$650.00**

$99 shipping lower 48 states

## 10" HYBRID TABLE SAW
### with RIVING KNIFE

- Motor: 2 HP, 110V/220V, single-phase, prewired to 220V, 16A/8A
- Precision-ground cast iron table with wing: 27" x 40"
- Arbor: ⅝"
- Arbor speed: 3850 RPM
- Capacity: 3⅛" @ 90°, 2³⁄₁₆" @ 45°
- Rip capacity: 30" R, 12" L
- Approx. shipping weight: 416 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G0715P** ONLY **$825.00**

$99 shipping lower 48 states

## 10" 3 HP CABINET LEFT-TILTING TABLE SAW

- Motor: 3 HP, 240V, single-phase, 14A, 3450 RPM
- Precision table with cast iron table size (with 2 solid extension wings attached): 40" W x 27" D
- Capacity: 3" @ 90°, 2⅛" @ 45°
- Rip capacity: 26" R, 8" L
- Base dimension: 20½" x 20½"
- Approximate shipping weight: 508 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G1023RL** ONLY **$1325.00**

$99 shipping lower 48 states

## 10" CABINET TABLE SAW with RIVING KNIFE

- Motor: 3 HP, 220V, single-phase, 12.8A
- Precision-ground cast iron table with extension: 27" x 40"
- Table height: 34"
- Arbor: ⅝"
- Arbor speed: 4300 RPM
- Max. dado width: ¹³⁄₁₆"
- Capacity @ 90°: 3⅛", @ 45°: 2³⁄₁₆"
- Rip capacity: 29½" R, 12" L
- Approx. shipping weight: 530 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G0690** ONLY **$1495.00**

$150 shipping lower 48 states

## 10" LEFT-TILTING TABLE SAW
### with RIVING KNIFE, 7' RAILS & EXTENSION TABLE

- Motor: 3 HP, 240V, single-phase, 3450 RPM, 14A
- Cutting capacity: 8" L, 53" R of blade
- Max. depth of cut @ 90°: 3"
- Max. depth of cut @ 45°: 2⅛"
- Extension table: 44" W x 27" D
- Base dimension: 20½" x 20½"
- Approximate shipping weight: 550 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G1023RLX** ONLY **$1575.00**

$150 shipping lower 48 states

## 10" CABINET TABLE SAW
### with RIVING KNIFE & EXTENSION RAILS

- Motor: 3 HP, 220V, single-phase, 12.8A
- Blade tilt: Left, 45° • Arbor speed: 4300 RPM
- Arbor size: ⅝" • Max. dado width: ¹³⁄₁₆"
- Max. depth of cut: 3⅛" @ 90°, 2³⁄₁₆"@ 45°
- Max. rip capacity: 50"
- Dist. from front of table to blade at maximum cut: 12¼"
- Dist. from front of table to center of blade: 17¼"
- Approx. shipping weight: 557 lbs.

FREE 10" CARBIDE-TIPPED BLADE

**G0691** ONLY **$1595.00**

$150 shipping lower 48 states

## 8" JOINTERS

- Motor: 3 HP, 240V, single-phase, TEFC, 3450 RPM, 15A
- Precision-ground cast iron table size: 9" x 72½"
- Cutterhead speed: 4800 RPM
- Cutterhead diameter: 3"
- Max. depth of cut: ⅛"
- Max. rabbeting depth: ½"
- Cuts per minute: 20,000 (G0656P), 21,400 (G0656PX)
- Approximate shipping weight: 500 lbs.

FREE PAIR OF SAFETY PUSH BLOCKS!

**4 KNIFE CUTTERHEAD**
**G0656P** ONLY **$825.00**

**SPIRAL CUTTERHEAD**
**G0656PX** ONLY **$1250.00**

$150 shipping lower 48 states

## 12" JOINTER/PLANER
### with SPIRAL CUTTERHEAD

- Motor: 5 HP, 220V, single-phase, 25A
- Jointer table size: 14" x 59½"
- Cutterhead dia.: 3⅛"
- Cutterhead speed: 5034 RPM
- Max. jointer depth of cut: ⅛"
- Max. width of cut: 12"
- Planer feed rate: 22 FPM
- Max. planer depth of cut: ⅛"
- Max. planer cutting height: 8"
- Planer table size: 12¼" x 23⅜"
- Approx. shipping weight: 704 lbs.

NEW END-MOUNTED FENCE

**G0634XP** ONLY **$2395.00**

$150 shipping lower 48 states

PRICING CODE 15POP
MENTION THIS CODE WHEN PLACING YOUR ORDER

17421

# 1-800-523-4777

3 GREAT SHOWROOMS!
BELLINGHAM, WA • MUNCY, PA • SPRINGFIELD, MO

TECHNICAL SERVICE:
570-546-9663
FAX: 800-438-5901

- OVER A MILLION SQUARE FEET PACKED TO THE RAFTERS WITH MACHINERY & TOOLS
- 2 OVERSEAS QUALITY CONTROL OFFICES STAFFED WITH QUALIFIED GRIZZLY ENGINEERS
- HUGE PARTS FACILITY WITH OVER 1 MILLION PARTS IN STOCK AT ALL TIMES
- TRAINED SERVICE TECHNICIANS AT ALL 3 LOCATIONS • MOST ORDERS SHIP THE SAME DAY

**FREE 2015 CATALOG**
784 PAGES OF HIGH QUALITY MACHINES & TOOLS AT INCREDIBLE PRICES

## 15" PLANERS

- Motor: 3 HP, 240V, single-phase, 15A
- Precision-ground cast iron table size: 15" x 20"
- Min. stock thickness: 3/16"
- Min. stock length: 8"
- Max. cutting depth: 1/8"
- Feed rate: 16 & 30 FPM
- Cutterhead dia.: 3", speed: 4800 RPM
- Approx. shipping weight: 675 lbs.

PRECISION-GROUND CAST IRON BED AND INFEED & OUTFEED TABLES

3 KNIFE CUTTERHEAD
**G0453P ONLY $1150.00**

SPIRAL CUTTERHEAD
**G0453PX ONLY $1795.00**

$150 shipping

## 20" PLANERS

- Motor: 5 HP, 240V, single-phase, 19A
- Precision-ground cast iron table size: 20" x 25¾" (20" x 55½" with extension)
- Max. cutting width: 20"
- Min. stock length: 8"
- Max. cutting depth: 1/8"
- Feed rate: 16 & 20 FPM
- Cutterhead dia.: 3⅛", speed: 4800 RPM
- Approx. shipping weight: 932 lbs.

4 KNIFE CUTTERHEAD
**G0454 ONLY $1750.00**

SPIRAL CUTTERHEAD
**G0454Z ONLY $2575.00**

Z SERIES

$179 shipping

## 3 HP SHAPER

- Motor: 3 HP, 240V, single-phase, with reversing switch, 12A
- Precision-ground cast iron table with standard wing attached: 30½" x 28¼"
- Floor-to-table height: 34"
- Spindle travel: 3"
- 3 Interchangeable spindles: ½", ¾", and 1"
- Spindle openings on table: 1¼", 3", 4", and 7"
- Spindle speeds: 7000 and 10,000 RPM
- Approximate shipping weight: 392 lbs.

Free! shipping lower 48 states

**G1026 ~~$1195.00~~ SALE $1150.00**

## 12 SPEED HEAVY-DUTY 14" FLOOR DRILL PRESS

- Motor: ¾ HP, 110V, single-phase • Swing: 14"
- Drill chuck: 1/64"–5/8"
- Drilling capacity: ¾" steel
- Spindle taper: MT#2 • Spindle travel: 3¼"
- Speeds: 140, 260, 320, 380, 480, 540, 980, 1160, 1510, 1650, 2180, 3050 RPM • Collar size: 2.595"
- Precision-ground cast iron table size: 11⅜" square
- Table swing: 360°
- Table tilts: 90° left & right
- Overall height: 64"
- Approx. shipping weight: 171 lbs.

INCLUDES BUILT-IN LIGHT (BULB NOT INCLUDED)

**G7944 ONLY $395.00**

$79 shipping

## 2 HP DUST COLLECTOR with 2.5 MICRON BAG

- Motor: 2 HP, 240V, single-phase, 3450 RPM, 9A
- 6" inlet w/ removable "Y" fitting with two 4" openings
- Impeller: 12¾" aluminum
- Portable base size: 21¼" x 33½"
- Bag volume: 5.7 cubic feet
- Height (with bags inflated): 78"
- Bag size: 19½" x 33" (2)
- Air suction cap.: 1550 CFM
- Maximum static pressure: 11"
- Standard bag filtration: 2.5 Micron
- Approx. shipping weight: 122 lbs.

FREE! 2-STAGE CYLONE SEPARATOR W1049—A $34.25 VALUE

**G1029Z2P ONLY $345.00**

MADE IN AN ISO FACTORY

$79 shipping

## 1½ HP CYCLONE DUST COLLECTOR

- Motor: 1½ HP, 110V/220V, single-phase, TEFC, 3450 RPM
- Air suction capacity: 775 CFM
- Static pressure at rated CFM: 1.80"
- Intake port: 6" with included 5" optional port
- Impeller: 13½"
- Height: 68"
- Built-in remote control switch
- Approx. shipping weight: 210 lbs.

FULLY MOBILE WITH BUILT-IN CASTERS


**G0703P ONLY $850.00**

$79 shipping

## ULTIMATE 14" BANDSAW

- Motor: 1 HP, 110V/220V, single-phase, TEFC, 11A/5.5A
- Precision-ground cast iron table size: 14" sq.
- Table tilt: 45° R, 15° L
- Cutting capacity/throat: 13½"
- Max. cutting height: 6"
- Blade size: 92½"–93½" L (⅛"–¾" W)
- Blade speeds: 1500 & 3200 FPM
- Approx. shipping weight: 196 lbs.

**G0555P ONLY $545.00**

Free! shipping lower 48 states

## 30TH ANNIVERSARY 17" HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, single-phase, TEFC, prewired 220V, 1725 RPM
- Amps: 20A at 110V, 10A at 220V
- Precision-ground cast iron table size: 17" x 17" x 1½" thick
- Table tilt: 10° left, 45° right
- Floor-to-table height: 37½"
- Cutting capacity/throat: 16¼" left
- Blade size: 131½" long
- Approx. shipping weight: 342 lbs.

MADE IN AN ISO FACTORY

**G0513ANV ONLY $875.00**

Free! shipping lower 48 states

## 17" HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, prewired to 220V, single-phase, TEFC
- Precision-ground cast iron table size: 17" sq.
- Table tilt: 45° R, 10° L
- Cutting capacity/throat: 16¼"
- Max. cutting height: 12⅛"
- Blade size: 131½" L (⅛"–1" W)
- Blade speeds: 1700 & 3500 FPM
- Quick-release blade tension lever
- Approx. shipping weight: 346 lbs.

MADE IN AN ISO FACTORY

**G0513P ONLY $895.00**

$99 shipping

FOLLOW US:

VIEW VIDEOS AT grizzly.com

FREE BROKERAGE RATES ON MACHINERY ORDERS TO CANADA!

grizzly.com®

OVER 15,000 PRODUCTS ONLINE!

PayPal VISA MasterCard BillMeLater AMERICAN EXPRESS DISCOVER NOVUS

CARD #57 or go to PWFREEINFO.COM

PROFESSIONAL HVLP

Earlex®
SPRAYPORT
The professional spraying series

# Introducing the SprayPort® 6000 Series for a Flawless Finish

- Compact and robust 2 or 3-stage turbine
- Pro-8™ non-bleed gun in gravity or pressure-fed options for superior atomization
- 25' Lightweight and flexible HyperFlex™ hose


6000 series

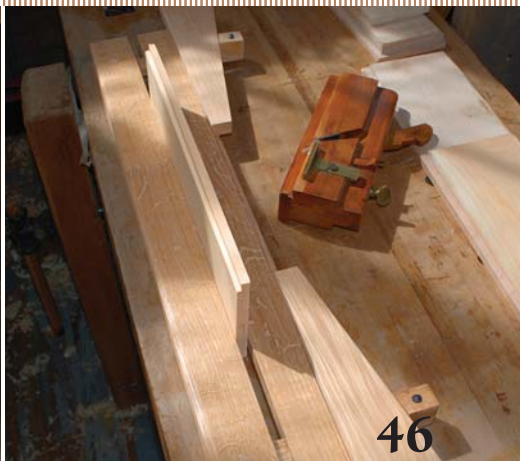
www.earlex.com

CARD #9 or go to PWFREEINFO.COM

# CONTENTS





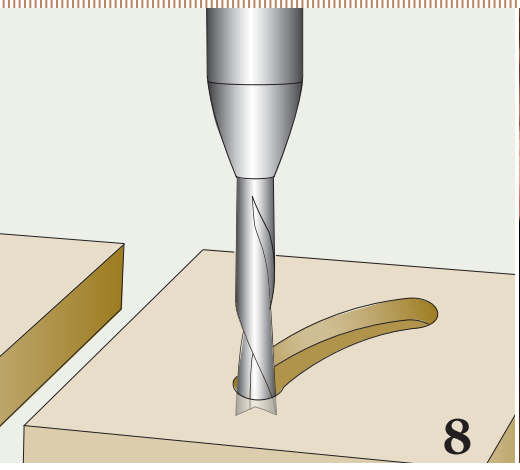

## FEATURES



COVER PHOTO BY RIC DELIANTONI; DRAWER SLIPS PHOTO BY GEREMY COY;
CHEST LID PHOTO BY AL PARRISH; "RAAMTANG" PHOTO BY ZACHARY DILLINGER; BOOKCASE PHOTO BY MICHAEL CROW

# CONTENTS

OCTOBER 2015






## REGULARS





POPULAR WOODWORKING MAGAZINE

Number 220, October 2015. *Popular Woodworking Magazine* (ISSN 0884-8823,USPS 752-250) is published 7 times a year, February, April, June, August, October, November and December, which may include an occasional special, combined or expanded issue that may count as two issues, by F+W Media. Editorial and advertising offices are located at 8469 Blue Ash Road, Suite #100, Cincinnati, OH 45236. Unsolicited manuscripts, photographs and artwork should include ample postage on a self-addressed, stamped envelope (SASE); otherwise they will not be returned. Subscription rates: A year's subscription (7 issues) is $24.95; outside of the U.S. add $7/year ▪ Canada Publications Mail Agreement No. 40025316. Canadian return address: 2835 Kew Drive, Windsor, ON N8T 3B7 ▪



Periodicals postage paid at Cincinnati, Ohio, and additional mailing offices. Postmaster: Send all address changes to *Popular Woodworking Magazine*, P.O. Box 420235, Palm Coast, FL 32142-0235 Canada GST Reg. #R132594716 ▪ Produced and printed in the U.S.A.




ILLUSTRATION BY MARY JANE FAVORITE; DOVETAIL PHOTO COURTESY OF ARTISAN MEDIA; TOOL BOX PHOTO BY JOE DIPIETRO; TAPERED CABINET PHOTO BY DAN MOSHEIM

# SHOP FOX® INNOVATIVE PRODUCTS SINCE 1989!

2 YEAR WARRANTY

SHOP FOX® machines are backed by a 2 Year Warranty!

## TRACK SAW

- Motor: 120V, 9A, 1100 watt, 5500 RPM
- Blade diameter: 160mm (6¼")
- Cutting capacity:
  With track: 1³¹⁄₃₂" @ 90°, 1⁷⁄₁₆" @ 45°
  Without track: 2⁵⁄₃₂" @ 90°, 1⅝" @ 45°

**W1832** Track Saw Master Pack (Includes: Saw, Guide Rail, and Accessory Pack

4000311

**W1835** Track Saw only

**D4363** Accessory Pack **D4362** Guide Rails

## 14" BANDSAW

- Motor: 1 HP, 110V/220V
- Precision-ground cast iron table size: 14" x 14" x1½"
- Blade size: 93½" (⅛" to ¾" wide)
- Cutting capacity 13½" (throat)
- Cast iron frame and wheels
- Ball bearing blade guides
- Includes fence and miter gauge

*Feature packed, and an incredible value*

177335

**W1706** 14" Bandsaw

## PLANER MOULDER with Stand

- Motor: 2 HP, 240V, single-phase, 10.8A, 3450 RPM
- Precision-ground cast iron table size: 14⅛" x 10" x 7⁄₁₆"
- Max planing width: 7"
- Max planing height: 7½"
- Cuts per minute: 14,000
- 2 HSS knives

177335

**W1812** Planer Moulder with Stand

## 10" TABLE SAWS with Riving Knife

- Motor: 3 HP, 220V, single-phase motor
- Precision-ground cast iron table size: 27" x 40¼"; (W1819) 53⅝" with extension; (W1820) 74" with extension
- Max. rip capacity: (W1819) 29½", (W1820) 50"
- Camlock fence with HDPE face

*Free 10" Carbide-Tipped Blade*

232857

W1819 SHOWN

**W1819** 10" Table Saw

**W1820** 10" Table Saw with Long Ext. Table

## ¾ HP 13" BENCH-TOP DRILL PRESS

- Motor: ¾ HP, 110V, 1725 RPM
- Overall height: 38"
- Spindle travel: 3¼"
- Swing: 13¼"
- Drill chuck: ⅝"
- Speeds: 12, 250–3050 RPM
- Table: Round 12⅜" dia.
- Table swing: 360°
- Table tilt: 45° L & 45° R

PATENT OWNED BY WOODSTOCK INTERNATIONAL INC.

**W1668** ¾ HP 13" Bench-Top Drill Press

## 6" x 12" HEAVY-DUTY COMBINATION SANDER

- Motor: 1½ HP, 120V, single-phase, 10.5A, 1725 RPM
- Precision-ground cast iron tables (2)
- Sanding belt size: 6" x 48"
- Belt Speed: 1066 FPM
- Disc size: 12"
- Disc speed: 1725 RPM

255023

*Made in an ISO 9001 factory*

**W1712** 6" x 12" HD Combination Sander

## OSCILLATING SPINDLE SANDER

226766

- Motor: ½ HP, 120V, 3.5A
- 58 oscillations per minute
- Stroke length: ⅝"
- Sanding drum length: 4½"
- 2000 RPM (½" spindle)
- Table size: 15" L x 11½" W
- Dust port size: 1½"
- Switch: Paddle ON/OFF with disabling key
- CSA certified meeting CSA C22.2 #71.2–10 and UL 987–7 standards

*VERY POPULAR!*

**W1831** Oscillating Spindle Sander

## WALL DUST COLLECTOR

- Motor: 1 HP, 110V/220V, single-phase
- Air suction capacity: 537 CFM
- Bag capacity: 2 cubic feet
- Standard bag filtration: 2.5 micron
- Static pressure: 7.2"

247569

**W1826** Wall Dust Collector

## 3-SPEED HANGING AIR FILTER

- Motor: ⅛ HP, 120V, 60Hz, 1A, single-phase
- Air flow: 260, 362, and 409 CFM
- Outer filter: 5.0 micron
- Inner filter: 1.0 micron

4005867

INCLUDES TIMER AND REMOTE!

**W1830** Hanging Air Filter

WOODSTOCK® INTERNATIONAL, INC. IS ALSO HOME TO ROMAN CARBIDE®, PLANER PAL®, JOINTER PAL®, AND MANY OTHER FINE BRANDS.
PLEASE VISIT OUR WEBSITE OR CALL TOLL FREE TO FIND AN AUTHORIZED DEALER NEAR YOU.

**SHOPFOX.BIZ**

sales@shopfox.biz WHOLESALE ONLY

WOODSTOCK INTERNATIONAL INC.

**1-800-840-8420**



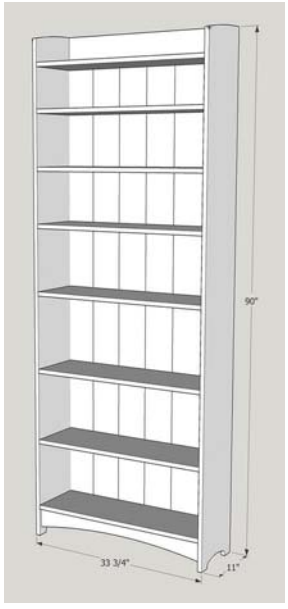
16953

CARD #114 or go to PWFREEINFO.COM

# The Problem with Being a Woodworker

In the last issue, I wrote about being "homeless." But just days after that issue went to press, I bought a house.

It's a 1906 three-story brick foursquare that retains many of the original architectural features – and it has an awesome (and dry) basement for a workshop (7'-high ceilings!). But there's been a lot of unfortunate remuddling over the years – much of it due to dividing the building into a two-family dwelling.




I face years of work (and a goodly cash outlay) to bring it back to at least some semblance of its former glory – everything from knocking out walls to rebuilding part of a staircase, from matching missing trim pieces on the front porch to fixing many of the bits still there, to re-outfitting two bathrooms and the kitchen (at least I'm fast at the kitchen cabinet builds now). And that's just some of the big stuff.

The problem is, because I own lots of tools and know how to use them, I simply can't bring myself to pay people for what I know can do myself – or for what I think I can teach myself to do.

So instead of calling in a crew of folks who can quickly remove the retrofitted walls and framing and fix the plaster, I'll be swinging a sledgehammer and wielding a hawk and trowel.

Instead of hiring a skilled craftsperson who specializes in building period staircases and can get the work done quickly, I'll be muddling through it myself on nights and weekends. I expect it will take months. But I'll get it done. Eventually.

The only similarity between plumbing remodeled baths and woodworking is that they both use tools. Close enough; I'm (perhaps foolishly)willing to give it a shot.

And the kitchen? Well, I now own working appliances; that'll have to do for the nonce.

But before I get to any of that, I have to 1) put together my shop and 2) get the rest of my boxes unpacked (because otherwise, I'll go mad). But I'm already out of shelf space.

So to get started (right after I get the shop set up enough), I'm going to tackle a few projects about which I actually feel confident – building (at least) three freestanding bookcases for the "library" (also known as a guest room) and designing and making a desk and shelves for what will become my study...just as soon as I decide in which room to locate said study.

I expect I'll be sharing some of that woodworking with you in our pages (who doesn't like bookcases?!). And in return, if anyone reading wants to share his or her expert plumbing knowledge, shoot me an e-mail. I'm likely to need your help. (I do own a pipe wrench – I find it's excellent for knocking paint can lids back in place.) **PWM**


ILLUSTRATION BY THE AUTHOR

POPULAR WOODWORKING MAGAZINE

OCTOBER 2015, VOL. 35, NO. 5
popularwoodworking.com
EDITORIAL OFFICES 513-531-2690

GROUP PUBLISHER ■ Jamie Markle
jamie.markle@fwcommunity.com, x11452

GROUP EDITORIAL DIRECTOR & EDITOR ■ Megan Fitzpatrick
megan.fitzpatrick@fwcommunity.com, x11348

SENIOR ART DIRECTOR ■ Daniel T. Pessell
daniel.pessell@fwcommunity.com, x11596

SENIOR MANAGING EDITOR ■ Michael Wallace
mike.wallace@fwcommunity.com, x11407

CONTRIBUTING EDITORS ■
Bob Flexner, Christopher Schwarz, Steve Shanesy

PHOTOGRAPHER ■ Al Parrish

PROJECT ILLUSTRATOR ■ Donna R. Hill

ONLINE CONTENT DEVELOPMENT MANAGER ■ David Thiel
david.thiel@fwcommunity.com, x11255

ONLINE CONTENT DEVELOPER ■ Jacob Motz
jacob.motz@fwcommunity.com, x11005

CONTENT EDITOR, BOOKS ■ Scott Francis
scott.francis@fwcommunity.com, x11327

F+W
CHAIRMAN & CEO ■ David Nussbaum
COO & CFO ■ James Ogle
PRESIDENT ■ Sara Domville
CHIEF DIGITAL OFFICER ■ Chad Phelps
SENIOR VICE PRESIDENT, OPERATIONS ■ Phil Graham
VICE PRESIDENT, COMMUNICATIONS ■ Stacie Berger

ADVERTISING
VICE PRESIDENT, SALES ■ Dave Davel
ADVERTISING DIRECTOR ■ Don Schroder
331 N. Arch St., Allentown, PA 18104
TEL. 610-821-4425; FAX. 610-821-7884
d.schroder@verizon.net
ADVERTISING SALES COORDINATOR ■ Connie Kostrzewa
TEL. 715-445-4612 x13883
connie.kostrzewa@fwcommunity.com

NEWSSTAND
For newsstand sales, contact Scott T. Hill:
scott.hill@procirc.com

SUBSCRIPTION SERVICES:
Subscription inquiries, orders and address changes can be made at popularwoodworking.com (click on "Customer Service"). Or by mail: *Popular Woodworking Magazine*, P.O. Box 420235, Palm Coast, FL 32142-0235. Or call 386-246-3369. Include your address with all inquiries. Allow 6 to 8 weeks for delivery.

