

DESIGN CHALLENGE: Two Chairs from One Sheet of Plywood

Popular Woodworking

APRIL 2021 | #258



Timber Frame Toddler Bed



DOVETAIL BOX

Refine Your Hand Tool Skills

BRUSHING SHELLAC

Master this Classic Technique



Grizzly Industrial®

**PURVEYORS OF
FINE MACHINERY®
SINCE 1983**

Quality Machines, Great Prices!

1/2 HP BENCHTOP MORTISING MACHINE

- Motor: 1/2 HP, 110V, single-phase, 6A
- Spindle: 1725 RPM, JT #2, 3/4" travel
- Chuck size: 3/8"
- Collar size: 3/8"
- Maximum stock width: 8 1/2"
- Maximum stock thickness without extension block: 4 1/4"
- Maximum stock thickness with extension block: 6"
- Maximum mortising depth: 3"
- Maximum chisel travel: 4 3/4"
- Maximum distance column to chisel: 5"
- Chisel size range: 1/4" - 1/2"
- Table size: 10 1/2" x 12 1/4"
- Overall dimensions: 13 3/4" W x 29" D x 32" H
- Approximate shipping weight: 76 lbs



WARNING! †
G0645 ONLY \$355⁰⁰



12" BENCHTOP DRILL PRESS WITH VARIABLE-SPEED & LASER

MADE
IN AN
ISO 9001
FACTORY

- Motor: 1/2 HP, 120V, single-phase, 5.1A
- Swing: 12"
- Spindle taper: MT#2
- Spindle travel: 3 1/2"
- Spindle speeds: Variable, 400 - 2700 RPM
- Drill chuck: 1/2" - 3/4", JT3, keyless
- Drilling capacity: 3/8" mild steel
- Max. distance from spindle to table: 13 1/4"
- Table dimensions: 9 3/4" x 9 3/4"
- Table tilt: 45° left/right
- Table swivel around column: 360°
- T-slots: (x4) 1/2", X pattern
- Overall dimensions: 13" W x 22" D x 36" H
- Approx. shipping weight: 93 lbs.



WARNING! †
T31739 ONLY \$374⁹⁵



14" HEAVY-DUTY FLOOR DRILL PRESS

MADE
IN AN
ISO 9001
FACTORY

- Motor: 3/4 HP, 110V, single-phase, 9A
- Swing: 14"
- Drill chuck: 1/2" - 5/8"
- Drilling capacity: 3/4" steel
- Spindle taper: MT#2
- Spindle travel: 3 1/4"
- 12 speeds: 140-3050 RPM
- Collar size: 2.595"
- Precision-ground cast-iron table
- Table size: 11 1/2" square
- Table swing: 360°
- Table tilt: 90° left & right
- Overall height: 64"
- Approximate shipping weight: 171 lbs.



WARNING! †
G7944 ONLY \$475⁰⁰



10" BENCHTOP TABLE SAWS

- Motor: 2HP, 115V, single-phase, 60 Hz, universal motor, 15A
- Table size: 22" x 26 3/4"
- Arbor: 3/4", 2000-4000 RPM
- Blade tilt: Left, 45°;
- Max depth of cut @ 90°: 3 3/8"
- Max depth of cut @ 45°: 2 1/8"
- Rip capacity: 28" right
- Dado capacity: 1 3/8"
- Dust port: 2 1/2"
- Overall size: 27" L x 32" W x 21" H (G0869); 41 1/2" L x 37 1/2" W x 41" H (G0870)
- Approximate shipping weight: 72 lbs. (G0869); 106 lbs. (G0870)



W/ RIVING KNIFE WARNING! †
G0869 ONLY \$390⁰⁰



W/ ROLLER STAND WARNING! †
G0870 ONLY \$495⁰⁰



14" X 20" VARIABLE-SPEED BENCHTOP WOOD LATHE

- Motor: 1/2 HP, 110V, single-phase, 6A
- Spindle: 1725 RPM, JT #2, 3/4" travel
- Chuck size: 3/8"
- Collar size: 3/8"
- Maximum stock width: 8 1/2"
- Maximum stock thickness without extension block: 4 1/4"
- Maximum stock thickness with extension block: 6"
- Maximum mortising depth: 3"
- Maximum chisel travel: 4 3/4"
- Maximum distance column to chisel: 5"
- Chisel size range: 1/4" - 1/2"
- Table size: 10 1/2" x 12 1/4"
- Overall dimensions: 13 3/4" W x 29" D x 32" H
- Approximate shipping weight: 76 lbs