NEWSSTAND DISTRIBUTION:
For newsstand sales, contact Scott T. Hill:
scott.hill@procirc.com

BACK ISSUES are available. Call 800-258-0929 for pricing or visit shopwoodworking.com. Send check or money order to: *Popular Woodworking Magazine* Back Issues, F+W Products, 700 E. State St., Iola, WI 54990. Please specify publication, month and year.

# I CAN DO THAT

## New Video Series!

Learn the simple skills and tools you need to build great-looking projects in our new "I Can Do That" video series, with host Chad Stanton. Each episode is free on the PWM site for four weeks.

**Plus**, you'll find articles from the magazine, and the downloadable ICDT manual. It's all free at:
**popularwoodworking.com/icandothat**

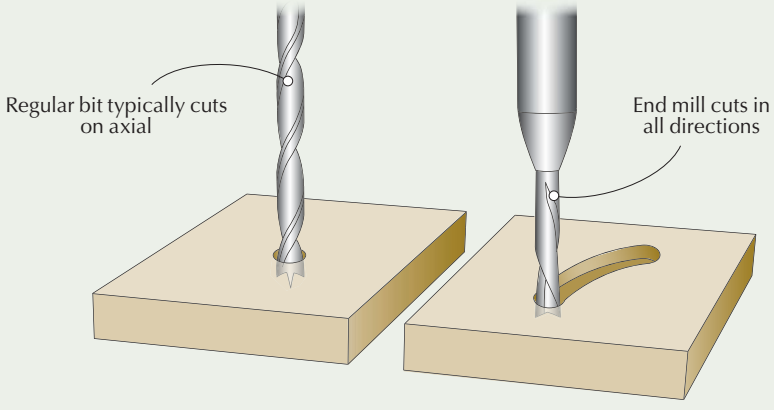
sponsored by
WOODCRAFT®

# Exactly What is an End Mill?

I am trying to make a wooden backgammon game board and I want to add stringing around the outside box of the game. In the "Federal Bowfront Table" article in the December 2014 issue (#215), author Frank Vucolo noted that he used a 1/32" end mill in a small router with a stock fence when he installed the holly stringing.

My problem? I do not know what an "end mill" is. Is it a bit? And if so, what is meant by the use of a small router with a small fence? Would that be a palm-held (trim) router?

Gary LaRault,
via e-mail




*Gary,*

*An end mill is basically a bit, but its geometry allows it to cut in all directions (a regular bit typically cuts only on the axial). And yes – the router is a trim router with a stock fence, meaning it's one Frank bought, not made; they're generally available from all major trim router manufacturers.*

*You can also use a rotary cutter if you prefer that to a trim router, or scratch in the line using a shop-made scratch stock or various tools such as the Groove Cutter from Veritas or the Latta Straight Line Cutter from Lie-Nielsen Toolworks.*

*Megan Fitzpatrick, editor*

## Shooting Boards: Start Simple

I am interested in buying a shooting plane and building a shooting board.

My question is, should I build a straight shooting board or a ramped shooting board?

As I understand it, the advantage of a ramped shooting board is twofold. First, it allows more even use of the plane blade than a straight shooting board. Second, a ramped board takes a much easier cut of the wood.

Because the blade of the plane I am considering is already skewed, I am not sure what the effect of using it on a ramped shooting board would be. It would use more of the blade, but I have no idea what it would do in terms of the ease of the cut. Any advice?

Mark Hagy,
Sunbury, Pennsylvania

*Mark*

*Historically, most shooting boards were disposable items built from available materials, then modified and used until they were chewed up or unreliable.*

*So I see very little need for a ramped shooting board. They require significantly more work to construct, and their only real advantage is the ramp spreads out the wear on the blade. If you know how to sharpen, then this is a trifling advantage. In any case, shooting board planes should be kept sharp. So I'm always sharpening mine anyway.*

*Simple shooting boards take about 20 minutes to construct and last about five years. I'd try one of those and see if you like it. Then decide in five years if you think a complex ramped board is worth the effort.*

*Christopher Schwarz,*
*contributing editor*

## Aluminum Planes: Yea or Nay?

I was recently given a Stanley A6 handplane. The condition is pretty ratty; the sole of the aluminum body has light gouges as if it has struck something. However, nothing snags on the bottom.

I sharpened the iron, and the A6 does a great job, from hogging off 0.015"-thick shavings to very, very thin shavings. The blade has a nice camber, which makes me believe the previous owner(s) actually used this foreplane. But the finish on the cap iron is ruined, and there is slight corrosion all over, suggesting poor storage. The bottom of the casting is as flat as I have ever seen on a longer plane like this one.

I might keep this as a user, but I have to wonder if it will be durable, due to the aluminum casting. What is your experience? Have you ever used one for an extended period?

Al Navas,
St. Joseph, Missouri

*Al,*

*The Stanley aluminum planes were a short-lived experiment in New Britain, Conn., that died out right before World War II. The selling point of the planes was that they were lighter, and so easier to use. They also were significantly more expensive.*

*On the plus side, the A-series planes are indeed lighter, which is an advantage with rough foreplane work. And alumi-*

CONTINUED ON PAGE 10



ILLUSTRATIONS BY MARY JANE FAVORITE

# Woodpeckers® Inc.

# PRECISION WOODWORKING SQUARES

## Unmatched Accuracy, Guaranteed for Life

**You'll Never Question the Reliability of Our Woodworking Squares.**
Woodpeckers new squares deliver the precision woodworkers demand and offer features not found on other squares. For years and generations to come, these are tools you will trust every time you reach for them.

**Unbeatable Precision and Quality.**
Our squares start as one piece of expensive, extremely stable cast aluminum tool plate. Each blank is individually machined on our state-of-the-art CNC equipment producing a single piece square blade and handle that's truly square. Our manufacturing process and rigorous quality control ensures each square is accurate to within one thousandth of an inch or less along its full length.

To complete the square handle we add two precision-machined aluminum cheeks. Stainless steel pins fasten the cheeks and ensure bulletproof rigidity and perfect alignment. The result is strength and precision that cannot be matched by squares using separate blade and handle parts.

**Imperial or Metric Scales.**
All Woodpeckers woodworking squares are laser engraved with Imperial scales in 1/16" increments or metric scales in 1 mm graduations.

**Our Guarantee.**
We're so confident in the accuracy of Woodpeckers woodworking squares, we offer them with a Lifetime Guarantee to stay square to within one-thousandth inch per foot or we'll repair or replace it upon return and inspection by us.


**1281 Square**
with 12" Blade, 8" Handle

**851 Square**
with 8" Blade, 6" Handle

**641 Square**
with 6" Blade, 4" Handle


All our woodworking squares feature a notch on the inside corner of the handle so you can mark your pencil line all the way to the edge of your stock.


The 641 Square, like its big brother 1281, also sports a 3/4" thick handle allowing it to stand on edge. You can check machine setups with both hands free to make adjustments. This handy little square is small enough to tuck into your shop apron pocket.


Our squares' handle design includes a lip so they can rest on the work unaided. The cheeks register against the stock for precisely square layout work.


The 3/4" thick handle easily stands on edge so you can check and adjust assemblies hands-free. The 1281 Square features handy finger holes for a firm grip when checking stock.

# Woodpeckers® Inc.

See our full line of American made precision woodworking tools at **woodpeck.com**

Strongsville, Ohio (800) 752-0725

CARD #52 or go to PWFREEINFO.COM

CONTINUED FROM PAGE 8

*num does not rust in the same way as iron.*

*However, the aluminum soles and sidewalls are easily dinged and gouged, so you need to keep an eye on those areas and keep burrs, etc. filed down so they don't mar your work.*

*Also, the aluminum can mark the work if the tool has not been used for some time (much the same way a bronze plane will). It's not a big deal, but worth noting.*

*So feel free to use the tool if it works well. They are not especially collectible, so it's best to put the thing to work, warts and all.*

*Christopher Schwarz,*
*contributing editor*

## Cutting Steam Hose to Length

I read with interest Christopher Schwarz's Tool Test in the June issue (#218) about the Earlex WS77 steam generator, and the trouble he had with the length of the hose – and Chris noted that there is no way to easily shorten it.

Steam-rated hose has a wire braid inside (sometimes two layers), making it difficult to cut. You can cut it yourself by using a vise and a hacksaw, but cutting steam hose with a hacksaw usually isn't pretty.

You can buy manual cutters online that are designed to cut 1/2" and smaller hydraulic hose. The cutters look like a tree-limb cutter and will set you back about $60 – too much to spend on one cut, I think.

If you do use a hacksaw to cut the hose, use a pair of wire cutters to trim any long wires protruding from the end. Above all, wear gloves and watch out for those little wire blood testers sticking out from the end – you get bit once, you'll remember.

As a journeyman pipefitter for 38 years, I've cut all manner of hoses. We use a special (expensive) braided hose-cutting machine to do the job. But going through all the types and styles of hose we use, the specialized tool makes it much easier to do the job. But for one cut, try the hacksaw.

Keith J. Whitmore,
Duquesne, Pennsylvania

## Can Shellac Go Over Glaze?

My brother and his wife are having a baby later this year, so I am building a rocking bassinet for them out of cherry.

In his April 2002 article in *American Woodworker* (issue #93), Tim Johnson calls for sealing the wood with shellac, adding glaze on top of the shellac, then film-finishing with a couple layers of polyurethane.

Is there a problem with film finishing with shellac on top of the glazed surface? Will shellac make the glaze melt and run, whereas polyurethane will not?

Owen O'Neill,
Stillwater, Oklahoma

*Owen,*
*There's no problem at all using shellac as a finish over shellac sealer and glaze. This was done, in fact, through most of the early 20th century, until lacquer replaced shellac as the preferred finish in furniture factories.*

*Actually, the risk of problems is greater with polyurethane over the glaze because they both thin with the same thinner, mineral spirits. Shellac thins with alcohol, so it won't have any "dissolving" effect on the glaze. I'd still let the glaze dry fully before applying the shellac. (I'm assuming you're using an oil-based glaze, but you won't have any problem with water-based glaze either.)* **PWM**

*Bob Flexner, contributing editor*

# ONLINE EXTRAS

## Letters & Comments

At popularwoodworking.com/letters you'll find reader questions and comments, as well as our editors' responses.

## We want to hear from you.

*Popular Woodworking Magazine* welcomes comments from readers. Published correspondence may be edited for length or style. All published letters become the property of *Popular Woodworking Magazine*.

Send your questions and comments via e-mail to popwood@fwmedia.com, or by mail to 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.


PHOTO BY THE AUTHOR

## Highly Recommended

Blaster Dry Lubricant has made my life incredibly better when moving heavy stock across machines.

It is available at any home center, is cheap (less than $5) and does not interfere with finishing.

*— Christopher Schwarz*

POPULAR WOODWORKING MAGAZINE

**Customer Service**

How can I contact customer service with questions regarding my subscription, including a lost or damaged issue?
*Visit popularwoodworking.com/customerservice. Or write to* Popular Woodworking Magazine, *P.O. Box 421751, Palm Coast, FL 32142-1751. Or, if you prefer the telephone, call 1-877-860-9140 (U.S. & Canada), 386-246-3369 (International) and a customer service representative will be happy to help you.*

When does my subscription expire?
*The date of your subscription expiration appears on your magazine mailing label, above your name. The date indicates the last issue in your subscription.*

Can I get back issues of *Popular Woodworking* and *Woodworking Magazine*?
*Back issues are available while supplies last. Visit popularwoodworking.com/backissues. Or if you know the exact month and year of the issue you want, call our customer service department toll-free at 855-840-5118 to order.*

What if I want more information about the projects or tools I read about in *Popular Woodworking Magazine*?
*For all editorial questions, please write to* Popular Woodworking Magazine, *8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236. Or send an e-mail to popwood@fwmedia.com.*

Does *Popular Woodworking Magazine* offer group discounts?
*Group discounts are available by special arrangement with the publisher. For more details, send an e-mail to Debbie Paolello at debbie.paolello@fwcommunity.com or call 513-531-2690 x11296.*

**Our Privacy Promise to You**

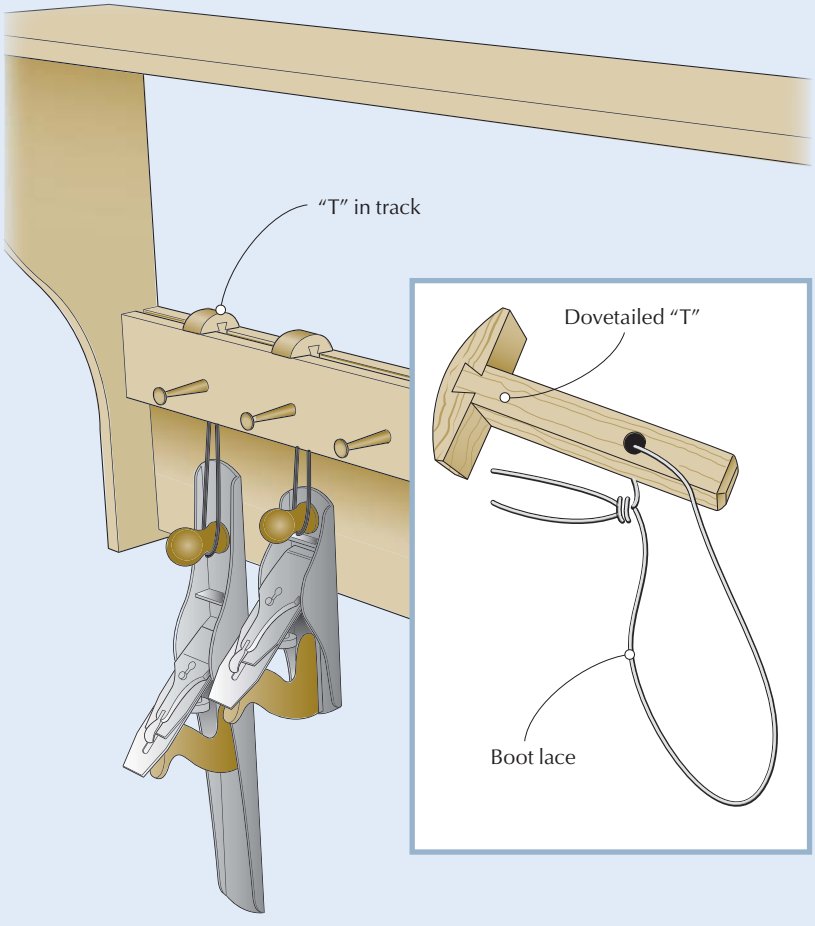
We make portions of our customer list available to carefully screened companies that offer products and services we believe you may enjoy. If you do not want to receive offers and/or information, please let us know by contacting us at:
*List Manager, F+W Media, Inc.*
*10151 Carver Road, Suite 200*
*Blue Ash, OH 45242*

**Safety Note**

Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking Magazine*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand.

THE WINNER:

# Planes Fit to a Tee




After building an "I Can Do That: Tool Rack" (April 2011, issue #189), I wanted to have my planes accessible on the rack as well. So here's my solution.

Cut two pieces of oak into 1/2" x 3/4" pieces, one 2" long and the other 3 3/8" long.

Form a "T" by cutting a sliding dovetail with the tail end on the long piece and the pin on the short piece.

After fitting the dovetail, I shaped the top of the "T" for aesthetics by rounding it over. But be sure not to make the top part of the "T" too thin because that might weaken the hanger and cause it to fail under heavy load.

Next, drill a 1/4" hole 1 1/8" from the bottom of the "T" on the 1/2" face.

Cut a piece of cordage (I used boot laces) 15" long and tie a knot to secure it (adjust the length as necessary for various sizes of planes). Apply a coat of boiled linseed oil or other desired finish.

Now simply the insert the "T" into the 1/2"-wide slot in the tool rack, and you have a great hanger for your planes.

While these support even my largest plane, a No. 7 jointer, I urge you to test your hangers before placing your cherished tools on them.

Aaron Henderson,
Fuquay-Varina, North Carolina

## Simple & Effective Shop Heat For Moderate Climes

Lately I've noticed a lot of woodworking magazine articles and inquiries about how to heat a shop. It's of special interest in the northern climes where cold winters are a big problem for garage and basement shops requiring big and expensive solutions.

But in areas where the temperature drop is not so extreme, here's a simple, inexpensive solution to make working in a chilly shop more comfortable.

Infrared heat lamps (bulbs) suspended above workstations can take the chill off. Infrared heat lamps transfer heat by radiation, which heats objects directly, but not the air…think, the sun. Also, the "clear" infrared heat lamps offer a bonus feature in that they can double as task lighting.

Be sure that you screw the heat lamp into a porcelain socket rated at 120 volts and 250 watts minimum.

A variety of infrared heat lamps are available online for about $10 each in the 250-watt size.

John Cusimano,
Lansdale, Pennsylvania

## Fuel Hose as Depth Stop

Most woodworkers have at some point needed to mark a drill bit to control hole depth.

Tape is a common solution, but has drawbacks, especially if there are a number of holes to drill.

Depth stops that secure to the bit with a screw are available, but often don't work well with smaller size bits.

An effective but inexpensive solution is available at the auto parts store: a vacuum or fuel hose. These are sold in many different sizes, and one can usually be found that will slip easily on and off the bit, yet still stay put in use.

If too much force is applied, the tubing will mark the work, but the mark sands off easily.

Harry Strawbridge,
Atwater, California



ILLUSTRATIONS BY MARY JANE FAVORITE

## 'Beater' Attachment for a Hand Mixer as Shop Helper

My wife was throwing away an old hand-held mixer. I noticed the beater attachments and thought they might come in handy in the shop, so I decided to give them a try.

I chucked one of the beaters into my drill and, with the drill running at low speed, used it to mix some polyurethane (even though the directions on the can direct you to stir). It would also be effective for mixing paint.

It works great, and I feel good about having recycled at least part of the mixer.

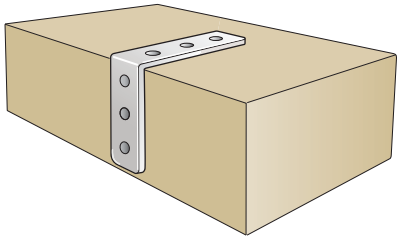
Lenny Harrison,
Browns Mills, New Jersey

## Squaring on the Cheap

Instead of spending good money on an expensive marking tool, use an angle bracket to mark a square line at two consecutive edges of a board.

Paint it a bright color and keep it with your other marking tools.

Les Beeckman,
Saginaw, Michigan



## Greasy Carpet: Slick Trick for Top-notch Tool Performance

Among the most important tools in my shop is a small piece of leftover carpet (about 3" x 12") that's impregnated with tallow.

I seldom go more than about a dozen or so strokes with a plane, chisel, drill bit or saw without a pass of the tool over the carpet.

The tallow makes a huge difference with my ease of motion and the performance of the tool.

Jim Tolpin,
Port Townsend, Washington

## Jig for Honing Narrow Chisels

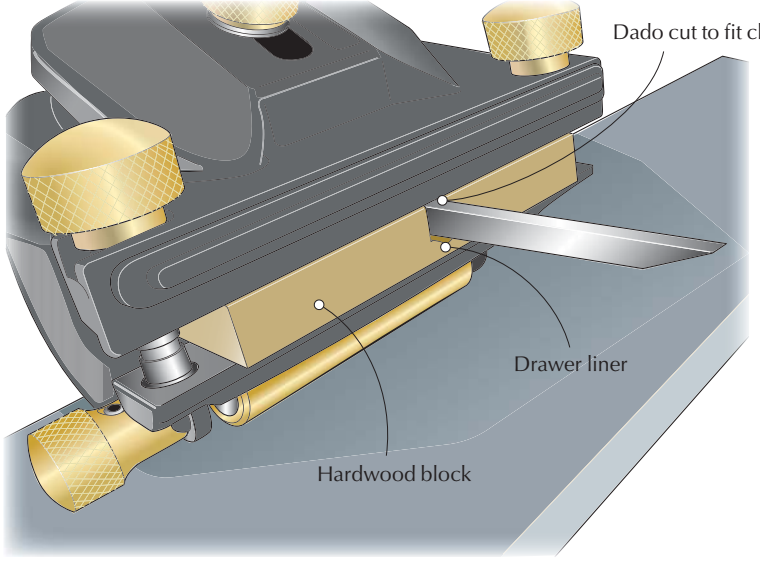
I use a honing guide that clamps from above and below. This works well for wide chisels, but for narrow chisels it can be a challenge not to bump it out of square or even mount it in the guide.

To help with narrower chisels, I use a piece of wood that is thicker than my chisel, but still fits in the honing guide.

I cut a dado that fits the chisel tight from side to side, but is slightly deeper than its height. In the bottom of the dado I put some drawer liner to raise the chisel proud of the top of the piece of wood by about 1/16". (Cork or foam would work for this too, as long as it can be compressed and is not slick.)

Then, I put all of this in my honing guide. The top and bottom clamp of the honing guide compress the chisel and register on the tool as well as the piece of wood. This helps to secure my narrow chisels square to get a consistent, keen edge. **PWM**

Dean Vande Griend,
Story City, Iowa




## ONLINE EXTRAS

*For links to all online extras, go to:*

- **popularwoodworking.com/oct15**

**TRICKS ONLINE:** *We post tricks from the past and film videos of some Tricks of the Trade in use in our shop. They're available online, free. Visit popularwoodworking.com/tricks to read and watch.*

*Our products are available online at:*

- **ShopWoodworking.com**

### Cash and prizes for your tricks and tips!

Each issue we publish woodworking tips from our readers. Next issue's winner receives a $250 gift certificate from Lee Valley Tools, good for any item in the catalog or on the web site (leevalley.com). (The tools pictured below are for illustration only and are not part of the prize.)

Runners-up each receive a check for $50 to $100. When submitting a trick, include your mailing address and phone number. All accepted entries become the property of *Popular Woodworking Magazine*. Send your trick by e-mail to popwoodtricks@fwmedia.com, or mail it to Tricks of the Trade, *Popular Woodworking Magazine*, 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.

# 'The Secret Mitre Dovetail'

## David Charlesworth's new video is groundbreaking instruction.

The "secret miter" dovetail is considered the most elegant and difficult of all the dovetail joints to make. As a result, many woodworkers hesitate to even attempt the joint, which can seamlessly wrap the grain around a furniture carcase to a beautiful effect.