WARNING! †
G0844 ONLY \$575⁰⁰



10" 2 HP HYBRID TABLE SAW WITH T-SHAPED FENCE

ETL
LISTED
Intertek
5012917

- Motor: 2 HP, 120V/240V (prewired for 120V), single-phase, 15A/7.5A
- Rip capacity: 31" right, 16 1/4" left of blade
- Max. depth of cut @ 90°: 3 3/8"
- Max. depth of cut @ 45°: 2 1/4"
- Table size with extension wings: 40 1/2" W x 27" D
- Distance from front of table to center of blade: 15 1/2"
- Floor-to-table height: 35 3/8"
- Arbor diameter: 3/4"
- Arbor speed: 3450 RPM
- Max. width of dado: 1 3/8"
- Dust port size: 4"
- Overall dimensions: 64" W x 40 1/2" D x 36" H
- Footprint: 21" L x 19 1/2" W
- Approximate shipping weight: 330 lbs.



WARNING! †
G0771Z ONLY \$995⁰⁰



14" X 37" WOOD LATHE WITH COPY ATTACHMENT

- Motor: 3/4 HP, 110V, single-phase, 11A
- Swing over bed: 14"
- Swing over tool rest base: 9"
- Distance between centers: 37"
- Distance between centers with copy device: 32"
- Spindle speeds: Variable, 600-2400 RPM
- Spindle thread size: 1" x 8 TPI
- Tool rest width: 12"
- Tool rest post diameter: 20mm
- Spindle and tailstock taper: MT#2
- Overall dimensions: 62" L x 24" W x 48" H
- Approximate shipping weight: 164 lb.



WARNING! †
G0842 ONLY \$595⁰⁰



10" CABINET TABLE SAW

EXTREME
SERIES

- Motor: 3 HP, 220V, single-phase, 13A
- Rip capacity: 36" right, 18" left of blade
- Max. depth of cut @ 90°: 3 3/8"
- Max. depth of cut @ 45°: 2 1/8"
- Table size with extension wings: 48 1/4" W x 30 3/4" D
- Distance from front of table to center of blade: 14 1/2"
- Floor-to-table height: 35"
- Arbor diameter: 3/4"
- Arbor speed: 4000 RPM
- Max. width of dado: 3/4"
- Dust port size: 4"
- Footprint: 23" x 21"
- Overall dimensions: 75" W x 44" D x 42 1/2" H
- Approximate shipping weight: 587 lbs.



WARNING! †
G0941 ONLY \$1795⁰⁰



16" X 46" WOOD LATHE WITH DRO

- Motor: 2 HP, 110V, single-phase, 14A
- Swing over bed: 16"
- Swing over tool rest: 13 1/2"
- Distance between centers: 46"
- Spindle taper: MT#2
- Spindle thread size: 1" x 8 TPI RH
- Tailstock taper: MT#2
- Spindle speeds: variable, 600 - 2400 RPM
- Headstock rotation: 0°, 60°, 90°, 120°, and 180°
- Tool rest width: 11 1/2"
- Tool rest post diameter: 1"
- Overall dimensions: 72 1/2" W x 19" D x 48" H
- Approximate shipping weight: 354 lbs.



WARNING! †
G0462 ONLY \$975⁰⁰



*To maintain machine warranty, 440V operation requires additional conversion time and a \$250 fee. Please contact technical service for complete information before ordering.

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TECHNICAL SERVICE: 570-546-9663

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Sale price cannot be combined with any other offer



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14" 1 HP DELUXE BANDSAW

- Motor: 1 HP, 110V/220V (prewired 110V), single-phase, 11A/5.5A
- Cutting capacity/throat: 13 1/2"
- Max. cutting height: 6"
- Table size: 14" x 14" x 1 1/2"
- Table tilt: 10° left, 45° right
- Floor-to-table height: 43"
- Blade length: 92 1/2"-93 1/2"
- Blade width: 1/8"-3/4"
- Blade speeds: 1800 & 3100 FPM
- Overall size: 27" W x 30" D x 67 1/2" H
- Approx. shipping weight: 246 lbs.



WITH CAST-IRON WHEELS!

WARNING! †

G0555LX ONLY \$695⁰⁰



8" X 72" DOVETAIL JOINTERS WITH BUILT-IN MOBILE BASES

- Motor: 3 HP, 230V, single-phase
- Table size: 9" x 72"
- Fence size: 4 1/2" x 38"
- Maximum depth of cut: 1/8"
- Rabbeting capacity: 1/2"
- Cutterhead speed: 5500 RPM
- Cutterhead diameter: 3"
- Cutterhead knives: 3 (G0855)
- Cuts per minute: 16,500
- Number of cutterhead inserts: 36 (G0856)
- Insert size: 15.0 x 15.0 x 2.5mm
- Power transfer: Poly-V belt drive
- Switch: push-button with large off paddle
- Approx. shipping weight: 450 lbs.



FREE PAIR OF
SAFETY PUSH
BLOCKS

WARNING! †

G0855 ONLY \$1195⁰⁰

WARNING! †

**W/ HELICAL CUTTERHEAD
G0856 ONLY \$1595⁰⁰**



15" 3 HP FIXED-TABLE PLANER WITH HELICAL CUTTERHEAD

- Motor: 3 HP, 230V, single-phase, 12A
- Max. stock width: 15"
- Max. stock thickness: 6"
- Min. stock thickness: 3/16"
- Min. stock length: 6"
- Max. cutting depth: 1/8"
- Cutterhead diameter: 2 1/2"
- Cutterhead type: 4-row helical, 48 inserts
- Dust port size: 4"
- Footprint: 21" x 18 1/2"
- Insert size & type: 15mm x 15mm x 2.5mm, 30° indexable carbide
- Cutterhead speed: 5200 RPM
- Feed rate: 16 FPM & 28 FPM
- Table size with extensions: 15" x 49"
- Overall dimensions: 25" W x 49" L x 47 1/2" H
- Approximate shipping weight: 375 lbs.



MADE IN AN ISO
9001 FACTORY

WARNING! †

G0891 ONLY \$1950⁰⁰



17" 2 HP BANDSAW

- Motor: 2 HP, 110V/220V (prewired 220V), single-phase, 19A/9.5A
- Table size: 17" x 17" x 1 1/2" thick
- Table tilt: 10° left, 45° right
- Floor to table height: 37 1/2"
- Cutting capacity/throat: 16 1/4" left of blade
- Maximum cutting height: 12 1/2"
- Blade size: 131 1/2" long
- Blade width range: 1/8" - 1" wide
- 2 blade speeds: 1700 and 3500 FPM
- Wheels: Computer-balanced cast-aluminum with polyurethane tires
- Wheel covers: Pre-formed steel
- Overall size: 73" H x 32" W x 32" D
- Footprint: 27" L x 17 1/4" D x 21 1/2" H
- Approximate shipping weight: 342 lbs.



WARNING! †

G0513 ONLY \$1150⁰⁰



13" PLANER/MOULDER

- Motor: 1 1/2 HP, 110V/220V (prewired 110V), single-phase, 15/7.5A
- Max. cutting width: 13"
- Max. lumber height: 6"
- Max. cutting depth: 1/8" (planing).
- Max. profile depth: 3/4" (moulding).
- Maximum width capacity: 4 1/16" (moulding).
- Planing feed rate: 24 FPM.
- Moulding feed rate: 12 FPM.
- 3 HSS knives at 13" x 5/8" x 1/8"
- Cutterhead speed: 5000 RPM
- Footprint: 22 1/4" x 21 1/4"
- Approximate shipping weight: 236 lbs.



INCLUDES
FLOOR STAND

MADE IN AN ISO
9001 FACTORY

WARNING! †

G1037Z ONLY \$895⁰⁰



6" X 48" BELT / 12" DISC COMBO SANDER

- Motor: 1 HP, 110V/220V, single-phase, 1725 RPM
- Belt table size: 7" x 12 1/2"
- Disc table size: 7" x 16 1/2"
- 2 1/2" and 3" dust ports
- Base measures: 16 1/2" W x 14" D
- 2500 FPM belt speed
- Approximate shipping weight: 149 lbs.



MADE IN AN
ISO 9001
FACTORY

WARNING! †

G1276 ONLY \$895⁰⁰



6" JOINTERS WITH CABINET STAND

- Motor: 1 HP, 110V/220V, single-phase, 14A/7A
- Prewired voltage: 110V
- Table size: 47 1/2" x 6 1/2"
- Table type: precision ground cast iron
- Table adjustment: dovetailed ways
- Cutterhead type: straight knife (G0814) V-helical (G0814X)
- Cutterhead diameter: 2 1/2"
- Max depth of cut: 1/8"
- Fence size: 4" x 29 1/2"
- Approx. shipping weight: 260 lbs.