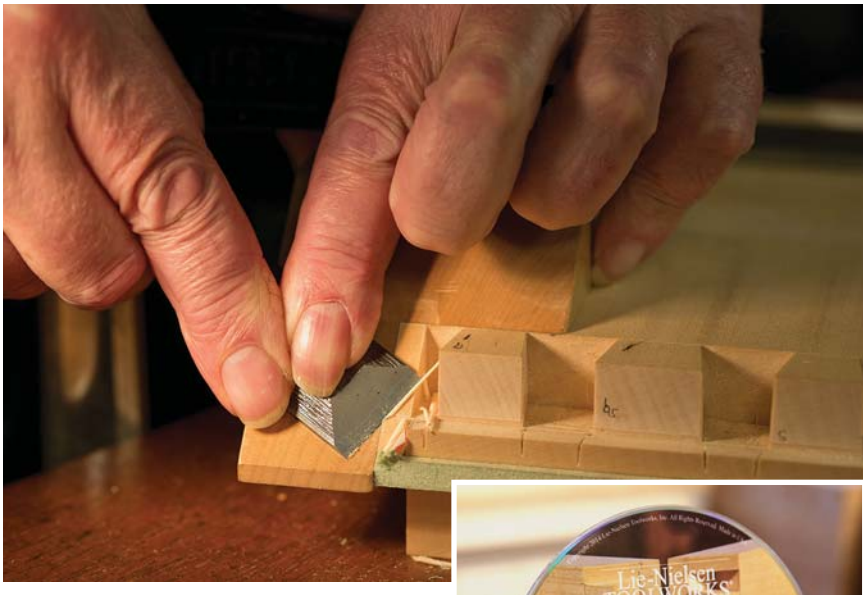
In his latest DVD, English craftsman David Charlesworth – best known for his "ruler trick" for sharpening – dissects the secret miter joint to present it as one that almost any woodworker can make with just a little care.

Like all of David's DVDs, "The Secret Mitre Dovetail" is an extremely detailed presentation of its topic. No aspect of the joint is too small to consider. And this particular DVD uses razor-sharp macro photography, which allows you to see exactly what is going on as the tools enter the wood.

What I quite like about David's DVDs is that he presents the absolute finest work imaginable. While some might see it as fussy or overly precious, I take a different view. Any woodworker who watches this DVD will come away with some fantastic approaches to layout, sawing, chopping and paring – even if they never cut a secret miter dovetail.

In particular, David offers some useful insights that I've never seen discussed, including:

- How to easily set your chisel perfectly horizontal and properly angled when paring a dovetail.
- How to use two parallel baselines in your dovetailing to improve the joint's accuracy.
- Using a small scrap to reliably undercut portions of the joint to 1° – a trick I will begin using immediately.
- Plus, how to asses the fit of the joint using a bench light to show areas that need paring before you even do a test-fit.




***Secrets revealed.*** *David Charlesworth's new video offers great tips and techniques for layout, sawing, chopping and paring dovetails – even if you never intend the joint to be secret.*

Personally, I cut this dovetail joint differently than David. He saws close to the line and finishes with a chisel. I saw directly on my lines. Yet, I thoroughly enjoyed seeing David's approach because I can see cases where his methods would save me from making an error or would improve some of the fiddly parts of the joint.

For example, the DVD ends with David showing how to glue up the joint with ingenious clamping blocks that help close the long miter and keep the case square – the blocks are a much better clamping approach than I was using.

The only criticism you'll possibly hear about this DVD is that David's teaching style is slow. Perhaps I'm slow myself, but I like his pace because it allows for some of the more difficult concepts to sink in – I never had to back up the video and watch the tricky bits again.

So if you have an open mind about different approaches to the craft, I think you'll greatly enjoy this new DVD – it's well worth your time and the minimal expense.

*— Christopher Schwarz*

CONTINUED ON PAGE 16

### 'The Secret Mitre Dovetail'

**Lie-Nielsen** ■ lie-nielsen.com or 800-327-2520

**Street price** ■ $45

■ **WEB SITE** *Visit David Charlesworth's web site.*

*Price correct at time of publication.*



LEAD PHOTO COURTESY OF ARTISAN MEDIA; DISK PHOTO BY THE AUTHOR

CARD #47 or go to PWFREEINFO.COM





CARD #126 or go to PWFREEINFO.COM



CARD #20 or go to PWFREEINFO.COM

CONTINUED FROM PAGE 14

# Veritas Stainless Steel Trammel Points

These clever stainless steel trammel points (for scribing large arcs and circles) from Veritas work a little differently than my vintage set, which fit only on a fixed-sized beam. The narrow-bodied heads are open on one side, and can thus be attached to any flat piece of material up to 1/4" in thickness – so, a yardstick, wood or metal rule, or any thin offcut in the scrap bin. Caveat: When attached to a metal rule, the head slips unless you crank the screw down hard – but the nicely knurled grip allows for a good hold to do so.

## Veritas Trammel Points

**Veritas** ■ leevalley.com or 800-871-8158

**Street price** ■ $25

■ **VIDEO** *See the Veritas trammel points in action on our web site.*

*Price correct at time of publication.*

Also unlike my vintage pair, which has needle-like points, the tips on these trammel points are for the most part rounded, with a small, sharp point at only the very bottom. I'll be interested to see how long that holds up under use, but so far, I've had no trouble scribing a clean arc on any of the five domestic hardwoods I've tried (nor on Eastern white pine). Lee Valley marketing states the tool effectively scribes on aluminum, brass, bronze and mild steel, as well as wood, though I've not tried them on said materials.

The tips are removable, so the heads can double as stops on a square – without risk of puncture – or what have you for marking repetitive angles (which might come in handy if I end up having to cut stringers as I rebuild part of a staircase).

My only complaint – if you can really call it a complaint – is that at the moment, no pencil attachment is available (though I've asked the designers at Veritas about it). How sweet would it be to have the option of screwing a graphite point into one of the heads to mark a pencil line?

*— Megan Fitzpatrick*

# Sterling Tool Works Stainless Steel French Curves

I like using French curves for laying out hyperbolas, ellipses and parabolas when designing furniture details. These curves are not static arcs – they are segments of the Euler spiral – and so the shapes they create have more spring and life.

The typical set of French curves consists of three small plastic layout tools that are suitable for small pieces of woodwork or small scaled layouts. What I've struggled to find are larger French curves that allow me to add curves directly to full-sized furniture work or full-size drawings.

Also, I hate plastic layout tools (that's a personal problem).

Sterling Tool Works has just released a set of stainless steel curves that are perfectly sized for furniture-makers. The largest is 18" long; the smaller ones are about 8" and 9" long. These sizes are fantastic for laying out curves for chairs or full-size casework.

Each tool is .06" thick, has a matte finish and its corners have been eased during manufacturing so they are a pleasure to use and scribe against. Because of their thickness, they also don't feel flimsy like plastic French curves.

Finally, I'm most pleased that the working edges of these curves are not rabbeted like they are on plastic curves. The rabbet is fine for sketching, but is not ideal for precise layouts.

The Sterling French curves are $70 for the set, but they will be the last set of curves you will ever buy. Highly recommended. **PWM**

*— CS*

## Sterling French Curves

**Sterling Tool Works** ■ sterlingtoolworks.com

**Street price** ■ $70

■ **BLOG** *Read more about these curves on our web site.*

*Price correct at time of publication.*



TRAMMEL POINTS PHOTO BY AL PARRISH; CURVES PHOTO BY THE AUTHOR

Popular Woodworking Presents

# *Woodturning with Tim Yoder*

— Tune in now. Shows airing each Saturday! —

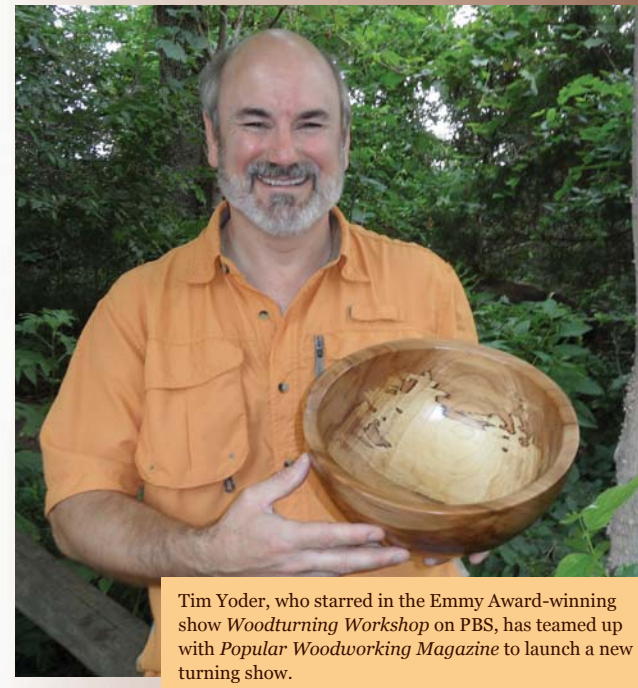
*Popular Woodworking Magazine* has teamed up with well-known PBS star Tim Yoder to launch a new online video show, filled with expert and friendly advice that will teach you how to become a better woodturner.

In each 30-minute episode, Tim takes you through the process of making beautiful woodturning projects, from wine stoppers and duck calls to platters and bowls. Along the way, you'll learn his favorite turning tips and techniques, and he'll offer reviews of the latest lathe tools, chucks and accessories to help you determine the best products to buy.

Whether you're an experienced woodturner who wants to improve your skills or you're new to the hobby and want to learn basic woodturning, *Woodturning with Tim Yoder* is a show you'll want to watch.

Visit **www.popularwoodturning.com** every Saturday for the latest episode of *Woodturning with Tim Yoder*.

This show is brought to you by: Easy Wood Tools, Robust Lathes, Titebond Glue, Thompson Lathe Tools, Woodworkers Emporium, and Rikon Power Tools.



Tim Yoder, who starred in the Emmy Award-winning show *Woodturning Workshop* on PBS, has teamed up with *Popular Woodworking Magazine* to launch a new turning show.

# Designer Profile: Dan Mosheim

## His creative process starts with pencil and moves on to CAD and CNC.

I first stumbled onto Dan Mosheim about six years ago through his eclectic blog, "Dorset Custom Furniture – A Woodworkers Photo Journal" (dorsetcustomfurniture.blogspot.com).

It's primarily about building and designing furniture, but it's also a peek into Dan's interest in art and literature, his forays into pottery, along with a bit of life in rural Vermont with wild turkeys strutting in the back garden and trout fishermen in local streams.

Dan's interests are as varied as the furniture coming out of his shop, and it's obvious that his work is infused with this genuine appreciation for life. A flock of colorful mallard ducks landing in his backyard pond may inspire the decorative inlay for a table or bed.

For much of history, what elevated an artisan was the ability to design and build at a very high level. It was assumed that an artisan who could build a library building or a library table was also capable of designing it.

Our word "architect" comes from the Greek word "architekton," a combination of the root "archi" (chief), and "tekton" (builder). For more than three decades, Dan has been the embodiment of that. Yet Dan is not some throwback. Although his designs are informed by an appreciation for woodworking tradition, he's firmly rooted in the present, not only in his designs, but also in the technology to which he avails himself.


***Family affair.*** *Dan (center) sometimes works with his sons, Will (left) and Sam.*

***Inspiration everywhere.*** *This claro walnut sideboard was inspired by "crazy quilt" pattern found in vintage quilts. The sideboard began as a simple concept sketch before the design was refined with CAD.*

### Blended Approach

When it comes to technology, folks tend to line up in two different camps. There are traditionalists who want to seal the old ways in amber, and the futurists who embrace technology and often jettison the past. Dan sidesteps both and instead embraces the best of tradition while remaining open to new ideas.

His workshop is nestled in the forested hills of Vermont and he's rooted in a practical outlook that he summed up by one of his favorite quotes from David Pye, the influential furniture design professor and author.

"Where the problem is old, the old solutions will nearly always be best (unless a new technique has been introduced) because it is inconceivable that all the designers of 10 or 20 generations will have been fools."

Perhaps it's that practical embrace of both old and new that explains the impressive array of furniture Dan and his crew produce at his shop, Dorset Custom Furniture.

That output includes stunning reproductions of classic American period pieces alongside contemporary and modern studio designs infused with his flair for the spontaneous and the beautiful.

### Yin & Yang

The scope of his work covers small artfully conceived sculptural pieces to massive corporate boardroom tables that stretch the limits of both wood and machinery to build and move. One week, Dan and his crew might be assembling thin veneer and tiny inlay, while the next, hoisting massive slabs of figured walnut.

Another aspect of Dan's exploring the intersection between traditional

CONTINUED ON PAGE 20



FAMILY PHOTO BY KATE PACE; ALL OTHER PHOTOS BY DAN MOSHEIM

CONTINUED FROM PAGE 18

and contemporary is combining wood furniture with metal structural elements. Both of his sons, Sam and Will, worked in the business and became accomplished builders before moving on to other creative pursuits.

Will builds custom banjos and Sam started up a metal shop in an adjacent building. Sam and Dan often team up to combine the possibilities of wood and steel.

Dan shares that from a design perspective, steel offers not only a contrast in color, but also the possibility of using heavy slabs of thick timber while still lending a design a feeling of lightness.

## A Different Take

I was pleasantly surprised to learn how this small custom furniture shop embraces technology. A large CNC router plays a role in much of the work going out to customers – but not for the reasons you might think.

Instead of leaning on the machine as a way to mass produce and industrialize the shop's output, Dan views it as a tool to increase his creative possibilities. He uses the CNC not only in the production of furniture pieces, but also to quickly work out mockups in MDF. Dan also uses CAD drawings, which play a major part of the design and build process.

He uses the technology to quickly bring ideas together to share with customers, but it's really just an extension of his foundation in drawing and years of building. Technology and tradition fuse together with the best of both worlds.

***Scaled reality.*** *These small-scale models of tapered cabinets were photographed in a cardboard room setting to help the client visualize the pieces.*

***Real reality.*** *Once the client approves the design, Dan builds the full-scale pieces.*

## Practical Design

Dan is quick to point out that he's always drawing and scribbling with pencil and paper. Drawing has always been a constant in the way he works; a way to think through ideas and explore possibilities.

Dan's sketches help him and his crew visualize flowing curves and refine the overall form of a project before moving forward with CAD drawings and mock-ups.

Every finished design, CAD drawing, or CNC program begins with a few (or perhaps many, over time) simple sketches. Ideas bubble up and are quickly captured on paper. Promising ideas quickly translate into a CAD drawing.

Small-scale models are frequently assembled that may include important details, even to the degree that small-scale parts destined to be made of metal are painted a metallic color.

In addition to small scale models, sample blocks of carving or ornament are quickly mocked up on the CNC.

Each of these vignettes come together to help the design come to fruition. Each one – the sketch, the model, the CAD drawing or sample – provides a springboard to push the idea forward as well as guide the actual build.

Because all the work is custom one-off commissions, the emphasis is not on producing detailed prints that leave nothing to chance.

With a grin, Dan describes the build process as moving from one recovery to the next. Yet beyond the needs within the shop, all these sketches, drawings and models are key for the most important part of the design process; the actual collaboration between Dan and the customer commissioning the work.

***Rehearsal in wood.*** *Dan often uses scale models as part of an iterative design process.*

On the practical side, his designs are very much driven by the desires and needs of his customers. Much of his success in this regard is in helping each client bring their own thoughts and ideas to fruition.

Dan's easygoing manner and solid grasp of his craft makes for a creative bond with each customer. Every piece coming out of Dorset Custom Furniture is a reflection of that. **PWM**

---

*George is the author of two design DVDs (Lie-Nielsen Toolworks) and author of "By Hand & Eye" (Lost Art Press).*

## ONLINE EXTRAS

*For links to all these online extras, go to:*

- **popularwoodworking.com/oct15**

BLOG: *Read Dan Mosheim's blog.*

BLOG: *Read more from George R. Walker on his Design Matters blog.*

IN OUR STORE: *George R. Walker's DVDs.*

WEBINAR: *"Hand Drafting Skill-builder with Bill Rainford."*

*Our products are available online at:*

- **ShopWoodworking.com**

## About This Column

Design Matters

Design Matters dives into the basics of proportions, forms, contrast and composition to give you the skill to tackle furniture design challenges with confidence.

Popular Woodworking Magazine presents

# NEW AND NOTABLE

## BESSEY

### NEW! Track/Table Clamps

**BESSEY introduces a Track/Table clamp** available in a wooden handle (GTR) or lever handle (GTRH) style. All units come with an all-steel rail that is forged from a single piece of bar stock which is then shaped into a 12 x 8 mm profile. This enables guide rails from brands such as Festool, Protool, Metabo, Makita and Hitachi to be fastened quickly and securely to a work table.

BESSEY Simply better.

**Visit besseytools.com**
**Or call (800) 828-1004**
CARD #101 or go to PWFREEINFO.COM

## General International

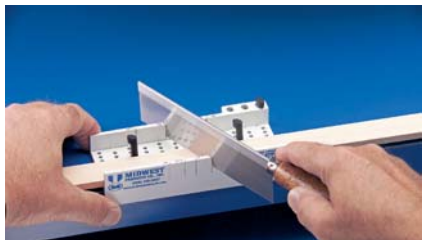
### 15" Variable Speed Drill Press with Digital Display

**An affordable drill press designed for everyday use.** With plenty of power, precision bearings, and smooth rack and pinion table height adjustment the 75-155 is a valuable addition to any shop. Sturdy design with cast-iron head, base and table, and polished steel column. With a powerful ½ HP industrial quality 120V motor and simple hand lever controlled mechanical variable speed from 280 to 2100 rpm with digital speed display. Includes safety chuck guard, laser pointer, ⅝" keyed chuck, and extra-safe forced opening line interrupter switch. Retail Price: $459.99 – valid until October 31st, 2015.

**Visit general.ca**
**Or call (888) 949-1161**
CARD #17 or go to PWFREEINFO.COM

## Midwest Products

### Easy Miter Box Deluxe



**Easy Miter Box Deluxe – Cuts More Angles Than Others**
The Easy Miter Box is an improvement over other typical miter boxes. It allows you to cut FOUR miter angles – 45º, 22½º, 30º and 60º. Accepts materials as wide as 2" and as thick as ½". Constructed of injection-molded plastic, the Easy Miter Box features three unique cam clamps that hold the material being cut firmly in place. Includes a razor saw.

MIDWEST PRODUCTS® WHEN PRECISION MATTERS

**Visit midwestproducts.com**
**Or call (800) 348-3497**
CARD #128 or go to PWFREEINFO.COM

## SpaceAge Ceramics

### Guideblocks

**Simply the Best Guide Blocks You'll Ever Use**
SpaceAge Ceramic Guideblocks® and Thrust Bearings are made of aluminum-oxide, the same material used to make ceramic products for NASA. They create far less friction and provide a cooler running blade and truer blade tracking. They run smoother, quieter, and outlast every other guide block on the market. Our patented ceramic guides practically never wear out. As an added bonus, our customers tell us that our guides and bearings increase blade life by 40%.

SpaceAge Ceramics
Research • Design • Development • Manufacturing

**Visit spaceageceramics.com**
**Or call (406) 363-4949**
CARD #40 or go to PWFREEINFO.COM

## Trend USA

### Sharpening Kit

**Trend Complete Woodworking and Woodturning Sharpening Kit**

The Kit features a 300/600 grit double sided credit card, a 3" mini taper file, 100ml bottle of diamond abrasive lapping fluid, cleaning block, non-slip mat and an instructional DVD and sharpening booklet.

A wide variety of tooling can be sharpened including: gouges, skews, carbide and HSS inserts, small fluted tools Forstner bits and router bits.

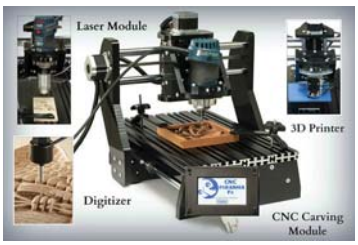
The set (Item DWS/KIT/C) retails for $89 and Trend diamond tools are covered by a five-year warranty.

trend® routing technology

**Visit trend-usa.com**
**Or call (877) 918-7363**
CARD #120 or go to PWFREEINFO.COM

## Next Wave

### CNC Piranha FX




**CNC Piranha FX – the Make ANYTHING Machine!**
CNC Piranha FX is the only machine available that can 3D print, laser engrave AND CNC rout/carve. CNC Piranha FX includes three easy to use modules letting users carve, laser engrave and 3D print, all on a single machine, all using a super simple, highly intuitive touch screen. The optional digitizer makes it possible to recreate and copy small objects or existing three dimensional images and objects.

Next Wave Automation

**Visit nextwaveautomation.com**
**Or call (800) 320-3039**
CARD #127 or go to PWFREEINFO.COM

# 2015 The Best New Woodworking Tools & Products for Your Shop

## Klingspor
### R-Flex Cleaners

**Drill Away Rust with Klingspor's New R-Flex Rust Cleaners**

EVERY SHOP needs a set of these ¼" spindle-mounted tools, which are embedded with abrasive grit and work well for light deburring as well as put an excellent surface finish on aluminum, stainless steel, and metals of all types. Use to clean up golf clubs, lawn mower blades, remove rust from anything. Cut them to any shape to reach what you need. Size: 2⅜" x 1⅛". Available Grits: 60, 120, 240.

KLINGSPOR'S WOODWORKING SHOP
"Quality Tools and Supplies for the Woodworker"
www.woodworkingshop.com

**Visit woodworkingshop.com**
**Or call (800) 228-0000**
CARD #89 or go to PWFREEINFO.COM

## Jacobs Chuck
### Super Ball Bearing Chucks

**Jacobs Super Ball Bearing Chucks**

- Ball Bearing Construction Maximizes Gripping Force and Drilling Accuracy
- Center Ground Jaws for Straightness and Alignment
- One Piece Sleeve Eliminates Crack Between Driving Teeth
- Through Hardened Sleeve Teeth Plus Hardened Nose and Keyholes Provide Outstanding Wear Resistance
- Fluted Sleeve Standard
- Each Chuck is 100% Inspected For Performance and Precision
- T.I.R. 0.003" Maximum at Half Capacity

Jacobs CHUCK

**Visit jacobschuck.com**
**Or call (410) 773-7800**
CARD #105 or go to PWFREEINFO.COM

## Amana Tool
### Miniature Router Bits

**Amana offers a full range of Miniature Bits** for fine production work such as instrument making, model-making, sign-making, lettering, inlay, duplication of antique wood-work. Features include:

- Wide range of Upper Bearing Mini Template bits with shank-mounted bearing guides
- Template Bits can be used in conjunction with Mini Flush Trimmers and Undersized Compression Bits
- Includes Plunge Bits, Round-overs, Rabbet, Edge Molders, Cove Bits, Ogees, Mini Beads, Chamfers
- All bits contain Amana's exclusive carbide grade for long life and crisp cut edges
- All Miniature Bits are brought together in a single offering for EASE in selection

Amana Tool®
REDEFINING WOODWORKING®

**Visit amanatool.com**
**Or call (800) 445-0077**
CARD #115 or go to PWFREEINFO.COM

## M-Power Tools
### CRB7—9-function Router Base


**The Worlds most versatile Router Base. FITS 99% OF ALL ROUTERS IN SECONDS.**

1. NEW Large circle cutting - Maximum Dia. 50".
2. Adjustable "Centred / Off-Centred" mortising.
3. Adjustable clamp guide rebating.
4. Variable height anti-tilt support.
5. Adjustable false panel rebate copier.
6. Small circle cutting - Minimum Dia. 1½"
7. Off-Set base plate.
8. Deep range edge guide rebating (accessory).
9. Flush trim lippings & dowels (accessory).

M POWER

**Visit m-powertools.com**
CARD #116 or go to PWFREEINFO.COM

## Woodpeckers
### OneTime Tools

**What are our OneTime Tools?**
They're the tools we make just once in short production runs. And once they're gone, they're gone. The process is simple: We build a couple of the tools for demonstration then open a 14 to 21-day window for woodworkers to order. Once those orders are filled, we move on to another OneTime Tool.

Don't miss your chance at these unique tools! Join Woodpeckers eCLUB and get automatic notifications when each new OneTime Tool is released. You won't be disappointed!

Woodpeckers®

**Visit woodpeck.com**
**Or call (800) 752-0725**
CARD #52 or go to PWFREEINFO.COM

## Rockler
### Dust Right® Universal Small Port Hose Kit

**Dust Right® Universal Small Port Hose Kit**
The Dust Right Universal Small Port Hose Kit includes two sizes of swiveling hose ports with innovative rubber ends that provide an airtight fit on a large range of tool ports. The 1" and 1½" inside-diameter ports are compatible across many popular brands and even stretch to fit oblong ports. They're also angled to provide hose clearance above the work surface. The kit also includes a flexible 1½" inside-diameter hose that expands from 3 to 15 feet long.