G0814
Pictured

FREE PAIR OF
SAFETY PUSH
BLOCKS



W/ STRAIGHT KNIVES **WARNING! †**
G0814 ONLY \$775⁰⁰



W/ V-HELICAL CUTTERHEAD **WARNING! †**
G0814X ONLY \$1175⁰⁰



15" 3 HP PLANER WITH CABINET STAND

- Motor: 3 HP, 230V, single-phase, 12A
- Maximum stock width: 15"
- Maximum stock thickness: 6"
- Minimum stock thickness: 3/16"
- Minimum stock length: 6"
- Maximum cutting depth: 1/8"
- Cutterhead diameter: 3"
- Cutterhead type: 3-knife
- Knife size & type: 15" x 1" x 1/8", HSS
- Cutterhead speed: 5000 RPM
- Feed rate: 16 & 28 FPM
- Table size with extensions: 15" x 50"
- Dust port size: 4"
- Footprint: 21 1/2" x 21"
- Overall dimensions: 32" W x 50" D x 44" H
- Approx. shipping weight: 517 lbs.



MADE IN
AN ISO
9001
FACTORY

WARNING! †

G1021Z ONLY \$1625⁰⁰



18" OPEN-END DRUM SANDER WITH VARIABLE-SPEED FEED

- Sanding motor: 1.5 HP, 120V, single-phase, 13A
- Drum surface speed: 2600 FPM and 3400 FPM
- Conveyor feed rate: variable, 0-12 FPM
- Maximum stock dimensions: 36" W x 4 1/2" H
- Minimum board length: 6"
- Minimum board thickness: 1/8"
- Sanding drum size: 4"
- Dust collection port: 4"
- Overall size: 35 1/2" W x 22 1/2" D x 50" H
- Approximate shipping weight: 235 lbs.



ETL
US
Intertek
3092372

WARNING! †

G0458Z ONLY \$895⁰⁰

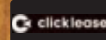


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W1742H

15" 3 HP PLANER W/ BUILT-IN MOBILE BASE AND HELICAL CUTTERHEAD

- Motor: 3 HP, 240V, single-phase, 15A
- Max. cutting width: 15"
- Max. cutting depth: 1/8"

⚠ WARNING! †¹



W1812

7" 2 HP PLANER MOULDER W/ STAND

D3393 ELLIPTICAL JIG FOR CURVED MOULDING PRODUCTION



- Motor: 2 HP, single-phase, 240V, 10.8A
- Planing width: 7"
- Max. stock thickness: 7 1/2"

⚠ WARNING! †¹



PATENTED



W1741H

8" JOINTER W/ ADJUSTABLE BEDS AND HELICAL CUTTERHEAD

- Motor: 3 HP, 240V, single-phase, 15A
- Table size: 76 3/8" L x 8" W x 1 1/2" T
- Max. width of cut: 8"

⚠ WARNING! †¹



Made in an ISO
9001 Factory



W1852

22" X 42" VARIABLE-SPEED WOOD LATHE

- Motor: 3 HP, 240V, 3-phase (with inverter), 8A
- Distance between centers: 42"
- Spindle threads: 1 1/4" x 8 TPI RH

⚠ WARNING! †¹



Made in an ISO
9001 Factory



W1837

10" 2 HP HYBRID TABLE SAW W/ CAST IRON WINGS & OPEN STAND

- Motor: 2 HP, 120V/240V (prewired for 120V), single-phase, 15A/7.5A
- Rip capacity: 30" to right, 15" to left
- Built-in mobile base

⚠ WARNING! †¹



Made in an ISO
9001 Factory



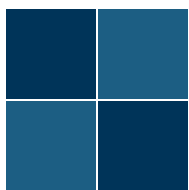
W1872

16" VS SCROLL SAW W/ FOOT SWITCH, LED LIGHT, MITER GAUGE, & ROTARY SHAFT

- Motor: 1/8 HP, 120V, single-phase, 1.2A
- Cast-aluminum table tilt: left 45°, right 5°
- Table size: 10" x 16 1/4"

⚠ WARNING! †¹





Connect

■ FROM THE EDITOR

Shop Dreams

By Andrew Zoellner

Working from home, my office space overlooks my backyard and garage. When those Zoom meetings run a bit too long, or my eyes glaze over after staring at a screen filled with text and numbers, I find myself daydreaming about my shop.

Not my actual shop, mind you. My actual shop is a 1920's one-car garage that was expanded to a two car some time mid-century. When I moved in two years ago, the walls were solidly out of plumb, the concrete floor was cracked and heaving, it had two, 15-amp circuits, and the roof had a few key leaks. Since then, I've added a plywood floor on sleepers to one half, upgraded the electrical to a 60-amp sub panel, insulated and sheathed the walls and added better lighting. I'm always weighing the pros and cons of improving my actual shop versus saving for the dream shop. And lately, that dream shop is where my mind drifts.

I like living in the city, so my shop can only have a footprint of about 700 square feet. I can only have one outbuilding on my property, so the shop may have to have a car or snowblower stored in it from time to time. But more than anything, I want my shop to be inspiring, a comfortable place to create, to work, to relax and maybe build a few things.