ROCKLER WOODWORKING AND HARDWARE
Create with Confidence™

**Visit rockler.com**
**Or call (877) ROCKLER**
CARD #71 or go to PWFREEINFO.COM

Popular Woodworking Magazine presents

# NEW AND NOTABLE

## TrueTrac
### E-Series Track Saw

**Introducing: The E Series Track Saw System!** TrueTrac has been manufacturing quality American made track saws since 2010; our unique design allows you to use your circular saw on our track. The E series track is designed to give you the important benefits (saw is on the track, exact line of cut, no offset measurements, with built in anti-chip) of a traditional track saw at an affordable price. Visit our website today and see why thousands of customers are enjoying the benefits of using a track saw and how you can start today with an affordable American made TrueTrac track saw system

TrueTrac
The Better Track Saw System

**Visit truetracsaw.com**
**Or call (888) 877-4514**
CARD #84 or go to PWFREEINFO.COM

## DMT®
### 12" Dia-Sharp® MagnaBase™

**12" Dia-Sharp® MagnaBase™** This unique sharpening system combines the power of two 12" x 3" DMT® continuous diamond surfaces with the innovative MagnaBase™ - a magnetic base for quick and easy grit changes. A full 72 Sq. inches of sharpening surface, it is available in 2 different grit combinations. DMT® products ensure maximum performance from your tools with the DMT Difference™; diamond coverage, uniformity and surface flatness. www.dmtsharp.com. DMT® products Proudly Made in the USA since 1976.

DMT

**Visit dmtsharp.com**
**Or call (800) 666-4368**
CARD #92 or go to PWFREEINFO.COM

## Bowclamp
### Clamping Cauls

**The days of never having too many clamps are over!** The Bowclamp clamping caul easily replaces many clamps needed in glue-ups of panels, laminations, face frames, carcass assemblies, veneering and edge banding. Precisely cut with a CNC, the shape of the clamp allows for equal clamping pressure along the entire length of the glue line...with only one clamp at each end! This means fewer clamps. We're confident you'll get some of the best, fastest and easiest glue-ups with the Bowclamp.

BOWCLAMP® "good caul"

**Visit bowclamp.com**
**Or call (973) 632-1196**
CARD #19 or go to PWFREEINFO.COM

## RIKON TOOLS
### Variable Speed Floor Drill Press

**17" Variable Speed Floor Drill Press #30-236** is the best in the 17" class. Designed with features that woodworkers have demanded – more powerful 1½ HP dual voltage motor, Vari-speed pulley that adjusts the chuck speed with a simple turning of a lever – no belt changing, a digital RPM display, rotating work table with clamp-friendly thin edges, large 6" spindle travel, and a handy LED light.

RIKON

**Visit rikontools.com**
**Or call (877) 884-5167**
CARD #42 or go to PWFREEINFO.COM

## Seneca Woodworking
### Domino XL Small Mortiser Kit

**Make Smaller Mortises with Your Domino XL** The Seneca Woodworking Small Mortise Kit allows you to make mortises as small as 4mm with your Domino XL, greatly expanding its capabilities. The kit includes our Domino Cutter Adapter for using DF500 cutters on your DF700, along with a shim and thickness gauge that allow quick fence adjustment for centering on plywood from ½" to 1". Designed and manufactured in the USA.

SENECA WOODWORKING

**Visit senecawoodworking.com**
CARD #129 or go to PWFREEINFO.COM

## CMT USA
### FAST X4 ® SYSTEM: THE HOLE SAW REVOLUTION!

**Our patented FASTX4 system makes the hole saw arbor obsolete!** Fast lock to change between hole saw size and type, fast drill for precise application even at extreme angles, fast bore enlargement by using two hole saws on one pilot drill bit and fast plug removal without using screwdrivers or further tools. We offer three professional lines in tungsten carbide, bimetal with 8% cobalt and diamond for boring in all materials.

CMT ORANGE TOOLS™

**Visit cmtusa.com**
**Or call (888) 268-2487**
CARD #102 or go to PWFREEINFO.COM

# 2015 The Best New Woodworking Tools & Products for Your Shop

## Highland Woodworking

### Mirka DEROS Random Orbit Sander

**Electrifying Efficiency** The Mirka DEROS is the first random orbit sander to use a brushless DC motor without the need for an external transformer. It combines the power and light weight of pneumatic tools with the convenience of an electric tool. It's small and light enough to use with one hand - even in the 6" version. If you do a lot of sanding on vertical surfaces, you'll love this sander.

**Visit highlandwoodworking.com**
**Or call (800) 241-6748**
CARD #22 or go to PWFREEINFO.COM

## CMT USA

### Reciprocating Saw Blades


**Quality Materials for Maximum Productivity** Produced by following state-of-the-art processes, using high-tech machines and premium quality raw materials, these tools have been designed to ensure maximum lifetime and performance in all materials. Our tools are made of three different materials: high carbon steel, bi-metal with 8% cobalt and tungsten carbide and feature different tooth geometry for a wide range of applications according to your needs.

**Visit cmtusa.com**
**Or call (888) 268-2487**
CARD #102 or go to PWFREEINFO.COM

## Leigh Industries

### RTJ400 Router Table Dovetail Jig


**Rout Perfect Dovetails and Box Joints on your Router Table!**
Leigh's new RTJ400 offers fast and accurate routing of Through Dovetails, Half-Blind Dovetails and Box Joints in multiple sizes. No jig adjustments, and perfect fit is guaranteed. Made from precision CNC-machined aircraft aluminum.

**Visit leighjigs.com**
**Or call (800) 663-8932**

## Custom Branding Irons

**Leave a Distinctive Mark on Your Next Project.** Our Branding Irons can be created in most any design that you can imagine. Using your art or our design services, we'll work with you to create a Brand that is uniquely yours. Call or email us with your wants and needs. Check out our line of predesigned Stock Brands, all you need to do is choose a design and add a name.

**Visit branding-irons.biz**
**Or call (586) 484-7713**
CARD #93 or go to PWFREEINFO.COM

## Bushton Manufacturing

### HAWK PanelMASTER IV

**The New and Improved HAWK PanelMASTER IV** With the Hawk PanelMASTER IV, making doors has never been easier. This horizontal shaper will cut your style, rail, raised panel, and make the door edge detail in just a few simple passes. Finally, all of your cutters on a single machine; and with a footprint of 29" x34" it is more bang for both your buck AND space. We also offer crown rail and cathedral rail templates. Call in and request a catalog today!

**Visit bushtonmanufacturing.com**
**Or call (620) 562-3557**
CARD #80 or go to PWFREEINFO.COM

## Forrest Blades

### Woodworker II

**Woodworker II 40-Tooth General-Purpose Carbide-Tipped Saw Blade is Like Having 3 Blades in One**


Forrest's award-winning 40-tooth Woodworker II—the king of all-purpose table and circular saw blades—delivers quiet, high quality rips, combos, and crosscuts of 1" to 2" in hard and softwoods with a smooth-as-sanded surface and no bottom splintering. Plus, specially-engineered clearances on the blade teeth eliminate side scoring. 4⅜" to 16" diameters, $77-$197 MSRP. All Forrest blades are American-made and come with a 30-day, money-back guarantee.

**Visit forrestblades.com**
**Or call (800) 733-7111**
CARD #13 or go to PWFREEINFO.COM

# Slat-back Chair

BY JEFF MILLER

Curves, angles and comfort – this piece will have you sitting pretty.

I've always found making something simple yet refined to be more work than it seems. I suspect that the slat-back chair doesn't exactly look simple to build if you're not a chairmaker. But it is relatively simple in the world of chairs, and it is a great entry into chairmaking. It covers all of the basic issues: curves, angles, comfort and structure.

In its refinement, though, it goes well beyond the basics, and gets into some sophisticated joinery that adds considerably to the strength of the chair. This is also a very comfortable chair, which is neither basic nor at all common. And it is a chair that has great presence, especially around a dining table. Simplicity. Comfort. Presence. Not a bad combination.

## Pattern Recognition

I don't build my chairs from plans. Instead, I rely on patterns. They define the shape of the legs, and I make sure to include information for all of the joinery that will be cut in the legs. Even though I've provided plans here, it still makes sense to begin by making your own patterns.

I use 1/4" plywood for most of my patterns, but there are also advantages to working with 1/8" clear plastic. With the latter, you can see the grain as you trace the leg shapes onto your wood. But 1/4" plywood is always available in my shop, and it can be smoothed out easily with a handplane (I actually keep a garage-sale block plane handy for use as a plywood plane). You'll want to spend time smoothing the edges of the pattern as well as you can, because any problems will be transmitted down the line to the actual work.

Once your rear leg pattern is cut, spend a few moments on the joinery layout, and mark out the two side-to-side and the one front-to-back mortises on the pattern.

PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DONNA R. HILL FROM THE AUTHOR'S MODELS

## Shapely Legs

Now use your pattern to lay out the rear legs. Try to orient the grain direction so that it flows with the overall shape of the leg. A tendency toward short grain is inevitable, but avoid any situation where the grain will run out across the leg in less than 4½" or 5".

Saw out your legs, being careful to stay just outside the layout lines. Keeping too much distance from the lines does have its penalty; you'll spend more time on the smoothing. Stay as close as you can comfortably and consistently cut.

You could use a router template and a flush-trim-bit setup to start the smoothing process, but I usually start right in with hand tools. Routing will sometimes blow out wood as you cut against the grain when cutting the curves. Even if you manage to avoid that, there will still be plenty of smoothing to do afterward to get rid of the machine marks. So I simply try to cut well at the band saw, and proceed directly to smoothing.

Start with the easy stuff and plane the straight sections on the legs. Then move on to the convex curves, which you should be able to fair and smooth using a block plane or a No. 2 bench plane. Planing curves may take a little practice if you haven't done it before, but it is a great technique for both fairing and smoothing, and it makes quick work of a fairly difficult task.

Finally, smooth out the concave curves with either a straight or curved-sole spokeshave (depending on the curve of the leg). If you have a compass plane, that is also an excellent choice.

You'll find that the transitions between concave and convex curves, as well as the grain direction changes in the hollows of a concave curve, pose the greatest challenges. A scraper can work wonders in these problem areas, but be aware that a scraper does not fair out the curve – it just smooths out the roughness. Don't shy away from sanding, either. A curved sanding block (made from a leg offcut) can do a terrific job on a leg that is proving difficult to smooth.

For now, leave alone the flat section where the side rails will join with the legs. Flattening this part of the legs is best done just before the mortises are cut for the side rails. And you need to complete more of the chair to determine the exact angle for these mortises.

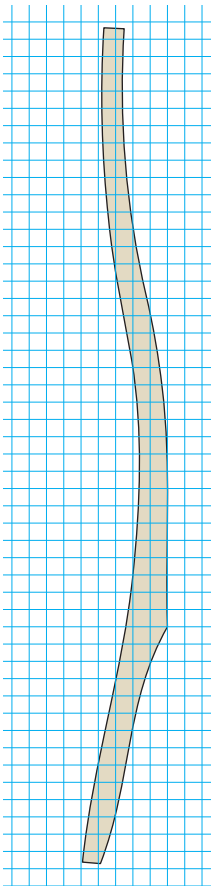
The mortises for the lower back rail are on a straight section of the leg, but aren't parallel to either the front or back of the leg. They run along the centerline of the leg. Cutting them now is a little more work, but it will make dealing with the slats later much easier. You can use a plunge router with a pair of centering pins to cut this mortise, or make up a wedge that you can clamp to the outside of the leg as a guide for routing with a fence (or with a mortising machine).

The upper back rail (the crest rail) is located on a slight curve, and runs tangent to that curve. Here, it will help to make a simple jig to control the mortise positions in the back legs. With this jig, cutting the mortises is as simple as cutting them on a straight section.

Now prepare the stock for the front legs and the rails on the rest of the chair.

While you're cutting mortises, you can do the front rail mortises in the front legs. Then, cut and fit the tenons for the front rails and the upper and lower back rails.

This will give you the actual widths for the front and the back assemblies of the chair, which you'll use to determine the side rail angle. This is the angle we'll use for the remaining mortises in the front and back legs.

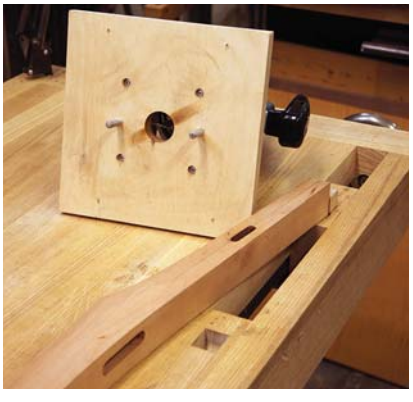


LEG PATTERN
One square = 1"

## Angled Mortises

There are many challenging aspects to building a chair, but dealing with the angled joinery ranks right at the top. And this joinery is a little more complex than some. I've opted to go with angled mortises and straight tenons with angled shoulders for this chair.

I've made these chairs with regular, right-angled through-mortises and an-

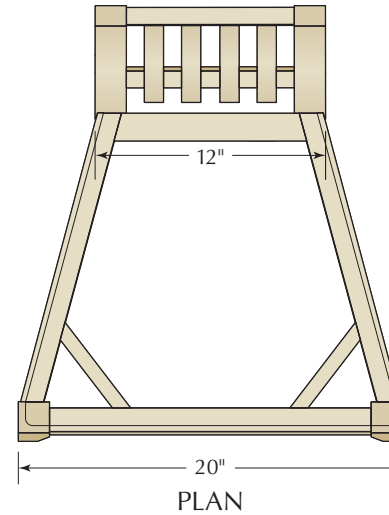


***Work from center.*** *Draw a centerline off which to locate the mortises for the lower back rail. I use a router with centering pins for the cuts.*

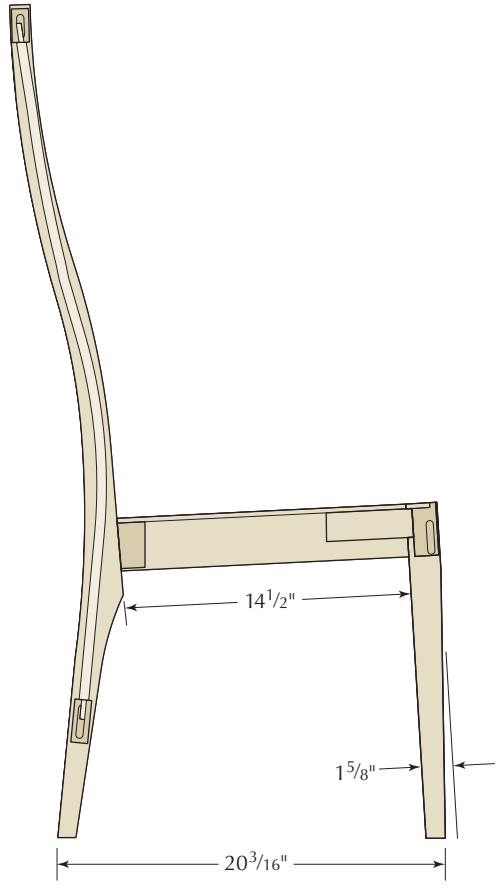
***Crest rail.*** *A simple jig to guide a router fence makes quick work of the mortises for the upper back rail.*

## Slat-back Chair

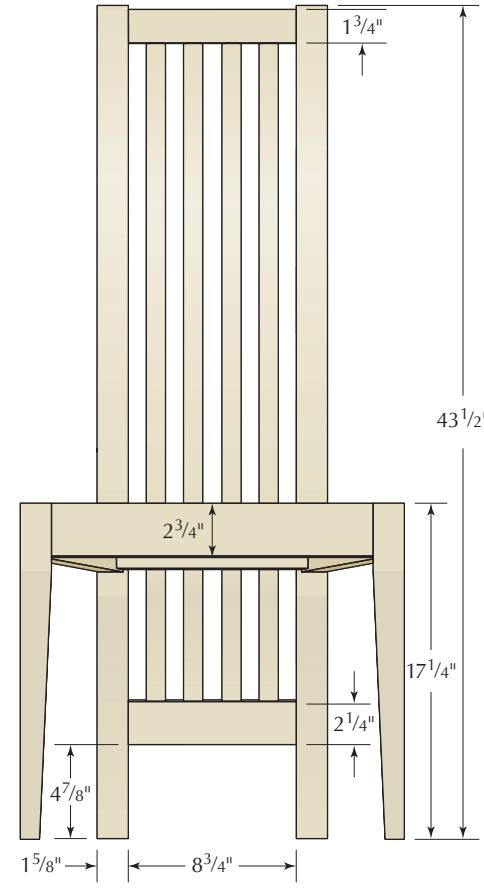
| NO. | ITEM | DIMENSIONS (INCHES) T | W | L | MATERIAL | COMMENTS |
|---|---|---|---|---|---|---|
| ❑ 2 | Back legs | 1 5/8 | 4 1/2 | 46 | Cherry | |
| ❑ 2 | Front legs | 1 5/8 | 1 5/8 | 17 1/4 | Cherry | |
| ❑ 3 | Front & side rails | 1 1/4 | 2 3/4 | 20 | Cherry | Rough lengths |
| ❑ 1 | Lower back rail | 7/8 | 2 1/4 | 12 | Cherry | Rough length |
| ❑ 1 | Crest rail | 7/8 | 1 3/4 | 12 | Cherry | |
| ❑ 1 | Seat back rail | 1 1/2 | 2 3/8 | 12 | Cherry | |
| ❑ | Slat stock | 1 1/4 | 6 | 42 | Cherry | For 4 slats |
| ❑ | Corner blocks | 1 1/4 | 2 3/8 | 12 | Hardwood | 2 pieces from stock |
| ❑ 1 | Seat | 3/8 | 20 | 20 | Plywood | |



PLAN



SECTION



ELEVATION

gled tenons in the past, but the wedged through-tenon between the back legs and side rails loosened up on a few occasions. With angled mortises, and the rail at the back of the seat screwed to the side rails, this joint gets significant additional reinforcement.

Getting a handle on this complex joinery is mostly a question of maintaining a methodical approach. Start by working out the angle for the side rails with a full-size drawing of the plan view of the chair between the legs.

Note that I'm not giving you the angle (or the length of the rail). As a chairmaker, it is better to work that out for yourself from a drawing. (See "Determining the Side Rail Angle" on page 30.)

This angle will then work for the side-rail mortises in both the front and rear legs. Save your drawing (I usually do it on a piece of plywood and set it aside). You'll need it later to determine the length of the side rails.

There are many ways to actually cut the angled mortises. The simplest approach is to hold the leg at the ap-

propriate angle, then cut however you would cut a straight mortise. This might mean making a pair of wedges (glue some sandpaper to the faces for a solid grip) for positioning the leg in a slot mortiser or hollow-chisel mortiser, or tilting the worksurface to the desired angle on a machine that has this capability. Or, you can build my router mortising jig (see "Shop-Made Mortise Jig" at right); it accommodates both angled and straight mortises, and has the advantage of allowing you to rout the flat for the side rail on the rear leg as well.

Create the 90° flat for the side rail on both of your rear legs before cutting the through-mortises. To do this, use your leg pattern to set three positioning stops to locate the legs precisely on the vertical face of the jig, aligning the flat on the pattern with the top of the hinged plywood face. Screw two of the stops to the plywood to register the front edge of the leg near the top and the bottom, and another stop to register the very bottom of the leg. This will ensure that all of the legs line up perfectly where it matters. Then rout the flat surface true, with a 1/2" straight bit or upcut spiral.

Now set the mortising jig to the desired angle with a wedge screwed into place to secure it to the jig. Install a 1/2"-diameter 4"(overall) straight bit.

Set up the router with a fence and auxiliary wood fence that will slide smoothly (without any slop) in your jig's wooden track. Then, set the fence so that the cut will be 1/8" from the outside face of the leg.

***Multi jig.*** *This simple jig guides a router fence to make quick work of the flats, and of the mortises for the side rails.*

Set stops on the top of the jig to limit the router's travel to create a 2 1/2"-long mortise.

Now plunge rout the mortise in very small increments, no more than 1/16" at a time. This will keep the router from overworking and vibrating excessively, which would give you a larger mortise.

This setup will only work for one of the legs for the chair, because the legs are symmetrical, not identical. For the opposite leg, you'll have to flip the legs end-for-end in the jig, and re-set the stops. If, however, you're making multiples, cut the mortises for all the like legs before resetting for the other side.

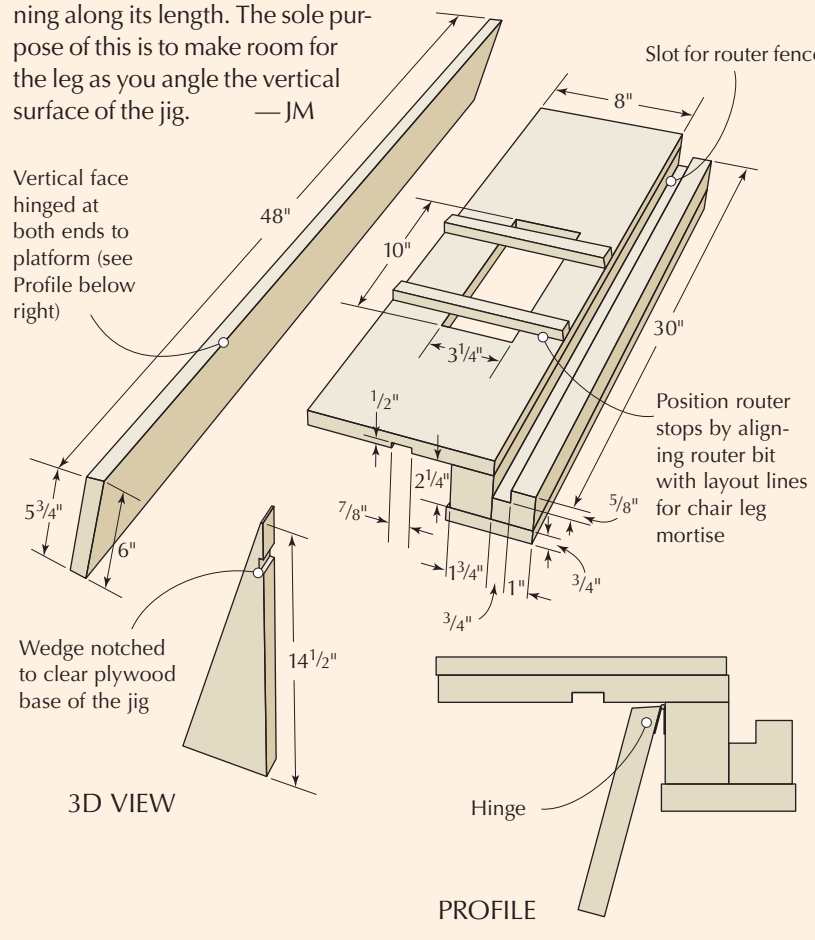
## SHOP-MADE MORTISING JIG

If you don't have a good method for cutting the angled mortises, or, for that matter, straight mortises, this jig is not a lot of trouble to build, and can do both types of mortise and cut the flat for the side rail on the rear legs as well.

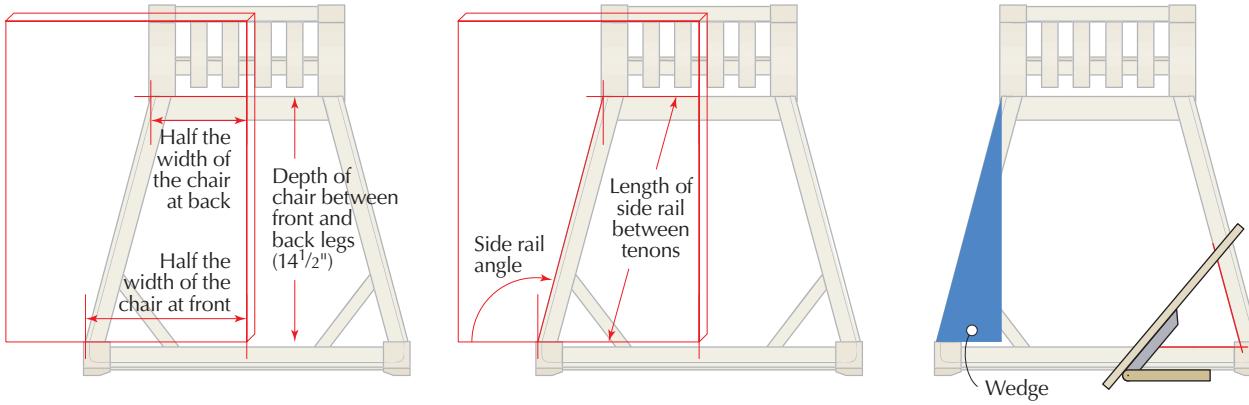
The jig allows you to hold the work in position on the vertical face while you rout. The router fence works with the track on the jig to limit the router's motion to back and forth, and the stops on the top of the jig are set to limit where and how far the router travels back and forth.

The vertical face is hinged to allow for the angled mortises we need on this chair. You can screw a wedge with the angle determined through your full-scale drawing behind the vertical face to directly transfer that angle to the jig.

The top (horizontal) surface of the jig with the large rectangular cut-out allows you to support the router fully as you mortise, but also allows you to cut the flat for the side rail on the back legs. Use the router without the fence for this operation. The underside of this horizontal surface has a dado running along its length. The sole purpose of this is to make room for the leg as you angle the vertical surface of the jig. — JM



## DETERMINING THE SIDE RAIL ANGLE & CORNER BLOCK LAYOUT




The angled mortises in the front legs are easy once you've set up for the backs. Simply rout the 3/8" angled mortises to roughly 1 3/16" deep (measured on the shallower side of the mortise). Don't forget that here, as with the back legs, the right and left legs are symmetrical, but require a mirror-image set up.

Once you've cut the mortises, you can move on to tapering the front legs. What I do here is not at all standard.

Taper the two front-facing sides of the legs first, down to 1" at the bottom. This looks better to my eye than the usual taper on the inside (rear-facing) sides. The two sides of the front legs that face each other get a taper that starts about 3 1/4" down from the top of the leg, and once again tapers down to 1" at the bottom. Leave the flat area around the mortise untouched.

### Side Rail Tenons

The side rails start out easily enough. After dimensioning the material (see the cutlist for sizes), cut 2"straight tenons however you usually cut your tenons.

Angling the shoulders gets a little more complicated, though. There are ways to start this process and at least score the shoulders on some machines using a wedge, but this is actually much simpler as handwork. You can simply scribe the angles and cut to your lines. But the easiest way to deal with these shoulders is to use a tenoning frame and chairmaker's saw. (I wrote about how to make this appliance and saw in the February 2014 issue (#209) of *Popular Woodworking Magazine*).

Use the wedge from the mortising jig, or make up one to the side-rail angle you determined with your full-scale drawing, then simply saw your shoulders all the way around the rail. Remove the wood up to the angled shoulders with a handsaw and router plane. Round the ends of the tenons if necessary to fit routed mortises, or leave them square if you've used a hollow-chisel mortiser.

The length of the side rail is as important as the angle, so you need to work through finding this length methodically. Start by cutting the tenons on the backs of the side rails, then cut and fit the angled shoulders. Now measure the length of the angled line you drew to determine the angle of the side rails. Because the layout of this line is based on the distance between the front and back legs on the chair, it should give you an accurate measurement (if you transferred the angle accurately). Measure this distance on the outside face of the side rail, then mark the angled shoulder location.

Before you move on to cutting anything, double-check to be sure that this distance is correct. Dry-assemble the back legs and rails with the side rails, and the front legs and rail. Now hold the front leg assembly up to the shoulder marks on your side rails to see where the rails will intersect the front legs.

There should be a 1/16" reveal between the side rails and the front legs. If things don't line up properly, move the front assembly in or out parallel to the back until you find the proper place, then re-mark your angled shoulders.

Add enough length for your tenon and cut the rail to size. Now you can cut a straight tenon on the end sized to fit the leg mortise, and set up to cut the angled shoulders along the marked line.

Cut the beveled ends of the seat-back rail on the table saw, either using a wedge (the same one from the mortising jig) or by angling the blade. Check the fit carefully, then drill pocket holes on the inside face of the rail for attaching to the side rails. There's no need to install this rail now.

***Angled shoulders.*** *A "chairmaker's saw" makes quick work of cutting accurate angled shoulders.*

***Trust, but verify.*** *It's best to double-check your measurements by doing a dry-fit of the back legs and rails, then showing the dry-fit front-leg assembly to the side rails.*

This completes the joinery for the chair's frame.

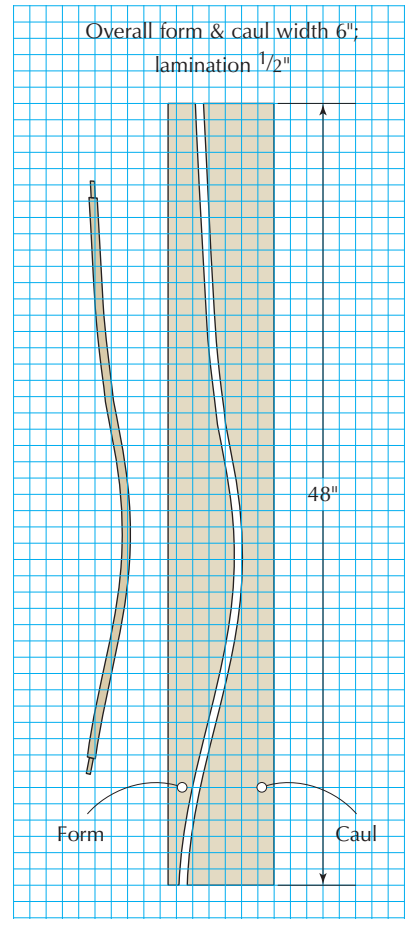
## Curve Creation

The slats, which form the chair's back and run almost to the floor, are laminated for strength; cutting them out of solid stock would invariably lead to short-grain sections that would be very fragile. Lamination is the best approach.

Begin by making a lamination form and caul (though you can skip the caul and make a wider form capable of gluing up four or more slats at once if you have a vacuum press). Enlarge the form shape from the Slat Form Pattern (above center) and copy it onto a piece of ¾" plywood or MDF roughly 6½" x 48" (4½" x 48" if you don't need the caul). Cut out the form on the band saw, then smooth carefully to your line. Now trace this curve onto a second layer of plywood, and cut this one out as well. Glue and screw the two layers together, flush-trim the new layer to the smoothed curve, then sand the two smooth.

If you're making a form for a vacuum press, you should repeat this process until your form is at least 5¼" wide (seven layers). If you'll be clamping your laminations, it's time to switch over to making the caul.

You can use the wood left over from




SLAT FORM PATTERN

One square = 1"

cutting the form to make the caul, but you can't just use it as-is. Instead, you'll need to create the caul shape by offsetting ½" from the form. The easiest way to do this is to use a small disc with a hole in the center exactly ½" away from the edge of the disc. An adjustable hole saw (also known as a fly cutter) set in the drill press works well to make this disc. Sets of these offset discs are also available for sale (Lee Valley). You can then insert a pencil into the hole in the disc, roll the disc along the curve of the form, and draw the exact shape of the form. Cut this out, smooth to the line, and duplicate a second layer as you did for the form.

Now mark a reference line across the bottom of the form 5" up from the end. This line will help you locate the lumbar curve in the right place on the chair. Because this reference line does not include the tenon in the lower back rail, you need to be sure to locate your slat laminae at least 1" below the line when you glue up. Wax your form and caul thoroughly, or add a layer of plastic packing tape to the clamping surfaces so you don't glue your slats to the form.

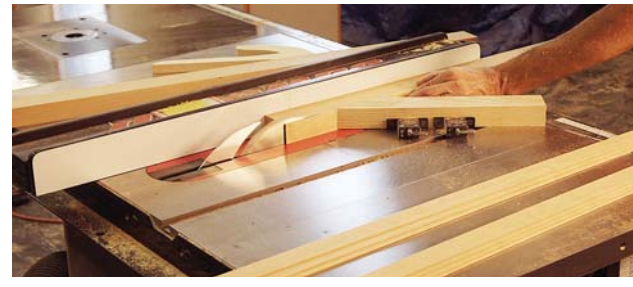
## Cut Lamination Strips

Select a flat-sawn 1¼" x 6" x 40" board from which to cut the lamination strips. Rip the board into two pieces of identical width, then mark two distinctly different layout triangles on the faces of these boards.

Now set up your table saw for ripping ⅛" strips – but it's not safe to simply set the fence to ⅛" and rip; you'll likely experience some nasty kick-back if you try. Instead, set the rip fence to take off ⅛" to the outside of the blade. You'll get cleaner results and be safer if you set a featherboard just ahead of the blade to help hold the stock against the fence. Don't let the featherboard press the strip against the blade or it will cause trouble.

Rip both your boards at the same setting, pushing the boards through with a push stick. Set the strips aside, starting a separate pile for the strips from each board. Then reset the fence. Add ⅛" (the desired thickness of the strips) to the exact thickness of the blade to determine how much to move the blade each time.

Rip the next pair of strips, add the strips to the appropriate pile, and re-



***Thin rips.*** *To safely cut these ⅛" lamination strips, cut to the outside of the blade and use a featherboard to help hold the stock in place just before it contacts the blade.*

peat until you've got the 16 strips you need. Do not attempt to rip strips out of a board narrower than 1/2".

## Slat Glue-up

I use plastic resin glue when I have laminations of this sort to do. The glue forms a very hard and rigid bond that allows for little, if any, spring-back. Mix up the glue according to the directions, and spread it on three of the strips using a foam paint roller.

Stack the three glued strips, add the fourth strip, then place the slat in the form (see images at right).

Leave the lamination clamped up for at least 12 hours, maintaining a temperature of at least 70° F. (I use a cheap electric blanket to keep the glue-up warm in the winter.) Then remove the slat and repeat. In a vacuum press on a wider form, you should be able to glue up all four slats at once.

The only decent way to clean up these slats is to run the edge over your jointer (exercise great care; the slat is narrow) and then through your planer. The glue will not be kind to your knives. Clean up the slats to 15/16" wide. Then plane, scrape or sand every face.

## Slat Mortises

It is stronger (and a little easier) to mortise the rails for the whole slat than it is to cut tenons on the ends of the slats, then cut smaller mortises. You'll have to be careful, though, to avoid leaving gaps around the slats where they go into the rails. It helps if you can cut the mortises slightly undersized, then plane the slats to fit.

Lay out the mortise locations centered in the width of both the top and bottom rails, then cut them. If you rout the mortises, you'll need to carefully pare the corners square. (If you use a hollow-chisel mortiser, you may also need to pare the edges clean.)

The curve of the slats should be roughly aligned with the curve of the rear legs. The 5" mark on the bending form should help you to position them correctly. Be sure to add whatever length you need for the insertion of the slats into the lower rail mortises.

You'll need to insert the lower back and crest rails into one of the legs to determine the overall length for the slats. They should fit to the bottom of the mortises. Be sure that each of the slats is cut in the same way so the shapes match when installed; it can be confusing because the curve is not quite symmetrical.

Fit each slat to its mortise, and mark each for location as soon as each is ready.

Dry-assemble the chair to ensure everything fits, and make adjustments as necessary. Mark where the side rail tenons come through the back legs and cut off the excess, leaving 1/16" to 1/8" beyond the marks. You'll flush this off after you glue up the chair.

Before you can glue up the chair, you need to rabbet the tops of the front and side rails for the seat blank. The front rail is easy, and can be done on the table saw. But you'll need to avoid cutting into the tenons on the back of the side rails. Use a router table for this, or make stopped cuts on the table saw, then follow up with handwork to clean up the uncut parts of the rabbets.

Finally, cut kerfs in the ends of the rear side-rail tenons for the wedges, and make up a bunch of wedges.

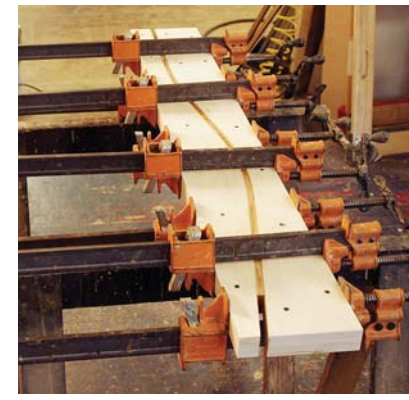
## Chair Assembly

Complicated glue-ups are no fun at all – and this chair is pretty complicated. So gluing up in stages makes sense. Working on manageable subassemblies takes most of the stress out of the process, as well as many of the clamps.

The angled mortises make it very difficult to fit the side rails into place if the front and back are already to-

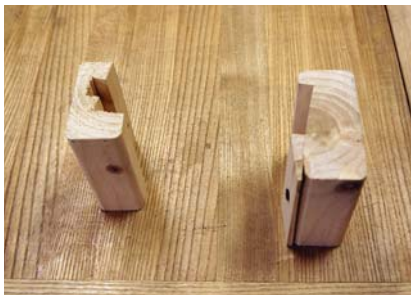
> "When tools were rude, great precision and nicety of finish could not be expected. To return to the crude joints of our ancestors would be a distinctly retrograde move."
>
> *—David Denning, from "The Arts & Craft of Cabinetmaking" (1891)*

***Roll away.*** *I find it easy and efficient to apply glue with a roller three strips at once before placing the fourth strip of each back slat atop the sandwich. Stack up the three glued strips and add the fourth strip of the set. Place the bundle between the form and caul and clamp up, spacing your clamps about every 6" and placing clamps alternately on the top and bottom.*



***Pressed into shape.*** *The bending form and caul capture the laminations as the glue dries. Place clamps alternating top and bottom every 6", then let the glue dry for at least 12 hours.*

***Sucked into shape.*** *If you have a vacuum press, make an at-least 5 1/4"-wide form and you can glue up all four laminated slats at once.*



***Glue-up help.*** *Make a set of cauls to cradle the leg-to-side-rail subassemblies. They'll allow you to place the clamps without marring the wood.*

***Listen carefully.*** *The sound of your tapping will change to a duller tone when you've got the wedges in all the way.*

gether. It is possible, but it will be nerve-wracking (don't ask me how I know this). It makes much more sense to glue the front and back legs to each of the side rails first. You'll need to make up a set of cauls to clamp this subassembly together effectively and without marring the legs.

You'll also want to get your wedges for the tenons, and have a small hammer ready.

Spread enough glue in the mortises to wet the side walls, but not so much that the glue drips and pools at the bottom of the mortise. Then, spread glue very lightly on the tenons (it should look like you wiped off the glue you applied) and insert them into the mortises. Put your cauls in place and clamp up tight.

Wait a minute for the glue to tack up, and then remove the clamps and clamp the rail in a vise. Spread some glue on your wedges and carefully tap them in until they are fully seated.

Then put your cauls and clamps back on and let the side assembly sit until the glue is set.

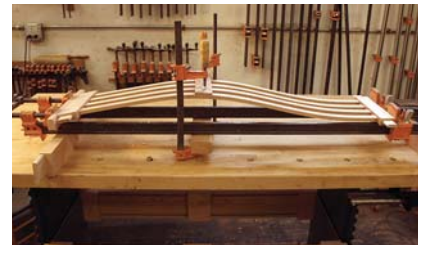
The back rails and slats are next. This time, spread glue very lightly just in the mortises; don't put glue on the ends of the slats. You don't want glue squeezing out all over the place, and in any event, these joints are completely captured. If the slats don't seat all the way, you can clamp from the top to the bottom rail to pull things tight.

Make an angled caul for the lower back rail. You'll also need to clamp a block across the top of the slats and another block below the clamps that spans them to prevent clamp pressure from simply bending the slats, as shown in the picture below at bottom. (Once the slats are fully seated, you should no longer need any of these clamps.)

Check the fit of the back slat and rail assembly in the back legs. If your slat lengths were off a little bit, you'll find that the tenons on the rails no longer line up with the mortises in the legs. You can take just a little bit off the tenons on the rails to compensate.

The final assembly requires only three clamps: one for the clamping the front legs to the front rail, and one each across the back legs at the crest rail and lower back rail. Spread glue in the mortises and lightly on the tenons, put the chair together and clamp. Leave the chair in clamps to dry fully.

***Reclamp.*** *With the wedges seated, put the sub assembly back in clamps and wait for the glue to dry.*



***Clamp the back.*** *Note the angled caul for the lower back rail, as well as the two cauls at the apex of the bend. The clamps there keep the slats in proper alignment.*

## Finishing Touches

It seems like you're about done at this point, though there are plenty of little details that still need to be taken care of. But it's worth taking a moment to savor what's happened thus far. You might even want to find a scrap of plywood big enough to use as a temporary seat and try out your chair. But then it's back to work.

Once the clamps are all off, you'll need to deal with the through-tenons of the side rails. Saw off the wedges, but keep clear of the leg surface. You can clean the tenon up further with a combination of spokeshave, scraper and sandpaper.

Next up is cutting away the inside of the tops of the front legs to complete the recess for the slip seat. Rout away the bulk of the wood using a trim router with a 1/4" straight bit, and finish up with chisels and a gouge for the curved corner. If you're building a set of chairs, you might want to make a pattern, clamp it in place and use that

***Almost there.*** *With the subassemblies dry, the chair can be clamped together.*

***Careful now.*** *Avoid marring the leg surface as you flush the wedges.*

***Seat recess.*** *A trim router with a 1/4" straight bit makes quick work of the bulk of seat recess waste atop the legs.*

to guide your router so the seat recesses all match.

Screw the seat-back rail into place.

The front of the chair needs corner blocks. To determine their exact angle, extend the lines of the inside edges of the rails until they intersect, as shown in the third illustration on page 30. Then measure with a ruler or a set of dividers about 6" out along both of the rails. Hold a straightedge up to these marks, then set this angle on a bevel gauge. Set your table saw blade to this angle, and cut your corner blocks using a miter gauge. A fence that extends across the blade will help make this a safer cut.

Then drill countersunk pilot holes for four screws that will attach each corner block to the rails. Drill a 3/16" hole through from the top to the bottom edge, which you'll use for bolting the seat onto the chair. Counterbore this hole from the bottom of the corner block with a 1/2" drill for the washer and bolt head. (I usually don't attach the corner blocks until after applying finish to the chair; it's just easier to finish when they're not in the way.)

The slip seat is a piece of 3/8" plywood (don't use MDF here). Cut the front-to-back dimension first. You want to leave roughly 3/32" of space (this will vary based on the thickness of your upholstery fabric) between the seat blank and the lip of the seat rails and back legs.

Clamp the still-oversized blank to the top of the chair, and trace around the outside of the side rails. Then offset this line in the thickness of the lip on the side rail plus 3/32". Cut to this line, then check the fit of the seat blank in the chair. Adjust the curve at the front corners to leave an even gap there as well. Once you've made one seat blank, you should just be able to duplicate it for the rest of a set.

***On the level.*** *If your legs are close to level, simply rub the longest one over rough sandpaper to adjust it to perfection.*

Once again, place the seat blank in position and clamp in place. Drill up through the holes in the front corner blocks. Remove the seat blank and pound #8-32 T-nuts into the top holes on the top of the seat.

Set the chair frame on a flat surface – I use the table saw – and check to see if the legs sit flat on the table. If you've got just a little bit of correcting to do, take a sheet of heavy-duty sandpaper and place it under one of the longer legs. Hold the leg with one hand and pull the sandpaper out from under the leg with the other. Check the results and repeat as necessary.

If things are really off, you should shim the chair level then scribe around the legs using a small spacer block and a knife. Then cut the legs off to your lines.

Chamfer the bottom corners of the legs, then hammer in some glides. The glides will protect both the bottom of the legs and your floor from damage.

If you're comfortable upholstering the seat yourself, go for it. I prefer to leave that to an expert, and simply bring my chair, seat blank and fabric to a local upholsterer and ask for a thin layer of dense foam, another layer of softer foam, and a layer of cotton batting over the top.

Now it's time to have seat and enjoy your comfortable and stylish new chair. **PWM**

---

*Jeff builds furniture and teaches woodworking from his shop in Chicago.*

## ONLINE EXTRAS

*For links to all online extras, go to:*

- popularwoodworking.com/oct15

**BLOG:** *Visit Jeff Miller's blog and web site.*

**WEB SITE:** *Sign up for one of Jeff's classes at his shop in Chicago.*

**TO BUY:** *Get Jeff's new video: "Design & Techniques for Curvy Furniture."*

**IN OUR STORE:** *Jeff's book and DVD, "The Foundations of Better Woodworking."*

*Our products are available online at:*

- ShopWoodworking.com

# Drawer Slips

BY GEREMY COY

An historical detail adds refinement to projects both period and modern.

The 18th century – a time when human hands were set to work in order to create the objects of material culture; when men and women by their sweat and ingenuity wrought wares in the latest fashions; when the cabinetmaker, toiling away in dusty corners of the world, rode at the vanguard of improvement and progress.

Over the course of that century, anonymous workers of wood trained their planes and chisels on many problems, perhaps none so unassumingly complex as that of making drawers. Their search for elegant and durable methods of affixing bottoms, in particular, led them to one of the final developments in the art of crafting fine drawers by hand: slips.

Drawer slips – slender pieces of wood glued to the sides of a drawer and grooved to accept the bottom – have remained largely mysterious, especially to those of us on American shores. But the time has come for the light of history to shine once again on these milestones of human thought and hallmarks of careful craftsmanship.

## In the Beginning

The earliest drawer bottoms were little more than boards nailed to the underside of boxes. This arrangement was perfectly satisfactory, as drawers did not ride upon their bottoms. Instead, grooves plowed into their thick sides engaged with guides attached to the surrounding case.

As time passed, new types of lumber were made available, novel forms of furniture emerged, and fashion began to dictate slimmer drawer components.

English cabinetmakers abandoned the exterior groove, instead designing cases in which drawers rode directly on their bottoms. But the bottoms wore and nails loosened, compromising the integrity of both drawer and case. Something needed to be done.

In particular, the drawer bottom needed to be raised. The most straightforward solution was to affix slender pieces of wood underneath the bottom and sides. These runners, sometimes referred to as "slips" (though of a different sort than the subject of this article), were usually applied with glue

PHOTOS BY THE AUTHOR

and could be easily replaced. The whole arrangement appeared awkward, however, and was sufficiently unsound that further experiments were warranted.

A breakthrough came in the 1720s. Rabbets were cut into the lower, interior edges of the sides and front, allowing both the drawer bottom and runner to be tucked neatly within the confines of the drawer. It was a remarkable achievement in construction. The bottom and runners were stabilized within the rabbets, the runners were still easily replaceable, and, with a nod to appearance, the entire assembly was now hidden from view.

One weakness remained, however: the bottom was fixed in place, unable to shrink and swell with the seasons. Though rabbets-and-runners remained the dominant form of attaching drawer bottoms through decades worth of cyclical expansion and contraction, the inevitable splitting of bottom boards called for more ingenious ways forward.

## Slips Onto the Scene

References to slips began to appear in print by 1788, when the first edition of the "Cabinet-makers London Book of Prices" included a succinct entry for "slipping drawers." Later editions of the same work (1793 and 1803) offered more detail in proposing prices for "slipping drawer sides and plowing in bottoms."

A definitive description of drawer slips was not published until 1803, when the following appeared in Thomas Sheraton's "The Cabinet Dictionary:"

"Slips are sometimes glued on the inside of drawers, and plained [sic] to receive the bottom, which is the best method for preventing drawer bottoms from splitting, as is too often the case when they are confined by a rabbet, and the slip is glued down at the under side."