While there are a lot of advantages to using modern building methods, for me, nothing beats the charm and inspiration of a timber



The view from my desk on a wintry day. Though by no means ideal, my garage gives me space to make nearly anything and a way to unwind. It doesn't, however, store any cars.

frame structure. In that dream shop, beams of pine and oak (readily available in my climate) are joined with extra large versions of the joints we use in furniture.

The pegs holding those joints together also function as places to hang a shop apron or coat, or maybe a saw or two. Posts supporting the upper floor provide the perfect location for outlets and dust collection runs. The skeleton of the building is visible and apparent to anyone who visits, at once both cozy and airy.

Knowing that timber frame structures have stood for hundreds of years on this continent (and thousands across Europe and the rest of the world), the building method feels very sustainable.

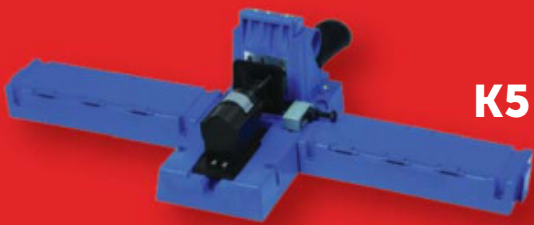
From my own experience with these joints, it feels like something I could really build (if only I had access to 20 or so good-sized logs and an extra large chisel).

And someday, that will be my shop. Hopefully soon enough that I'll have a hand in building it. But if you're like me (and Jason Stephens, page 36), it's never too early to start learning the fundamentals, though on a slightly smaller scale. For now, it's back to the reality of working in an old garage, making it as nice as I can, while my dream shop gets built (and rebuilt) in my head.

Andrew Zoellner



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K5

or



K4

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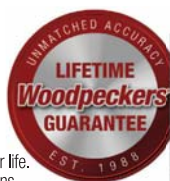


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- 600mm metric version available.



Precision T-Square

Includes a wall-mountable Rack-It™

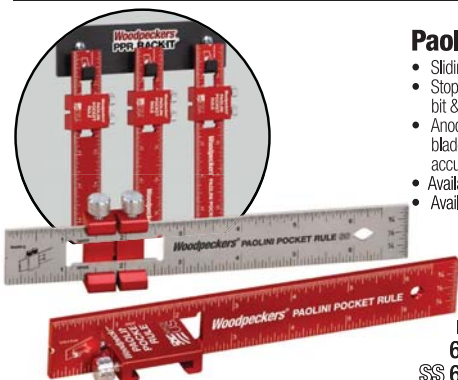
TS-12 12"....\$89.99

TS-24 24"....\$124.99

TS-32 32"....\$154.99

Paolini Pocket Rules

- Sliding stop simplifies repetitive marking.
- Stop doubles as stand to set router bit & saw blade height.
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- Available in inch, metric or combination.



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6", 8", 12" Set....\$124.99

SS 6", 8", 12" Set....\$149.99

Saddle T-Squares

- Scribing holes on 1/32" centers.
- Milled from solid aluminum billet.
- Mark face and edge at the same time.
- Edges beveled 30° to reduce parallax.
- Scale accurate to $\pm .004$ ".
- Available individually or as a set.
- Available in inch or metric graduations.
- Metric scribing guides on 1mm centers.



Includes a wall-mountable Rack-It™

Saddle T-Square Set....\$299.99

Includes a Systainer case

Saddle T-Square Set....\$369.99

in-DEXABLE Combination & Double Squares

- Push-button index locks head at any full-inch.
- Laser-cut scribing guides for precision parallel lines.
- Retractable support keeps head aligned to your stock.
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in-DEXABLE Squares

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- Profile perfectly centered on your stock.



EZ Edge Corner Plane

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- Works with any clamp.
- CSP Clamps add speed & convenience.
- Available individually or as a set.



Clamping Squares PLUS
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ULTRA-SHEAR™ by Woodpeckers®

Woodturning Tools

- Eliminate the drudgery of sharpening with nano-grain carbide inserts mounted to hardened alloy steel shafts.
- Sharpest, longest lasting carbide inserts on the market.
- Exclusive shaft design delivers both fast shaping & fine finishing.
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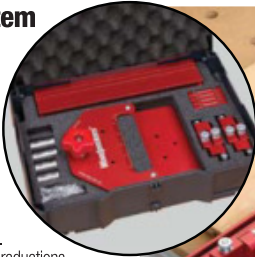


Mid-Size Woodturning Tool Set....\$269.98

Offset Base System

Made for Festool® Domino

- Attaches to both Festool Domino DF-500 & DF-700 XL.
- Wider, deeper referencing surface improves stability.
- Precision-milled spacers center mortise on standard dimensions.
- Outrigger carries stops for accurate repeat spacing.
- Available in inch or metric graduations.



Domino not included.

Includes a Systainer case

Offset Base System....\$429.99

Parallel Guide System

Made for Festool® Track Saws

- Makes repetitive, parallel cuts with table saw accuracy.
- Maximum rip capacity of 52".
- Narrow stock guides deliver accurate results down to 1/4".



Saw not included.

Includes a Systainer case

Parallel Guide System....\$429.99



Dust Port fits either end!



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- DP-PRO Fence integrates dust collection & delivers accuracy.
- Micro-adjustable DP-PRO Flip Stops.
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- DP-PRO Tables are full 1" thick with laminate top & bottom.
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- Drawer Base and Fence compatible with all drill press tables.

**NEW
TOOL**

DP-PRO Drill Press Table Master System

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36" Table, 36" Fence....**\$389.99**

48" Table, 36" Fence....**\$419.99**

48" Table, 48" Fence....**\$439.99**



RIP-FLIP Fence Stop System™

- Bring your rip fence back to the same spot each and every time you need it.
- Stop drops out of the way when not needed, flips up when you want it.
- Couple two stops together for perfect fitting dados in two cuts.
- Models available for SawStop T-Glide Fences® and Powermatic Accu-Fences®.
- Extra stops and dado couplers available. Add as many as you need!

**NEW
TOOL**

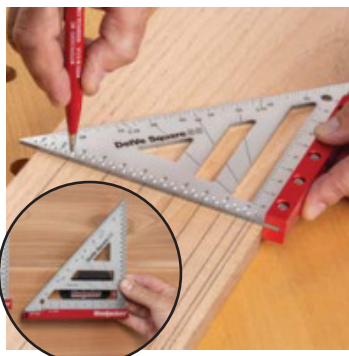
RIP-FLIP Fence Stop System

36" Capacity - Fits SawStop®....**\$209.99**

30" Capacity - Fits Powermatic®....**\$219.99**

52" Capacity - Fits SawStop®....**\$219.99**

50" Capacity - Fits Powermatic®....**\$229.99**



DeVe Square SS®

- Offset base simplifies layout on standard 3/4" material.
- Perfect thirds for mortise and tenon layout.
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- Scribing Guides on eighth-inch centers.
- Machined steps in base create accurate set-up blocks.
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DeVe Square SS

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3-1/2"....**\$89.99**

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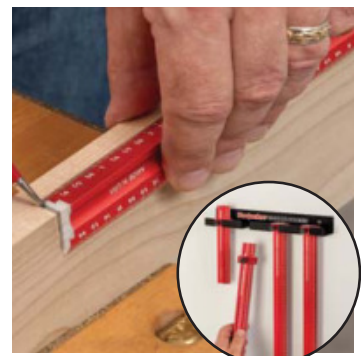
Woodworkers Edge Rules

- Wraps around the corner of your stock for instant alignment.
- Mark face and edge at the same time.
- Optional stops simplify repetitive marking.
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- Sizes to fit every need...6-inch is perfect in your pocket.
- Available individually or as a set.
- Available in inch or metric graduations.

Woodworkers Edge Rule

Includes wall-mountable Rack-It™.

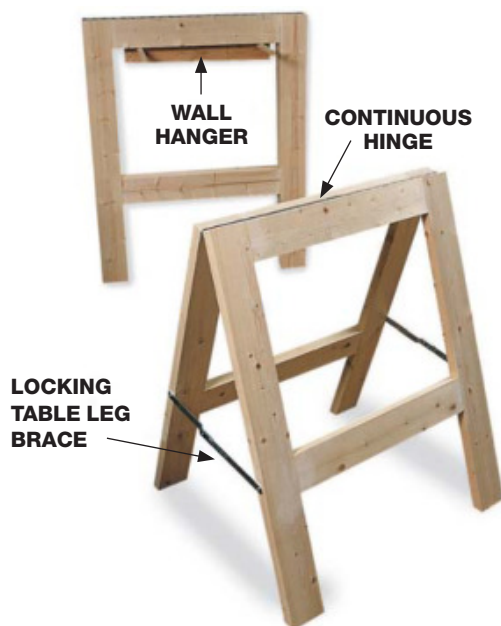
Edge Rule Kit & 4 Stops....**\$109.99**



For more sizes & ordering options for these tools plus hundreds more, visit **Woodpeck.com**

*NOTE: The Festool, DF-500, DF-700 XL, SawStop & Powermatic brand names are the registered trademarks of the respective companies and are not associated with Woodpeckers, LLC.