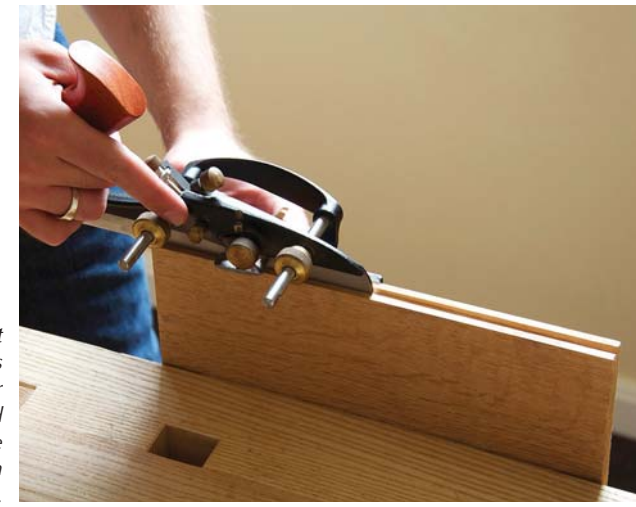
Ten years later, Thomas Martin cribbed Sheraton's definition for his "Circle of the Mechanical Arts," an appropriation repeated by Peter Nicholson in his "Practical Carpentry, Joinery, and Cabinet-making" of 1826. Nicholson, at least, elaborated on the reasoning behind the use of slips:

"Drawers made of unseasoned wood, break at the joints: to prevent this, slips are sometimes glued on the inside of drawer-sides or ends, and these are grooved to receive the bottom, and the upper edge rounded; this is esteemed the best method for preventing drawer-bottoms from splitting…."

It is notable that these early chroniclers mention only that slips were employed to avoid split bottoms. This may have been the real problem that spurred period makers to action. Sensing that drawer bottoms would be able to more freely expand and contract in a groove than in a rabbet, they discovered a clever way to retain the best features of earlier systems – an elevated bottom and wide bearing surfaces – while leaving the bottom free to move, even in the thinnest of drawer sides.

This discovery almost assuredly took place in England, where a preference for slipped drawers in bespoke work persists to this day. The English taste for thin drawers never made its way across the Atlantic, where thick sides in softer woods have long been more common. Because slips were likely developed at a time when England's influence in this country was waning, using rabbets-and-runners and plowing grooves directly into thick sides remained the standard methods of attaching bottoms for American cabinetmakers.

"Don't fear slow, only fear stop."
—*Chinese saying*



***Plow slips, not drawers.*** *Grooves to accept a drawer bottom are plowed into the edge of a wide board, which will then be cut into narrow slips.*

## Make Your Own

In examining how slips are made, it's natural to begin with the rounded version, generally regarded as the earliest form.

First, prepare the front, back and sides of a drawer in the usual manner. Lay out the dovetails in front, keeping in mind that despite using slips along the sides, the drawer front must still receive a 1/4" x 1/4" groove to support the bottom. Therefore, plan to cover the groove with a full or half tail.

With the drawer box assembled, prepare a board from which to cut the slips. It should be longer than the drawer sides and wide enough to produce several slips (which also makes it easy to hold in a vise). Its thickness should be equal to the height of the slips, plus an extra 1/64" or so for trimming. In practice, the position of the groove in the drawer front determines the finished height of the slips, because each slip must bear a corresponding groove in its inner face. Also, enough wood must remain to support the bottom; 3/16" above and below the groove is a good compromise between strength and appearance.

Secure the board, square the upper edge and plow a 3/16"-deep groove a hair more than 3/16" from the reference face. This slight addition will allow the slip to project from the drawer side so that it may be planed perfectly flush after gluing.

Plane the upper, interior edge of the future slip into a series of long facets,

***A slip is born.*** *After its groove is plowed and top edge shaped, each slip is marked for width and sawed free.*

***Clean-up work.*** *The back of each slip is planed to remove saw marks and to square up its gluing surface.*

***Two slips, two tenons.*** *Small tenons are formed on the front ends of a round slip (left) and a flush slip (right).*

***Perfect mate.*** *The round slip's small tenon fits into a groove in the drawer front, making alignment during glue up a cinch.*

blending them with light passes to arrive at a final rounded shape. Referencing from the grooved edge, scribe the width of the slip on both faces of the board. Saw just outside the line, and plane the resulting slip down to its finished width.

Prepare the slip to meet the drawer front and back. First, cut a small tenon at the front end. Mark a shoulder line 1/4" from the end, and saw away the material above and below the groove. The resulting tenon is a positive version of the groove's negative space and should register neatly with the drawer front.

Next, form a notch at the top rear of the slip. Its depth is equal to the amount of material above the groove, which allows the top of the groove and the bottom of the drawer back to align.

***Notch in rear.*** *Round slips are notched to pass under the drawer back and to align their grooves with the back's bottom edge.*

***Make it proud.*** *Affixing a slip to protrude slightly below the drawer side allows you to plane it perfectly flush after gluing.*

Butt the shoulder of the slip's tenon against the back of the drawer front and scribe where the rear of the slip meets the inside and outside of the drawer back. Transfer the latter mark around the entire slip, and cut and plane it to length. Use the inside mark to square across the top of the slip, then transfer it down both vertical faces to the top of the groove. Saw and pare away the waste above the groove.

All that remains is to glue the slips in place, clamping to ensure solid contact along their entire length.

## Modern Styling

Flush slips are so named because the top surface of the drawer bottom sits flush with the top surface of the slips – a look that appeals to more modern sensibilities. In order to achieve this, the sides of the drawer bottom must be rabbeted along their top edges, and the lower, front edge of the bottom rabbeted to fit a groove plowed higher up the drawer front.

After plowing a 3/16"-wide x 1/4"-deep groove in each slip, cut a tenon on one end. This time, square across the bot-

***Layered grooves.*** *The groove in the drawer front accepts a flush slip's tenon and eventually, the rabbeted front edge of the drawer bottom. The bottom's rabbeted sides slide into grooves in the slip.*

***No measuring.*** *With the slip firmly seated against the drawer front, mark its finished length directly from the back of the drawer.*

***Offset rabbets.*** *Flush slips require a specially shaped bottom; it is first rabbeted along the top of one side, flipped over, then rabbeted again along the front edge.*

***Rabbets, meet slips.*** *To ensure a clean fit, the shoulder of the first side rabbet is pressed against a slip while the second rabbet's shoulder is scribed directly from the other slip.*

***Sliding home.*** *Flush slips support a drawer bottom along its sides, while a groove in the drawer front receives the bottom's rabbeted front edge.*

***Behind the scenes.*** *A view of the back of a drawer reveals the profile of a flush slip and a rabbeted bottom.*

tom face of the slip 1/4" from the front end, and transfer the mark up the vertical faces to the top of the groove. Saw out this lower portion, then repeat for the other slip.

Because flush slips simply butt against the underside of the drawer back, they don't require a notch at rear.

Seat the tenons into the groove in the drawer front, mark and cut the slips to length, and glue them to the drawer sides.

Now make the rabbeted drawer bottom. First, cut a rabbet into the top of one side. The rabbet's depth should be the distance from the top of the slip to the top of the slip's groove and its width identical to the depth of the grooves. Next, cut a rabbet into the lower front edge of the drawer bottom. Its width is again equal to the depth of the grooves, but this time its depth should be the distance from the bottom of the slips' grooves to the bottom of the groove in the drawer front.

Set the drawer box on top of the partially rabbeted bottom, pressing the shoulder of the side rabbet against its corresponding slip. Scribe a line where the bottom meets the other slip; this establishes the edge of the second side's rabbet. Cut the rabbet into the top edge of the second side to the appropriate depth.

The bottom should now slide in from the rear, its top surface butting against the bottom edge of the drawer back, its sides engaging with the grooved slips and its leading edge ultimately entering the groove in the drawer front.

***Face first.*** *To simplify the fitting of mitered slips, glue the front slip in place before mitering and notching the side ones.*

***Get in the grooves.*** *A small scrap of wood planed to perfectly fit the grooves of mitered slips guarantees that they'll be aligned after glue up.*

## Another Angle

Mitered slips are perhaps the easiest version to make. Because they do not require a groove in the drawer front, they involve much less initial planning and make laying out symmetrical dovetails a straightforward affair.

Start by preparing a grooved slip for the front of the drawer. Miter both ends to fit snugly between the drawer sides, profile the top edge to your liking, and glue the slip in place. Next, miter one end of each side slip, press it against the corresponding miter at the front, and mark for length and notching. As in their rounded brethren, the top of the groove in mitered slips should align with the bottom of the drawer back. Cut the notches accordingly, profile the top edges to match the front slip, and glue the side slips to the drawer.

## Worth the Effort

Slips do require a bit of extra effort, but as symbols of attentive and thoughtful work, they imbue meaning even to parts normally hidden from view. They evoke, too, the spirit of cabinetmakers past who, through decades of experimentation, wrestled with the intangible forces of weight and wear and the seasonal expansion of wood to produce a tradition of small boxes capable of great endurance and subtle beauty.

Given the vast scale of industry and manufacture governing our era, it is now rare for those devoted to the intimacy of craft to effect such widely influential change. But for those of us engaged in making fine things out of wood, quiet moments of pride at having done the simple things well and beautifully – slipping drawer bottoms, for instance – often prove satisfaction enough. **PWM**

***Mitered underbelly.*** *A drawer front, drawer side and two mitered slips combine to form a seemingly complex joint.*

***Beauty & brawn.*** *Whether round (left), flush (middle), or mitered (right), slips provide plenty of wearing surface to thin drawer sides while supporting bottoms in expansion-friendly grooves.*

*Geremy designs and makes furniture by hand in Alexandria, Va. His web site is geremycoy.com.*

## ONLINE EXTRAS

*For links to all online extras, go to:*

- **popularwoodworking.com/oct15**

WEB SITE: *Visit the author's web site for a look at his work and photography.*

ARTICLE: *Read "Four Good Ways to Make Drawers," if slips aren't your style.*

IN OUR STORE: *Get the June 2015 issue for step-by-step instruction from Geremy Coy on building a "Sideboard fit for Tea."*

TO BUY: *"Building a Classic Drawer with Alan Turner," available on DVD or as a download.*

*Our products are available online at:*

- **ShopWoodworking.com**


# Tool Chest as Art

BY JAMEEL ABRAHAM

## An embellished lid is your woodworking calling card.

Embellished tool chests are perhaps the quintessential calling card of the cabinetmaker. From Benjamin Seaton's mahogany and tulipwood masterpiece to the unequalled work of Henry Studley, we woodworkers tend to pull out all the stops when we decorate our chests.

I'm convinced that the old timers built as much for their own eyes as their customers'. And because I don't build furniture for a living, I designed this chest lid for me, with its inlaid dividers, dovetail saw and crossed chisels. A sort

***High-class ply.*** *Like a good sandwich, the best plywood is homemade. Make sure you alternate each layer at 90°.*

of coat of arms for the battle against cheap furniture. With that in mind I ask you, "are you ready for a war?"

## The Foundation

Typical chest lids are constructed either of a solid panel framed by a narrow dust seal, or by a smaller panel or two and wider, more substantial frame members to help keep the lid flat and isolate wood movement. I wanted as much real estate as possible for my embellishments, so a solid lid with a narrow dust seal would be ideal.

To get the stability needed, there is only one option for quality work: lumber-core plywood. This product has all but vanished from lumberyards, so I made my own with the best materials.

Lumber core has the same basic structure as any plywood: an odd number of layers with grain running perpendicular in each layer. But the core is thicker in a lumber-core panel, so you can work it and attach hardware to it like a solid-wood panel.

For the core I used mahogany, which I glued up from three boards, each about 6" wide. It's pretty easy to get quartered mahogany in these widths, but any quartered, mild-grain wood will work.

Onto each face of this core, glue a layer of 1/16"-thick veneer or two alternating layers of typical thinner veneer (always glue both sides of the panel at once), orienting the grain at 90° to the layer it's glued to.

I made the panel about 3/4" larger in length and width than the final size. Final thickness is not so critical. My completed lid finished out around 7/8".

## The Sunburst

To lay out the sunburst, draw a circle in the middle of the lid, then, using dividers, walk off as many rays as you'd like. Next, strike lines through the center point of the circle to the edge of the lid. Mine has 56 rays. That sounds like a lot, but once they get to the edge of the panel, they end up quite wide.

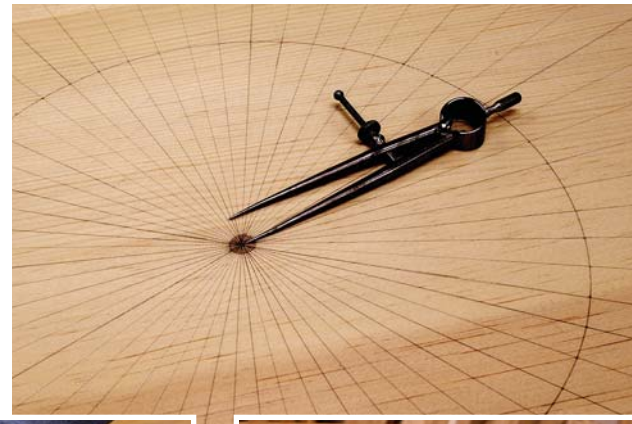
I didn't want the rays to jump out too much, so I used woods that were close in value: bird's-eye maple and quartered beech. I resawed these from one board so the grain matched.

Slice each ray at just over 1/16" thick. Cut more material than you think you'll need, then cut some more. You will ruin some.

To cut the rays to shape, first shoot one edge straight and square. My shooting board is ramped to use more of the plane's iron. The board runs uphill so the action of the plane forces the thin ray down onto the board, which is also faced with self-adhesive sandpaper to keep the rays from slipping. A stop at the end keeps the rays from shifting forward. To use the shooting board, extend the edge of the ray over the ramp and plane the edge. The plane's sole doesn't ride against the edge of the ramp.

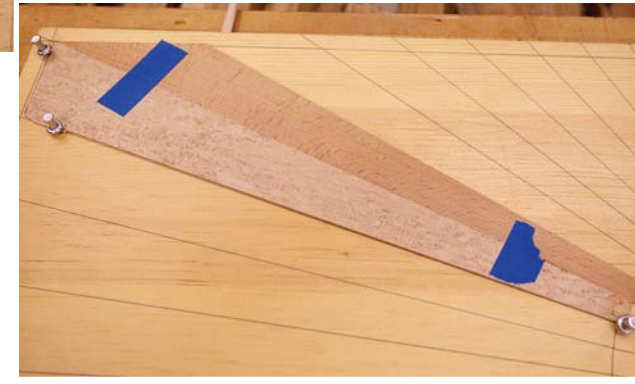
Now lay out the ray's shape using the lines on the lid, cut close to the line and to length, then plane the tapered edge precisely on the shooting board. Secure the first ray on the lid with push pins, then move onto the next ray, taping each to its mate as you progress.

Fitting the rays one edge at a time



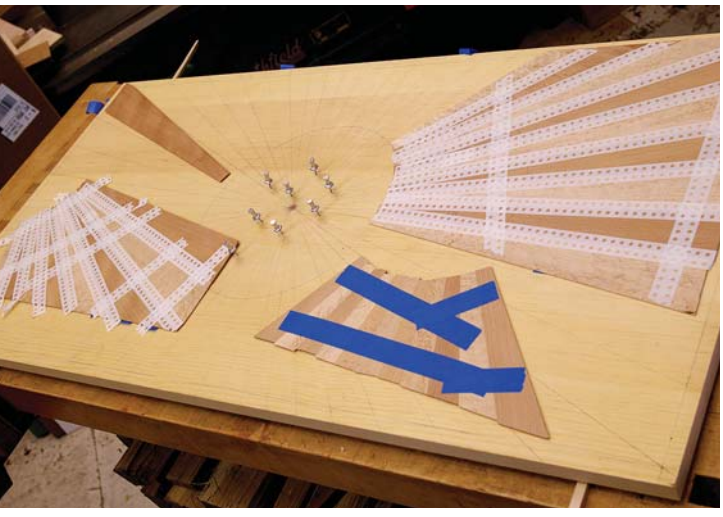
***Divide & conquer.*** *One tool is all it takes to lay out the sunburst.*

***Arrow-straight.*** *A ramped shooting board is used to present the edge of the rays to more of the plane's iron. This keeps your plane sharper longer by spreading the wear on the blade.*



***One by one.*** *Fit the rays' edges precisely, but keep the narrow end long. The wide end gets trimmed later when installing the crossbanding.*

OPENING PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR



***Sectioned off.*** *Assemble a few rays at a time, then assemble each section into the final sunburst. This helps keep you sane.*

***Here comes the fun.*** *And it's all right. Smooth-planing the sunburst is the first really satisfying moment of the process.*

allows a bit of wiggle room. If you're off a tad on one ray, make up for it on the next one. When you get to the last ray, fit each edge precisely, but leave the ray extra long and separate from the others.

The rays are edge-glued before gluing them to the panel. Number the rays in sequence and, using a pencil, draw a light line that crosses each ray all around the sunburst. This will help you align each section during assembly.

Separate the sunburst into sections of about eight rays. Flip over each section and tape the rays together. Now flip it back over and remove the small pieces of tape you used to join each ray. Replace these with veneer tape along each joint. Once the veneer tape is dry, flip the section over again and remove the masking tape.

To glue each section, fold open the rays one by one to expose the joint, run a small bead of glue, then do the next joint. Clean any squeeze-out, then lay the section flat between a couple of pieces of MDF or plywood and put a weight on it. Line the MDF with packing tape or waxed paper so the glue doesn't stick.

With all the rays glued and cured, glue each section together the same way. Check the fit of all them together before gluing. You can tweak the fit by shooting the edges of the sections.

Finally, the last oversized ray is fit. It will need to be refit because the glue thickness, multiplied over 56 joints, has slightly changed the shape of the sunburst. Once fit, glue both edges and tape it into position. Don't force it in too tight, or you'll cause the whole sunburst to buckle like a potato chip. After it cures, scrape off any dried glue, then glue it to the plywood panel, along with the outside veneer (mine is sugar pine). After the glue cures, smooth-plane the sunburst.

## Crossbanding & Medallion

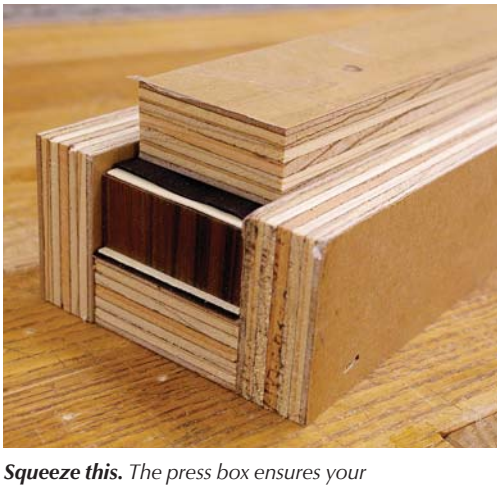
To make the Macassar ebony crossbanding, cut slices from the end of a board about 5/8" thick, then sandwich these between double layers of holly and black-dyed veneer. Make sure the blank is longer than the longest run of banding on the lid. Glue them together in a "press box" made from plywood. I line the inside of the press with packing tape so the glue doesn't stick. Because the ebony glue surface is all end grain, use epoxy. When the glue is cured, saw strips from the edge of the blank just a bit thicker than the sunburst.

To fit the banding, cut a shallow rabbet around the entire perimeter. Use a router with an edge guide to get close to your layout lines, then use a shoulder plane to make it all as perfect as possible. Where the banding wraps around the corner squares, hinges and catch, do the layout with a square and marking knife, then rout and chisel to the gauge line.

Start at any corner and cut a miter on one end of a piece of banding, then mark the other end and cut the miter, then glue it in place with masking tape wrapped over the edge. Fit the next piece to the end of the first piece, miter the opposite end, and glue. This way you're only fitting and gluing one side of a miter at a time. Only the very last piece requires fitting both miters before gluing.

I use a small miter box with a fine dozuki saw and a small plane to tweak the angle. A small piece of scrap plywood with sandpaper glued to both faces acts as a planing support. You'll need to plane from both directions in some cases to prevent blowout of the stringing or short grain.

Crossbanding is unusual in that the grain runs opposite to a typical miter.



***Squeeze this.*** *The press box ensures your banding blank glues up straight and flat. I make these quickly with a pneumatic nailer.*

***It's tricky.*** *Don't be discouraged if you toast some of the banding. I did. For every goof, you've gained twice the experience.*

This means you can't always plane with the grain. So use a file or sanding block to tweak the miter.

The bookmatched kingwood corner squares and holly stringing are fit and glued next. The crossbanding and corners should be oversized, so when you trim the lid to final size, they will terminate crisply at the very edge. I added a 3/16" strip of cherry banding to the short ends of the lid, which will get buried in the lid's skirt.

The circular crossbanding is easier than you might imagine. First, set up a router for circle cutting and rout a groove around the center of the sunburst.

Now crosscut tiles about 5/8" long from a 1/8"-thick, 3/4"-wide Macassar ebony strip. Plane both long-grain edges of the tile to a taper (you'll get the angle right with some practice). Glue it down with hide glue as you press it to the outside edge of the groove. Move from tile to tile, fitting each one individually while gluing it to the edge of the previous tile. Don't worry about the gap at the outer diameter – but don't let it get too large.

After the glue cures, plane the tiles flush with the sunburst. Set up a small router to cut the channel for the stringing between the outside edge of the tiles and the sunburst. I use a 3/32" end mill in a Dremel tool with a mini router base.

To glue in the stringing, first glue the veneer lines together for the first inch or so for easy handling, then take a chisel and cut a miter on this end. With a little glue in the groove, begin pressing the stringing into the groove, doing a few inches at a time. They should be snug, but not tight, or they may not fit at all once saturated with glue.

When you reach the beginning, hold the end of the stringing lines up to the miter and cut a matching miter on the free end. If you're careful, this mini scarf joint will disappear. Let the glue cure, then plane the stringing flush.

Finally, cut the inside diameter of the tiles with your circle-cutting router then excavate the circle to a uniform depth. You'll need to attach a larger auxiliary base to your router to span the cavity. The final depth should be about 1/16" deeper than your medallion's thickness.

With your circle-cutting router, cut a piece of MDF or hardboard to act as a template for sizing the medallion. Fit the medallion template to the lid precisely, but not tightly. If you test-fit the medallion later and it's too tight, it might get stuck. It should fit easily, but not sloppily.

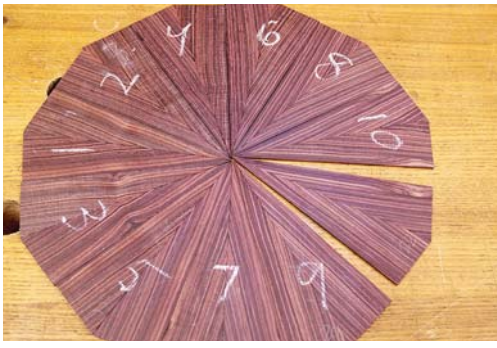
Make the sunburst medallion the same way as the large one. Bookmatch every other ray, number them and arrange them in order as shown below. By arranging the pieces this way, the grain will match all the way around.

Glue it up the same way as before, but this time assemble each half, then

***Channel groove.*** *A 3/32" metal-cutting end mill cuts a clean path for the stringing.*

***String theory.*** *The block at the top holds the free end of the stringing while you glue a few inches at a time.*

***Rout the enemy.*** *Waste away the center of the circle. The extended base keeps the router from taking a dip.*



***It's good to be the king.*** *Kingwood, that is. Arrange the sequential slices as pictured, and each ray will be no more than two slices away from its mate.*

joint the two straight edges to complete the medallion. Attach the circle template to the medallion with double-sided tape and rout with a bearing-guided bit.

> "It is the first of all problems for a man to find out what kind of work he is to do in this universe."
>
> —*Thomas Carlyle (1795-1881), "Address at Edinburgh"*

## The Monograms

To make the monograms, start with the background wood. I used kingwood to match the medallion and corner squares. Using resawn stock allows you to make a four-way bookmatch that looks elegant behind the holly letters. Wrap the background with a smaller version of the ebony banding, mitering the corners. At the top and bottom of each monogram, using 30° and 60° miter cuts, create a "weaved ribbon" design. This adds tons of visual interest and dimension to the monogram. Glue each piece to the background's edge as you fit each miter.