WORKSHOP TIPS



Folding Sawhorses

These sawhorses are sturdy and fold flat for easy storage. Building them is a snap: joint and plane 2x4 stock to 1"; then rip to 3". Crosscut at 30" for the legs and 18" for the stretchers. Use a biscuit joiner and double stack #20 biscuits at each joint. Assemble with a 1 1/2" continuous hinge and locking table leg braces.



Larger Try Square

Transform a framing square into a large try square by adding a wooden head. The holes bored through the framing square to hold the head must be oversized to allow adjustment. Check the tool for accuracy and adjust accordingly.

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Wood carving photos courtesy of J Paul Fennel

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WORKSHOP TIPS



Back Up Thin Stock

Make a sacrificial two-sided miter box when you're slicing thin stock into short pieces. Mount a toggle clamp on the box to safely hold your work (available at most wood-working stores). Fasten the box to your saw's fence so it won't move. Then cut a slot partway through. Use the slot to align the layout mark on your workpiece. This box also acts as a back stop so the cut-off won't fly away. It also prevents tear-out below and behind the cut.



Flap Sanders Eat Wood

A flap-sanding disc turns an angle grinder into a great tool for shaping and sculpting wood. You'll be amazed at how quickly these things remove wood. Be sure to take time to practice a bit before you scoop out your first chair seat.

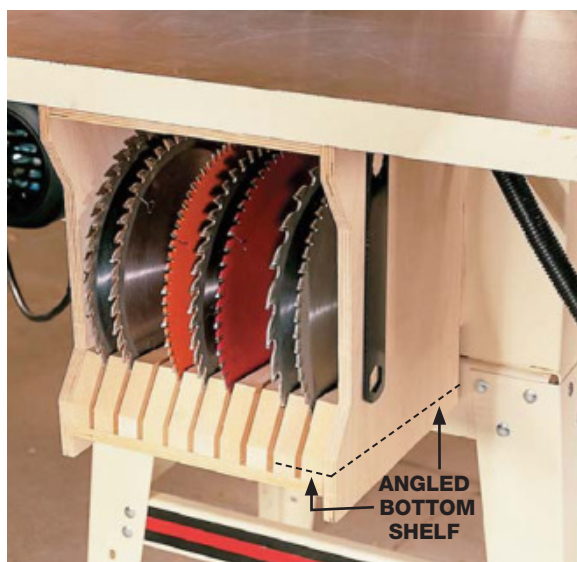


Table Saw Blade Rack

I'm always trying to eke out more space in my shop, and I found some hidden under my tablesaw behind the bevel crank. There's just enough space back there to hang a blade rack. I made the rack with an angled bottom shelf so the blades stay in their slots when I'm rolling the saw around on its mobile base. — *Ray Kendrick*



Divide a Board

To divide a board into equal widths without complex fractions, place a ruler diagonally across the surface so you can mark off the number of segments in whole numbers. For example, to divide a board into seven equal parts, place the zero mark on one edge, and place the 7" mark on the other edge. Make a pencil mark at each 1" mark to divide the board.



Squaring Blocks for Precise Corners

Here's a surefire way to keep drawers and boxes square during clamping. Cut some perfectly square blocks of solid wood (or glued-up layers of plywood) about 4" square by 1 1/2" thick. Drill a 2" hole in the middle of each block with a holesaw. Use spring clamps to hold the squaring blocks in place. Add bar clamps, but leave the squaring blocks attached until the glue is set.