But before the crossbanding can be fit to the background, the holly letters must be inlayed. Well, that's not entirely true. The letters and mortises are actually cut out simultaneously on the scrollsaw with the table tilted slightly.

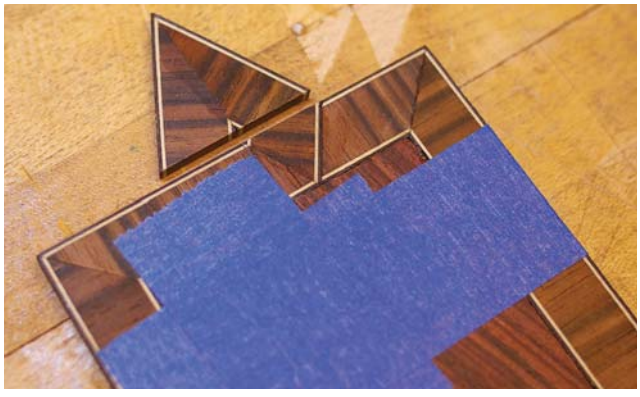
This double-bevel technique (about which I wrote in the August 2013 issue of this magazine, #205) creates a wedge-shaped holly letter that drops into an equally tapered recess for a flawless fit.

Tack-glue a piece of holly to the kingwood (they should both be the same thickness), tilt your saw to about 10° to start, then make some test cuts on the edge of the piece. If the piece on top fits perfectly in the bottom and ends up flush, you've got it. If it's too loose or tight, adjust the tilt of the table until it's just right.

When you test-cut, notice that when moving clockwise or counterclockwise, either the top piece will fit in the bottom layer or vice versa. You'll need this knowledge when cutting out interior shapes, such as the triangle in the letter A. The Roman numerals are made the same way.

***Crisp.*** *If this mortise was cereal, it'd be magically delicious. But you can't get good results with lucky charms. You need sharp tools, and that's no blarney.*

***Buy a vowel.*** *When you cut the double-bevel inlay, the letters will fit just perfectly. This is inlay for the lazy, but smart.*



***Here's the point.*** *Make the points as an assembly, plane the bottom edge flat, then glue it to the top of the monogram. This is much easier than fitting each point separately.*

To inlay the completed monograms, tack them in position with a few tiny dots of cyanoacrylate glue, then scribe around them carefully with a hobby knife.

Pop off the monogram with a thin knife, then rout the mortise to just a little less than the monogram's thickness and chisel carefully right in the scribe line. Before scribing, you can file the edge of the monogram at a slight angle (just a couple degrees at most), so your scribe line ends up slightly smaller than the inlay, encouraging a perfect fit.

Glue the monograms in using a flat caul, then plane them flush.

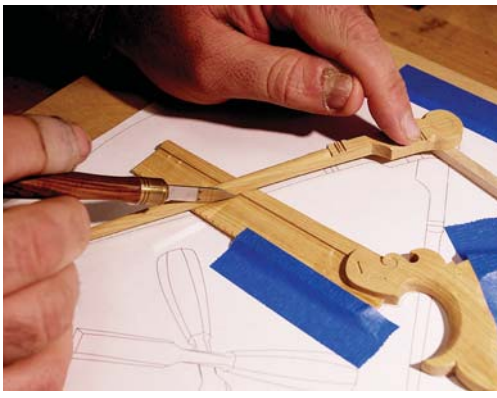
At this point, you can scrape the lid flat and smooth, cut the top to final size and apply a finish (leave the outside and edges unfinished for now). Sanding kingwood and holly at the same time is risky business (the kingwood heats up and bleeds red into the holly) so plane and scrape the final surface, sanding very sparingly.

## The Montage

Still with me? Excellent. Because the montage is where you get to break free and have some real fun. To get the right look, first make some pencil sketches of your favorite tools. Don't worry if they don't look perfect. Just sketch roughly to let your ideas flow. Once I was happy with my sketch, I then refined everything using drawing software so I could easily manipulate the size and arrangement of the tools.

Print the tool profiles and glue them to blanks of boxwood. Cut them out

***Pencilshop 2.0.*** *Use the meat computer God gave you and render yourself a coat of arms.*



***Slice & dice.*** *With the tools precisely made, you can then cut them up into little pieces. It's a little sad. You have hugged a tree lately, haven't you?*

***Chalk it up.*** *A bit of white powder in the scribe lines ensures you don't blow it when routing the mortise.*

on the scrollsaw or fret saw and refine their shapes with carving chisels, rasps, scrapers and files. Don't pay attention to which tools overlap the others, or what parts might get cut away. Just carve the tools as if they will stand on their own.

Once the tools are completely shaped, you can begin the layout process. Set out the tools on your sketch and mark the parts that overlap with each other.

Use a marking knife to accurately scribe your cutlines. I use a fine dozuki to make the cuts, then refine them with planes, files and chisels.

Make everything fit sweetly, then tack the tools onto the medallion and scribe with a hobby knife. Press the knife tightly to the edge, make a light pass, then go back once or twice to deepen it slightly.

Pop the tools off the medallion, then rub some chalk dust into the scribe line, which will make it highly visible. Rout the inlay mortise, and chisel right in the scribe line on straight sections.

On tight curves, I use the Dremel tool to rout directly up to the scribe line. When you see the chalk disappear, you've routed to the line.

Ease the bottom arris of the inlay and test-fit carefully. It should be tight. Be careful as you remove the piece; it could chip out some of the short grain if you're ham-handed.

Once the inlay mortises are cut, finish the medallion, keeping finish out of the mortises – I use an old T-shirt on a cork block. Then glue the medallion into the lid.

While that cures, apply finish to the boxwood tools. Mask the bottom surface so it stays free of finish. Once the finish is dry, glue the tools into the medallion using hide glue. Brush a little into the mortise and press the tools firmly in place (tapping lightly with a block and small hammer if necessary), hold for a few seconds, then do the next piece. Don't use excessive glue. When it's dry, you can pop off any little beads of dried glue with the tip of a hobby knife.

If you're thinking of making an embellished lid for your tool chest (and I think you should) make sure you develop a strategy, sharpen your weapons and above all, emerge from the ashes of battle with your own trophy of victory. **PWM**

*Jameel is an artist, luthier and co-owner of Benchcrafted (benchcrafted.com).*

## ONLINE EXTRAS

*For links to all online extras, go to:*
- **popularwoodworking.com/oct15**

**ARTICLE:** *Read "Double-bevel Artistry," by Jameel Abraham, free on our web site.*

**BLOG:** *Read the Benchcrafted blog.*

**WEB SITE:** *Visit the author's online store for bench vises, tools and more.*

**IN OUR STORE:** *"Creating Veneer, Marquetry & Inlay," a DVD featuring Paul Schurch, Warren May, Bill Hull, Patrick Edwards and Gerard Ryan.*

*Our products are available online at:*
- **ShopWoodworking.com**

# Make a 'Raamtang'

BY ZACHARY DILLINGER

This Dutch joiner's tool leverages simple design into a cheap & effective workholding device.

While studying Gerrit van der Sterre's "Four Centuries of Dutch Planemakers" (Primavera Pers, 2001), I ran across what the author calls a "raamtang" – Dutch for "window pliers." As you might guess, it is a joiner's tool used originally to hold narrow window sash bars for moulding.

The similarities between this entirely shop-made wedge-powered vise and the screw-powered "Moxon" vise led me to make and try a raamtang with great success for other work.

## Heart of Oak

There is a lot of force exerted on the jaws of a raamtang – so much that they often bend in use. To counteract this, I chose to make mine from strong white oak.

The version of the raamtang presented here is long enough to hold up to a 24"-wide panel and stock up to about 1½" thick. Feel free to make modifications to suit the scale of work you do in your shop, but this size works well for most furniture tasks.

Prepare your ¾"-thick wedge blank and mark out the angle, then saw the pieces apart and plane the sawn edge to a smooth surface.

I like to use about a 15° or 20° angle, but the exact angle of the wedge is unimportant because you will lay out the shoulder cut from the wedge. Just remember – a shallow angle will hold with more strength than a steep angle.

## Strong Arm Tactics

Use straight-grained white oak for the arms. For the jaws, pick up some 6/4 white oak a little more than 4" wide.

Rough-plane both faces and pick the most attractive grain pattern to serve as the top side of the vise. After that, flatten that face with your try plane. This will serve as the reference face, so make sure it is as flat as you can make it.

***Memory help.*** *Plane the wedges to a consistent angle. This frees you from having to remember which wedge goes to which arm.*



PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DAN PESSELL FROM THE AUTHOR'S MODEL

***Square deal.*** *Keep the stock of the square tight against your blanks while keeping the arm blank tight against the blade of the square.*

Next, set a marking gauge to the thinnest dimension present between the two faces of the board and mark a line all the way around. Plane the board down to this thickness, but save the final smoothing until after you've chopped the mortises.

Joint the first edge of your board. When finished, this will serve as your reference edge for laying out the arm mortises. Mark out and plane the width of the board so that it is about 4" wide, then scribe a line on each face that is 2" from the reference edge.

Because you want the mortises in both arms to line up, lay them both out at the same time before separating the jaws with your rip saw.

Start by establishing the inside lines of the mortises so that they are 24" apart. Align the arms with those lines and mark out their width along the top face. Square these four lines down both edges using the top face for the stock of the square.

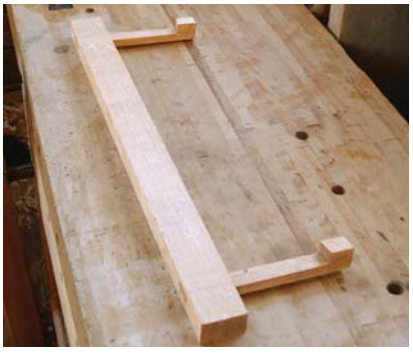
## Open the Jaws

Now saw the jaws apart with your rip-saw. Place the separated jaws on your benchtop with the reference edge down, then square the sawn edges with your try plane, planing a slight crown on the inside edge of the rear jaw.

Square mortise lines down the sawn edges from the reference face. Finally, lay out a 3/8" x 3/8" rabbet along the top back edge of the rear jaw; this engages with the wedges and helps them stay aligned when you drive them into place.

Lay out and saw the angled cuts on the top of the arms using the wedges as templates. Next, scribe the 5/8" tongue, referencing the face of the marking gauge off what will be the bottom face of the arms. Rip the waste material away close to the line, then smooth the rough-sawn face of the tongue down to your line with planes and chisels.

***A tight grip.*** *The slight crown in the rear jaw will provide maximum holding power near the center of the vise.*



***Lignin biceps.*** *Here are the raamtang arms in their final shape.*

Save the sawed-off waste to make the pegs that attach the arms to the front jaw. Finally, drill a pilot hole, then drive a rosehead nail into the center of the remaining thick portion to help prevent shearing this piece off in use.

## Chop the Arm Mortises

Set a marking gauge to the thickness of the arm tongues so the fence is 3/8" away from the first tooth. Scribe the mortises on both edges down from the top of the jaws. If you have a mortise chisel that fits the width, chop the mortises in both jaws working from each edge. Otherwise, bore a 1/2" hole, then pare the waste to the line.

Ensure that the arms fit tightly in the front jaw mortises but have a little play in the rear jaw. I like to use a rasp to open up the rear jaw mortises a little.

Bevel the outside edge of the front jaw. Plane a 3/8" x 3/8" rabbet along the top back edge of the rear jaw. Smooth plane the faces, then break all the outside corners on the jaws. Slide the arms through the rear jaw and into the front jaw. Line up the end of arm so that it slightly proud of the reference face.

Bore 3/8" peg holes through the fixed front jaw and the arms. Make two roughly rounded 3/8"-thick pegs from the arm waste you sawed away earlier.

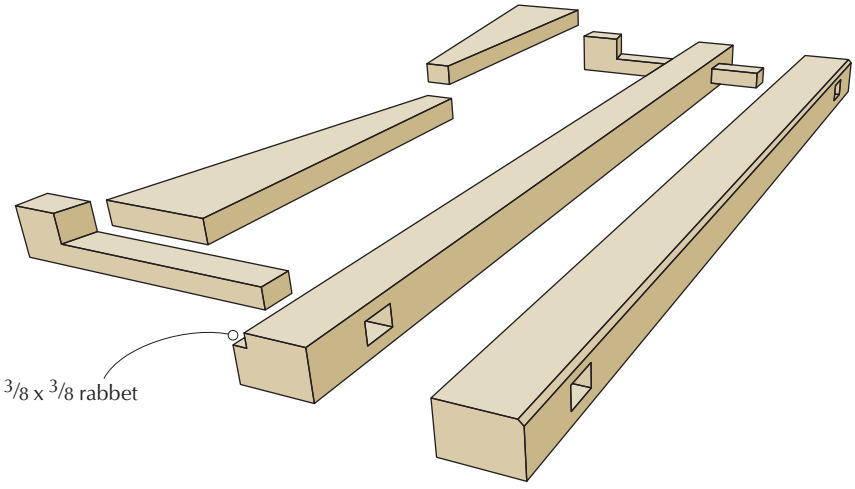
***Strike zone.*** *I prefer to strike my mortise layout lines with a sharp bench chisel.*

***Smooth action.*** *This arm has a nice loose fit through the rear jaw; this will enable the vise to work without binding.*

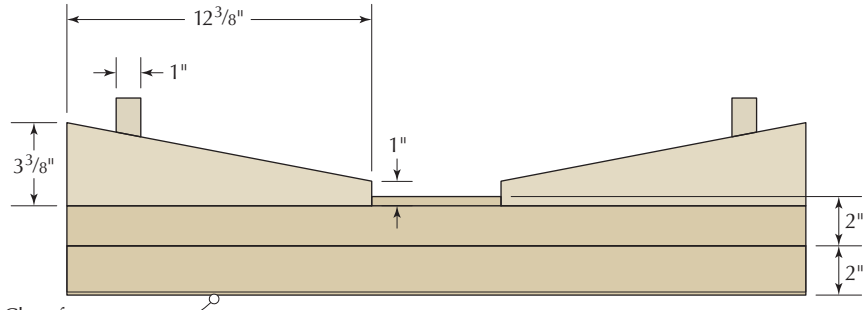
***Line it up.*** *Note that the bottom of the rabbet aligns with the top edge of the arm mortises.*

## Raamtang

| NO. | ITEM | DIMENSIONS (INCHES) T | W | L | MATERIAL | COMMENTS |
|---|---|---|---|---|---|---|
| ❑ 2 | Jaws | 1 3/8 | 2 | 30 | White oak | |
| ❑ 2 | Arms | 1 1/2 | 1 | 8 | White oak | |
| ❑ 2 | Wedges | 3/4 | 3 3/8 | 12 3/8 | White oak | Taper to 1" |




EXPLODED VIEW




PLAN

Check one final time to ensure that the rear jaw slides smoothly on the arms and make any necessary adjustments.

Finally, drive the pegs home into the peg holes and make any final adjustments to the wedges to ensure they hold tight. Give the entire piece a couple of coats of wiping varnish to complete the project.

"Character is like a tree and reputation like its shadow. The shadow is what we think of it; the tree is the real thing."

*— Abraham Lincoln (1809-1865) 16th president of the United States*

## Using the Raamtang

If you've seen the Moxon vise in action, you are familiar with many of the things of which this type of vise is capable.

I have used the raamtang in conjunction with my holdfasts to dovetail case sides, a task at which it excels. I have also used it to help keep boards aligned while gluing them into wide panels.

This vise also is an excellent appliance to hold and support a workpiece while cutting a mortise; clamping along the outside helps prevent you from blowing out the side of the mortise with the chisel.

As you might expect, given that this was originally designed as a joiner's appliance (namely for holding window pieces for shaping), it excels at holding stock for moulding, rabbeting and even planing grooves.

When it comes to planing the saw marks off the back of a freshly stuck piece of hand-cut moulding, I've yet to find anything better.

It holds like a bear trap (especially with a bit of leather glued to the working faces), is simple to make and costs next to nothing if you use pieces from the scrap bin. What else can you ask for from a shop appliance? **PWM**

***Side action.*** *Clamping the sides of the piece being mortised helps prevent cheek blowout.*

***Working out.*** *Here's the task for which the raamtang was designed – holding small pieces of moulding for planing.*

*Zachary is currently at work on a book on 18th-century furniture (due out late in 2016 from Popular Woodworking Books).*

## ONLINE EXTRAS

*For links to all online extras, go to:*

- **popularwoodworking.com/oct15**

WEB SITE: *Visit theeatoncountyjoinery.com for the author's blog and gallery.*

BLOG: *Read a roundup up of our many Moxon Vise posts.*

IN OUR STORE: *Go "Beyond the Vise: Workholding for Hand Tools," a webinar hosted by Steve Branam.*

TO BUY: *"Jigs & Fixtures for the Hand Tool Woodworker," by Graham Blackburn.*

*Our products are available online at:*

- **ShopWoodworking.com**

# Mid-century Modern Bookcase

BY MICHAEL CROW

## Simple joinery serves this sophisticated geometric design.

Mid-century modern design is enjoying a surge in popularity, and rightly so: Its clean lines and functional design make it practical and attractive, two traits evident in this bookcase by an unknown designer.

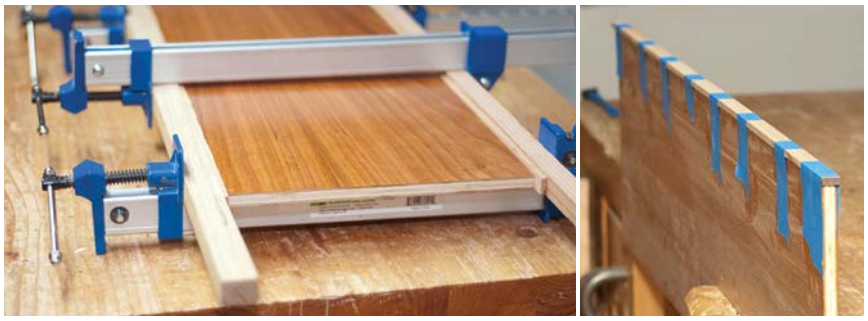
Its stark, geometric design shows modern roots while giving it a strong graphic presence. And because it looks good from both the front and back, it's perfect for dividing a space without completely partitioning it, making it a good match for the open-plan homes of the period, and of today.

Simple construction techniques underlie the sophisticated design: Rabbets in the leg assemblies capture the case, with its interior dividers and shelves joined by dados. The asymmetrical dividers are made from 1/2"-thick stock while the outer case is made from 3/4"-thick material. The legs and rails are 1" thick. The varying thicknesses, and a 1/2" reveal of the case in the legs, add another subtle detail to the design.

The original case was executed in rosewood, but I opted for cherry finished with oil and shellac. It provides a warmth similar to rosewood without the expense. Too, the design lends itself to a variety of materials, so pick your materials to suit your décor.

Following the original, I built the case from sheet goods (the legs and rails are solid cherry), but there's no reason to choose sheet goods over solid wood. While plywood does require

PHOTOS BY THE AUTHOR;
ILLUSTRATIONS BY DAN PESSELL FROM THE AUTHOR'S MODEL



***Edge-banding two ways:*** *clamp and caul, or use masking tape. For either approach, make sure your banding is wide enough to stand slightly proud of both faces of the board.*

edge-banding, you'll likely spend the same amount of time gluing up narrower solid stock to produce the wide boards required for the project, so let your preference and working style guide your choice of material.

## Edge-banding Two Ways

Because it simplifies cleaning glue squeeze-out, I prefer to pre-finish my parts when a design allows it. That's the approach I took here for the case interior, wiping on a coat of boiled linseed oil, followed by padding on a couple of coats of blonde shellac.

Rip the ¾" and ½" plywood to 10¼" (which allows for ⅛"-thick edge-banding on both sides to produce 10½"-wide panels). Then apply the boiled linseed oil and first coat of shellac. With the panels ripped and pre-finished, you're ready for edge-banding.

You can use commercial veneer tape and iron it to the edges of your plywood, but ripping your own banding gives you enough thickness to round or chamfer your finished edges. That looks nicer, and it makes the banding blend better with the sheet stock.


***Flush it.*** *A trim router equipped with a flush-cutting bit makes quick work of trimming the edge-banding – but so can a block plane or smoothing plane (though you need to take care to avoid gouging the thin veneer face).*

While it's tempting to set the fence for a narrow cut for ripping, you'll avoid the risk of the narrow stock jamming in the throat plate if you position the fence to produce a strong ⅛" offcut, and reset the fence after every pass.

After ripping my banding, I planed one face smooth for gluing, then applied it to my plywood. I sized the edge of the plywood by brushing on a thin layer of glue, letting it sit for a minute for the long-grain plies to absorb glue, then applying another thin coat before aligning the banding to the sheet-good edges.

You can use a clamp and cauls to secure the banding while the glue dries, or you can use masking tape, scraping away any glue squeeze-out after it gels.

Once the glue is dry, cut the banding flush with the plywood. A trim router equipped with a flush-cutting bit is designed for this work. The hand-tool alternative is a sharp plane set for a shallow cut.

## Dados Join the Interior

The case interior is joined with ¼" x ¼" dados, stopped about ½" from the edges of the boards. A simple plywood jig (shown below, left) guides the router for making these cuts.

Mark the location of the dados, align the cut in the fence with your marks, position the router, plunge and plow. Note that where two shelves line up on either side of a divider, the dados will cut all the way through the plywood, leaving solid stock only at either end of the cut.

Take care when handling the unassembled ½"-thick dividers to avoid breaking the workpiece – or set your router a little shallow for these cuts, then trim the corresponding tenons to fit.

Tenon the ends of the interior parts with a rabbeting bit (router) or dado stack (table saw), then notch the ends of the boards for the stopped dados. You'll need to round over the tenons or square the dados with a chisel to get the parts to fit.

***Easy dados.*** *This simple jig holds the router base in position and guides it while cutting stopped dados. Align the bit at the start of the cut (½" in from the edge), plunge, then plow.*

***Router tenons.*** *I used a router with a rabbeting bit to cut ¼"-thick tenons on the divider and shelf ends.*

***Perfect miters.*** *A simple plywood fence clamped flush with the end of the board guides the 45° chamfer bit (take multiple passes) for clean miters. The fence should extend past the edges of the board, and the inside edge of the board should face up.*

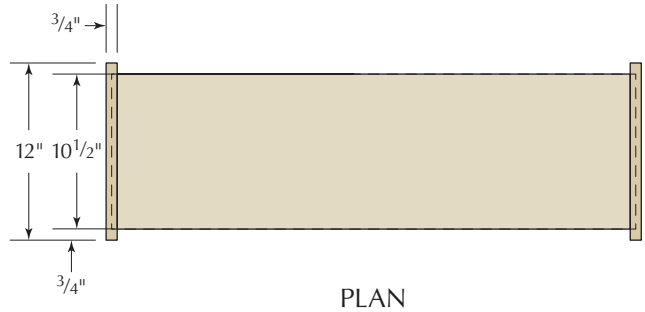
"The simple joy of taking an idea into one's own hands and giving it proper form – that's exciting."

*—George Nelson (1908-1986), American designer*

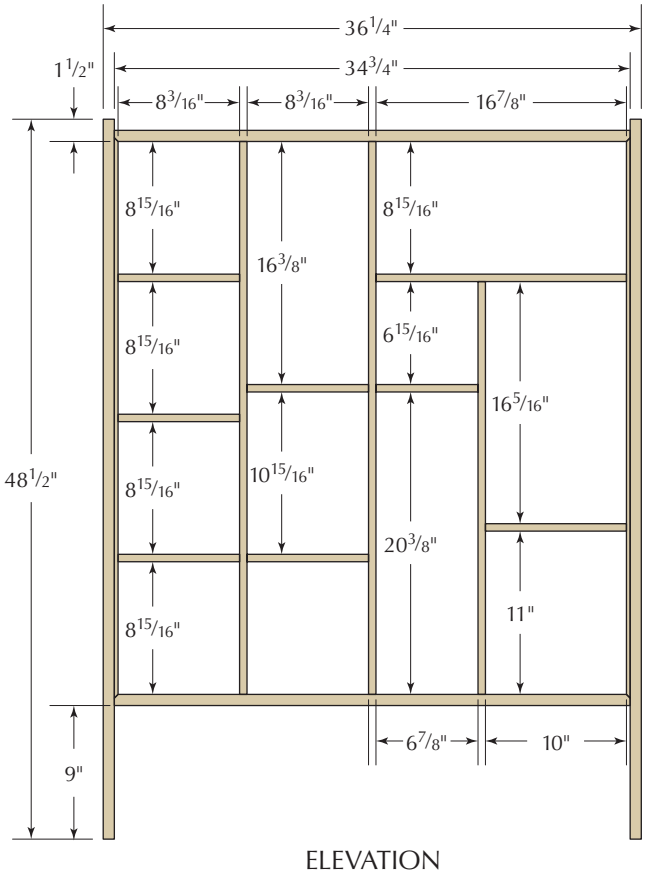
## Mid-century Modern Bookcase

| NO. | ITEM | DIMENSIONS (INCHES) T | W | L | MATERIAL |
|---|---|---|---|---|---|
| ❑ 2 | Case bottom/top | 3/4 | 10 1/2* | 35 3/4 | Plywood |
| ❑ 2 | Case side panels | 3/4 | 10 1/2 | 38 3/4 | Plywood |
| ❑ 1 | Long shelf | 1/2 | 10 1/2* | 17 3/8 | Plywood |
| ❑ 1 | Medium-long shelf | 1/2 | 10 1/2* | 10 1/2 | Plywood |
| ❑ 5 | Medium shelves | 1/2 | 10 1/2* | 8 11/16 | Plywood |
| ❑ 1 | Short shelf | 1/2 | 10 1/2* | 7 3/8 | Plywood |
| ❑ 2 | Tall vertical dividers | 1/2 | 10 1/2* | 37 3/4 | Plywood |
| ❑ 1 | Short vertical divider | 1/2 | 10 1/2* | 28 5/16 | Plywood |
| ❑ 2 | Side frame rails | 1 | 1 1/2 | 12 | Cherry |
| ❑ 4 | Legs | 1 | 1 1/2 | 48 1/2 | Cherry |
| **DRAWER** | | | | | |
| ❑ 1 | bottom | 1/4 | 6 3/8 | 9 1/2 | Plywood |
| ❑ 2 | Front/back | 3/4 | 6 7/8 | 6 15/16 | Maple |
| ❑ 2 | Sides | 1/2 | 6 15/16 | 10 | Poplar |

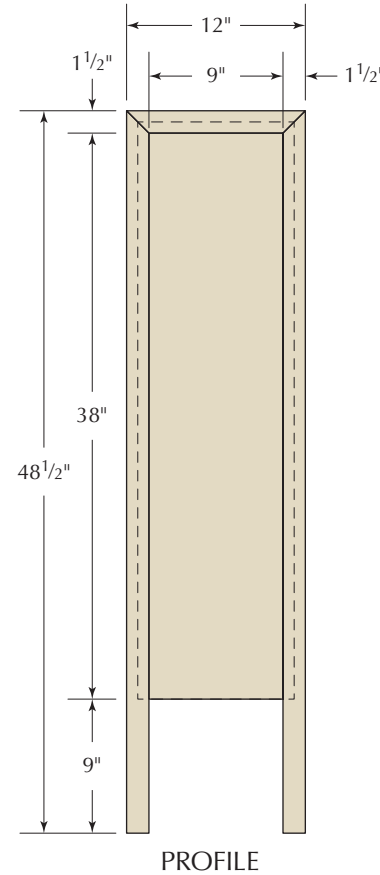
*Includes 1/8"-thick solid edge-banding on both edges




PLAN




ELEVATION




PROFILE

## Cut the Miters

Miters join the case. I used a length of plywood as a fence to guide a large 45° chamfer bit to cut these joints with a router. Simply position the fence along the end of the board, set the bit for a ¾"-deep cut, and rout the chamfer, easing up to the final depth with multiple passes. Cut and miter the case sides now, but leave the ends a little long until after you've dry-fit the case. Doing so allows you to size the pieces for perfect fit.

The frame assembly pieces are also mitered, but these can be cut with a miter saw. If your stock is long enough, cut each assembly from a single board so the grain runs continuously around it.

Rip the parts to width, cut your miters, then cut the legs to final length.

Size the ends of the boards before gluing and clamp in both directions across the joint, taking care that the boards align and the miters stay tight. When the glue is dry, rout a stopped ¾"-wide x ½"-deep rabbet for the case, then square the ends of your cut with a chisel.

## Assemble in Stages

Assembling the case is a bit like putting together a jigsaw puzzle. I built the case from left to right in stages. Join the first series of dividers and shelves and let that section dry before adding the next series. Finally, size the miters and glue the ends to the case.

Once the assembly is out of the clamps, level its hardwood faces with a smoothing plane or sander and ease the edges of the boards. Now's a good time to smooth and finish the leg assemblies, too. Glue them to the case, taking care to remove squeeze-out after the glue has gelled, then finish the outside of the case.

With the case and drawer complete, now comes the hard part: deciding what deserves pride of place on your stylish new bookcase. **PWM**



***Staged assembly.*** *Assemble the case in stages, building from one side to the other. After the first section is glued up and dry, the second series of shelves and the divider are glued to the first subassembly. And so on.*

## DECORATIVE DRAWER

With its prominent placement, the drawer creates a strong focal point for the design of the case – so it's a great place to express yourself.

Do you have a special piece of stock or veneer you've been saving? What about that custom wooden pull you've been wanting to try out? Or Greene & Greene-style finger joints? The drawer's small scale makes it the perfect place for experimentation.

I used some figured maple and created a simple wooden pull, then coved the edges to create a shadow line. Half-blind dovetails join the drawer box, and the plywood bottom is glued into a rabbet.

—MC

***Drawer details.*** *After cutting the drawer front to size, I drilled a clearance space for fingers at the drill press, then chopped a mortise to house the pull. After coving the edge with a router, I glued in the wooden pull.*

*Michael is the author of "Mid-Century Modern Furniture: Shop Drawings & Techniques for Making 29 Projects."*

## MINIMALIST DESIGN: MAXIMUM STYLE


In the middle of the last century, a new generation of designers sought to render furniture to its most essential forms – and in doing so, defined mid-century modern style. The piece shown here is among those in Michael Crow's new book, "Mid-Century Modern Furniture: Shop Drawings & Techniques for Making 29 Projects" – available now at ShopWoodworking.com.

## ONLINE EXTRAS

*For links to all online extras, go to:*

- **popularwoodworking.com/oct15**

WEB SITE: *Visit the author's web site at 1910craftsman.com.*

ARTICLE: *Build Steve Shanesy's "Wall-mounted Server," inspired by mid-century modern designs.*

IN OUR STORE: *"Building Classic Arts & Crafts Furniture: Shop Drawings for 33 Traditional Charles Limbert Projects," by Michael Crow.*

TO BUY: *"Mid-Century Modern Furniture: Shop Drawings & Techniques for Making 29 Projects," by Michael Crow.*

*Our products are available online at:*

- **ShopWoodworking.com**

# Classified

## Books

**WE HAVE A WIDE VARIETY** of woodworking books - from small projects, to home improvement, to enhancing your woodworking skills, and more! To see our full line of books, please visit our web site at ShopWoodworking.com!

## Finishing Supplies & Equipment

**BLOXYGEN SAVES LEFTOVER FINISHES -** Prevent oxygen or moisture damage. www.bloxygen.com or (888) 810-8311.

**SHELLAC.NET — WOOD FINISH SUPPLY** Large Shellac Flake Selection - Brushes - Dyes BEHLEN Finishing Supplies - Stains - Aerosols RENAISSANCE Wax. 877-245-5611.

## Hand Tools

**WWW.JIMBODETOOLS.COM** The Largest Antique Tool Website on Earth! Fine Antique Woodworking Tools of every kind. 845-505-8665.

## Kits & Plans

**FULL SIZE FURNITURE LAYOUTS** Drawn by Philip C. Lowe. 978-922-0615. 116 Water St, Beverly, MA 01915. www.furnituremakingclasses.com

## Power Tool Accessories

**COPING ATTACHMENT FOR SHAPER OR ROUTING TOOL** www.JDLTES.COM or call George at 847-877-2027.

## Schools/Instruction

**JOHN C. CAMPBELL FOLK SCHOOL,** Brasstown, NC. Courses for all skill levels. Week and weekend classes year-round, taught by nationally known instructors. Friendly, supportive environment. Comfortable, on-campus housing. Delicious meals served three times a day. www.folkschool.org. 800/365-5724.

**FRANKLIN STREET SCHOOL OF WOODWORKING,** Tampa, FL. Group andPrivate classes year round. www.FranklinStreetFW.com. 813/223-3490.

## Seat Weaving Supplies

**CHAIR CANE & SPLINT,** Shaker tape, fiber & natural rush. Complete line of basketweaving supplies. Royalwood Ltd., 517-WW Woodville Rd, Mansfield, OH 44907. 800-526-1630. www.royalwoodltd.com.

*Classified rate is $6.00 per word, 15-word minimum. Order must be accompanied by payment; ads are non-commissionable. Send to: Popular Woodworking Magazine, 10151 Carver Road, Suite 200, Blue Ash, OH 45242 or Don Schroder, d.schroder@verizon.net. Phone: 610-821-4425, Fax: 610-821-7884.*

# Advertiser's Index

*(See pages 48-49 for reader's service postcard)*

| | PAGE# | CARD# | WEB ADDRESS |
|---|---|---|---|
| Amana Tool | 23 | 115 | amanatool.com |
| Beall Tool Company | 53 | 2 | bealltool.com |
| Bessey Tools of North America | 19, 22 | 101 | besseytools.com |
| Bloxygen | 54 | 3 | bloxygen.com |
| Bowclamp | 24 | 19 | bowclamp.com |
| Bushton Manufacturing | 25 | 80 | bushtonmanufacturing.com |
| CMT USA | 24, 25 | 102 | cmtusa.com |
| Connecticut Valley School of Woodworking | 53 | 64 | schoolofwoodworking.com |
| Craftsman Gallery | 11 | — | craftsmangallery.com |
| Craftsman Studio | 53 | 59 | craftsmanstudio.com |
| Custom Branding Irons | 21, 25 | 93 | branding-irons.biz |
| DMT | 24 | 92 | dmtsharp.com |
| DR Power Equipment | 15 | — | drpower.com |
| Earlex | 2 | 9 | earlex.com |
| Epilog Laser | 7 | 56 | epiloglaser.com |
| Forrest Mfg. | 25 | 13 | forrestblades.com |
| Franklin Street School | 54 | 130 | franklinstreetfw.com |
| Furniture Institute of Massachusetts | 53, 54 | 16 | furnituremakingclasses.com |
| General International USA | 22 | 17 | general.ca |
| Gorilla Glue | 11 | 18 | gorillaglue.com |
| Grex USA | 15 | 20 | grexusa.com |
| Grizzly Industrial | Cvr 2, 1 | 57 | grizzly.com |
| Harbor Freight | 55 | 76 | harborfreight.com |
| Highland Woodworking | 25 | 22 | highlandwoodworking.com |
| I Can Do That | 7 | — | icandothat.com |
| Jacobs Chuck | 23 | 105 | jacobschuck.com |
| JDL Company | 54 | 88 | jdltes.com |
| Jim Bode Tools | 54 | 24 | jimbodetools.com |
| John Campbell Folk School | 54 | — | folkschool.org |
| Klingspor's Woodworking Shop | 23 | 89 | woodworkingshop.com |
| Knew Concepts | 11 | 60 | knewconcepts.com |
| Lee Valley | 19 | 28 | leevalley.com |
| Leigh Industries | 25 | — | leighjigs.com |
| Lignomat USA | 11 | 124 | lignomat.com |
| M.Power Tools | 23 | 116 | m-powertools.com |
| Midwest Products | 22 | 128 | midwestproducts.com |
| Next Wave Automation | 22 | 127 | nextwaveautomation.com |
| Oneida Air Systems | 21 | 35 | oneida-air.com |
| Osborne Wood Products | 17, 19, 53 | 36 | osbornewood.com |
| Popular Woodturing | 17 | — | popularwoodturning.com |
| Rikon Power Tools | 24 | 42 | rikontools.com |
| Rockler | 23 | 71 | rockler.com |
| Royalwood Ltd. | 54 | — | royalwoodltd.com |
| Saburrtooth | 11 | 79 | saburrtooth.com |
| Seneca Woodworking | 24 | 129 | senecawoodworking.com |
| Shellac.net | 54 | — | shellac.net |
| Southwest School of Woodworking | 53 | 90 | sw-sw.org |
| SpaceAge Ceramics | 22 | 40 | spaceageceramics.com |
| Tools for Working Wood | 17 | 45 | toolsforworkingwood.com |
| Trend Routing Technology | 22 | 120 | trend-usa.com |
| TrueTrac | 24 | 84 | truetracsaw.com |
| Varathane | Cvr 3 | — | varathane.com |
| Wall Lumber | 15 | 47 | walllumber.com |
| West Penn Hardwoods | 15 | 126 | westpennhardwoods.com |
| Whitechapel Ltd. | 53 | 48 | whitechapel-ltd.com |
| Woodcraft | Cvr 4 | 49 | woodcraft.com |
| Woodfinder | 53 | — | woodfinder.com |
| Woodpeckers | 9, 23 | 52 | woodpeck.com |
| Woodstock International | 5 | 114 | woodstockinternational.com |
| Woodworker's Supply | 21 | 54 | woodworker.com |
| Woodworking in America Show | 21 | — | woodworkinginamerica.com |

# HARBOR FREIGHT

**QUALITY TOOLS AT RIDICULOUSLY LOW PRICES**

## How Does Harbor Freight Sell GREAT QUALITY Tools at the LOWEST Prices?

We have invested millions of dollars in our own state-of-the-art quality test labs and millions more in our factories, so our tools will go toe-to-toe with the top professional brands. And we can sell them for a fraction of the price because we cut out the middle man and pass the savings on to you. It's just that simple! Come visit one of our 600 Stores Nationwide.

## SUPER COUPON

# 20% OFF

ANY SINGLE ITEM

LIMIT 1 - Save 20% on any one item purchased at our stores or HarborFreight.com or by calling 800-423-2567. "Cannot be used with other discount, coupon, gift cards, Inside Track Club membership, extended service plans or on any of the following: compressors, generators, tool storage or carts, welders, floor jacks, Towable Ride-On Trencher, Saw Mill (Item 61712/62366/67138), Predator Gas Power Items, open box items, in-store event or parking lot sale items. Not valid on prior purchases after 30 days from original purchase date with original receipt. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

52261250

## SUPER COUPON

# FREE

WITH ANY PURCHASE

**3-1/2" SUPER BRIGHT NINE LED ALUMINUM FLASHLIGHT**

LOT 69052 shown
69111/62522/62573

$6.99 VALUE

LIMIT 1 - Cannot be used with other discount, coupon or prior purchase. Coupon good at our stores, HarborFreight.com or by calling 800-423-2567. Offer good while supplies last. Shipping & Handling charges may apply if not picked up in-store. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one FREE GIFT coupon per customer per day.

52257912

## SUPER COUPON

CENTRAL MACHINERY

**2 HP INDUSTRIAL 5 MICRON DUST COLLECTOR**

- 70 Gallon Capacity

LOT 61790/97869 shown

SAVE $80

$169.99 REG. PRICE $249.99

52225416

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

PITTSBURGH

**24" CLAMP AND CUT EDGE GUIDE**

LOT 66126

SAVE 52%

$7.99 REG. PRICE $16.99

52181702

LIMIT 7 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**2 HP, 8 GALLON 125 PSI PORTABLE AIR COMPRESSOR**

CENTRALPNEUMATIC

LOT 67501 shown
68740/69667


SAVE $40

$99.99 REG. PRICE $139.99

52189289

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## WOW SUPER COUPON

**18 GAUGE BRAD NAILER**

CENTRALPNEUMATIC

LOT 62255/68021 shown

SAVE 60%

WE CARRY A FULL LINE OF FASTENERS

$13.99 ~~$18.99~~ REG. PRICE ~~$34.99~~

52211522

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**12" SLIDING COMPOUND DOUBLE-BEVEL MITER SAW WITH LASER GUIDE**

NEW

CHICAGO ELECTRIC POWER TOOLS

LOT 69684 shown
61776/61969/61970

SAVE $165

$134.99 REG. PRICE $299.99

52258096

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## WOW SUPER COUPON

**14" OSCILLATING SPINDLE SANDER**

CENTRAL MACHINERY

SAVE $50

LOT 95088/62146
69257 shown

$99.99 ~~$139.99~~ REG. PRICE ~~$149.99~~

52205647

LIMIT 4 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**16 OZ. HAMMERS WITH FIBERGLASS HANDLE**

PITTSBURGH

SAVE 62%

CLAW
LOT 69006/60715
47872/60714

RIP
LOT 47873 shown
69005/61262

YOUR CHOICE! $2.99 REG. PRICE $7.99

52207390

LIMIT 8 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## WOW SUPER COUPON

US GENERAL PRO

**30", 5 DRAWER TOOL CART**

- 704 lb. Capacity

LOT 95272 shown
69397/61427

SAVE $180

$169.99 ~~$189.99~~ REG. PRICE ~~$349.99~~

52184838

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**POWDER-FREE NITRILE GLOVES PACK OF 100**

HARDY

- 5 mil. thickness

SAVE 45%

YOUR CHOICE! $6.49 REG. PRICE $11.99

MEDIUM
LOT 68496/61363

LARGE
LOT 68497/61360

X-LARGE
LOT 61359
68498 shown

52190072

LIMIT 7 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## WOW SUPER COUPON

CENTRAL MACHINERY

**8", 5 SPEED BENCH MOUNT DRILL PRESS**

LOT 62390/62520
60238 shown

SAVE $80

$49.99 ~~$69.99~~ REG. PRICE ~~$129.99~~

52218241

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**RETRACTABLE AIR HOSE REEL WITH 3/8" x 50 FT. HOSE**

CENTRAL PNEUMATIC

LOT 93897 shown
69265/62344

SAVE $90

$59.99 REG. PRICE $149.99

52231762

LIMIT 4 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

## SUPER COUPON

**RAPID PUMP® 1.5 TON ALUMINUM RACING JACK**

PITTSBURGH AUTOMOTIVE

- 3-1/2 Pumps Lifts Most Vehicles
- Weighs 27 lbs.

SAVE $60

$59.99 REG. PRICE $119.99

LOT 69252
60569/62160
62496/62516
68053 shown

52239012

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 12/4/15. Limit one coupon per customer per day.

- 100% Satisfaction Guaranteed
- Over 25 Million Satisfied Customers
- No Hassle Return Policy
- Lifetime Warranty On All Hand Tools
- 600 Stores Nationwide
- HarborFreight.com 800-423-2567

CARD #76 or go to PWFREEINFO.COM

# A Father's Legacy

## The lessons learned didn't stop at the shop door.


Christmas, 1956. I was a little fella, and my seeing the Tonka Hi-Way series display in the W.T. Grant store months earlier had captured my entire attention.

In my letter to Santa, I asked for the Tonka set. What I didn't know was that my folks had already put the set in layaway at Grant.

After I'd settled down some with my bright orange Tonkas, I noticed a little box made of red oak with brass hinges and a snap closure on the front.

The aroma of dad's shop and red oak filled my nose as I opened the box. And inside that box, three tools for dad's little apprentice – a level, a plumb bob, and a square. Just like dad's, except sized for my little hands.

I remember just holding them, as if they were precious metals or jewels, so much so I was hesitant to touch them. Dad explained each tool and what each meant and how they were used.

April, 1973. My dad died. He was only 55 years old. A master shipbuilder for the U.S. Navy and a master furniture maker no longer graced this world.

I was a junior in college at the time, and my journey was carrying me to a career in health care; what some might think is far from working wood.

When I arrived home on April 5, after spending time with my mom, I went to "our" shop. I turned on the light – dad had been in there late on April 4, fixing something for mom, and I thought maybe, just maybe, something of dad remained.

A cool rain fell outside, and I realized that even the shop appeared different. Maybe I just felt lost, until I walked to dad's bench.

On the benchtop were the large versions of the tools I'd received on Christmas Day 1956, plus one more – the compass. I completely lost any composure I had, and I just wept.

And then, I heard dad's voice from across time, as he'd said many years before, the real meaning and use of these tools: "Use these tools to help the less fortunate."

His reminding me to "measure thrice and cut once," and "pay attention to everything," were just as clear as when he first told me such things.

All these years later, making tools each day in my shop is my reminder of what I was taught about focus, commitment and desire – and of Tonka trucks (which I still have).

My shop drips with tool history, including my dad's "apprenticeship Navy Gray" tool chest he made in the summer of 1941 as an apprentice ship's joiner for the U.S. Navy and inside it, all the tools he used.

As I was taking photos of dad's chest for this essay, I found a small compass at the bottom – a Starrett #85 compass, with a pencil attached by my father decades ago. A bit of cleaning revealed his initials – "J.A.D."

I've never found the little toolbox I received in 1956. But the real gifts dad gave me weren't in that little box anyway. Those little tools only represented the true sacred nature of things, and I believe that's exactly what my dad wanted me to know. And after serving the sick and broken, and then teaching such things for 40 years, I realized two things: 1) I had used the tools to serve the less fortunate; and 2) I'm now able to make such tools.

Thing is, though, legacy is not just the tools I have that belonged to my dad. It's far deeper. It's about those skills I've learned and developed in my own journey. Like my dad often said: "Tools make a master not; skills, strength of heart and focus do." **PWM**

*Joe, who lives in Lebanon, Va., is owner of DiPietro Toolworks and is the former director of Cardiopulmonary Sciences at Southwest Virginia Community College.*

## ONLINE EXTRAS

*For links to all online extras, go to:*
- popularwoodworking.com/oct15

TWITTER: *Follow us on Twitter @pweditors.*

*Our products are available online at:*
- ShopWoodworking.com

PHOTOS BY THE AUTHOR

# Thicker. Faster. Stronger.


Triple Thick Poly: 1 coat

Traditional Poly: 3 coats

Get the durable finish you expect, faster than you can imagine. With new Varathane Triple Thick Polyurethane. Just one coat of Triple Thick has the strength and thickness of three coats of traditional polyurethane. With an advanced self-leveling formula that's perfect for interior horizontal and vertical surfaces. Get the protection. Get the beauty. And save your valuable time. Varathane Triple Thick Polyurethane. The Ultimate Finish In One Coat. **Staining123.com**

Varathane

THE HOME DEPOT
More saving.
More doing.

# WOODCRAFT®

**QUALITY WOODWORKING TOOLS • SUPPLIES • ADVICE®**

**Basket Illusions**
Courtesy of Doug Mooney

Razertip® Industries Inc.

## Innovate, Create, Decorate – NEW! Razertip® Woodburning Tools & Tips

Razertip® Pyrographic Tools have been setting the standard for hot-wire pyrographic tools since the mid-1980s: Razertip burners that feature near instant heat response, ultra-sharp tips (120+ lines per inch), a choice of the smallest handpieces or the toughest handpieces on the market, and CSA C/US safety certification.

Create your next piece of art with Razertip Woodburning Tools & Tips that come in a variety of styles.

- Add Feathers, Hair Or Sculpted Bumped Surfaces In Fine Detail
- Apply "Stoning," "Rippling," And Shading Effects
- Ideal For Miniatures, Embellishing Or Decorating Woodturnings
- Use To Add Calligraphy To Projects

160476 - 160538

Choose Single Pen or Dual Pen Connection Control Units

Complete Selection of Standard & HD Tip Profiles

**For A Free Catalog Or To Find Your Local Woodcraft Store, Visit woodcraft.com Or Call 800-225-1153.** 15PW10P

**For Information On Woodcraft Retail Franchise Opportunities, Visit woodcraftfranchise.com**

CARD #49 or go to PWFREEINFO.COM