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WORKSHOP TIPS

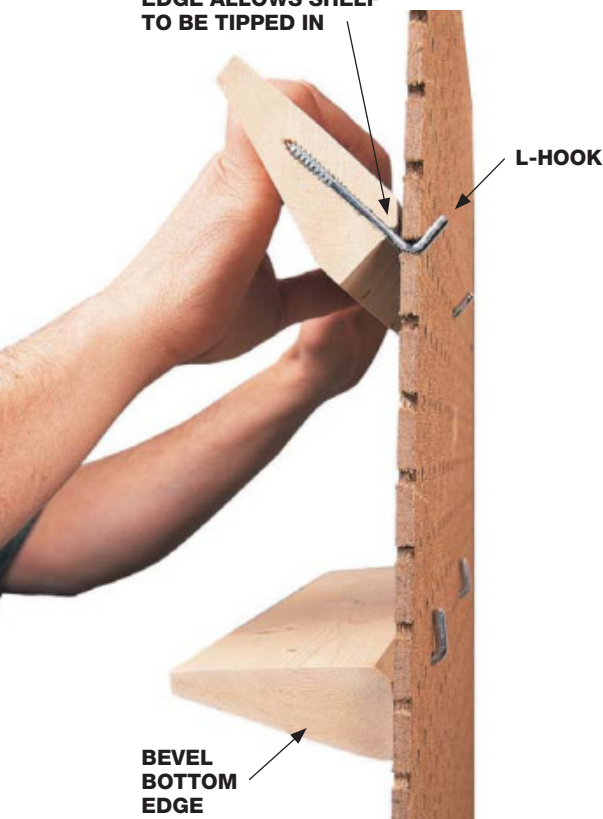
Floor Drawer

Here's a great space-saving tip. I first made "floor drawers" like these for under-the-bed storage. They worked so well I decided to use them in the shop. Floor drawers work great for storing scrap wood or infrequently used tools and supplies. Make the drawers long but shallow so the contents are easy to get at. I made mine with non-swiveling wheels and an oversize handle so I can push them in a straight line with my foot. — *Mike Fillipi*



NON-SWIVELING
WHEELS

CHAMFER ON BACK
EDGE ALLOWS SHELF
TO BE TIPPED IN



L-HOOK

BEVEL
BOTTOM
EDGE



SCREW A SUPPORT
BRACKET ONTO
DEEP SHELVES

Perf-Board Shelving

I use a perf-board over my bench to keep tools organized and within easy reach. These shelves take the concept one step further and remove the clutter that tends to build up on a workbench. Use 2x4s and 1/4" L hooks to make the shelves. Chamfer the top back edge so the shelf can be tipped in and tighten the L hooks for a snug fit against the perf-board. These shelves are surprisingly strong and can be sized to fit your specific needs. — *Myron S. Levy*

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Slab Flattening Mill•PRO

NEW
TOOL



Wider, Thinner, Thicker & Cleaner...

Woodpeckers Slab Flattening Mill•PRO has all the best features of our original Slab Flattening Mill, but with a new router carriage that has an amazing range of adjustment, working with stock as thin as 3/4" and up over 3" without spacers or shims. Dust collection is now built right into the carriage with twin collection ports that collect equally well on push or pull cuts. We reinforced the frame of the router carriage for even better surface flatness and finish.

Like the original, the Slab Flattening Mill•PRO and your router can surface irregularly shaped and twisted slabs into stunning table, counter and shelf surfaces. With a standard width capacity of 48-1/2" and optional extensions available, there's no slab project you can't master.

Learn more about Woodpeckers Slab Flattening Mill•PRO at woodpeck.com

NEW TOOLS

The Multi-Router Returns

Woodpeckers recently acquired the rights for the legendary multi-router (originally brought to market by the now-defunct JDS Manufacturing nearly three decades ago). This machine excels at cutting all kinds of joinery with a router, from mortises and tenons, to box joints, dovetails, rabbets and more.

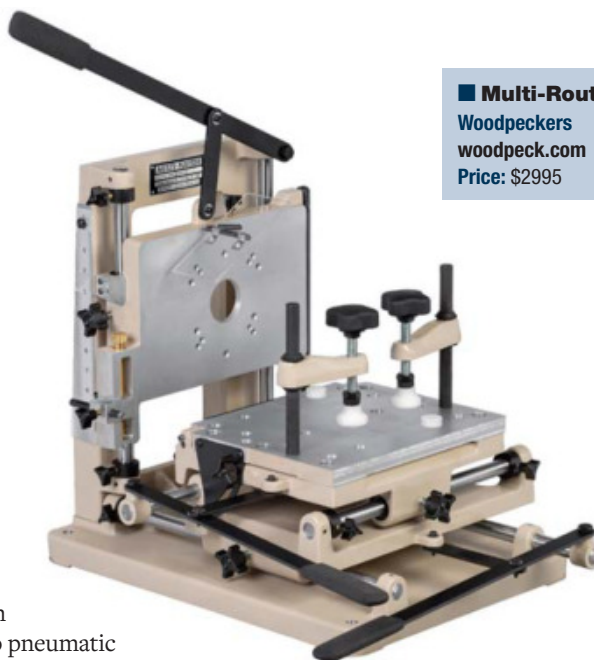
The machine features 3-axis movement. The router is mounted horizontally and moves up and down. The table (where you clamp your workpiece), moves in and out and side to side. Levers and stops control the parameters of the cut—most operations require working two levers. Pair the right bit with one of the multi-router templates, and you can quickly batch out all kinds of joinery. Angled joinery is easy to dial in, with the tilting table and adjustable hold

downs. You can also upgrade to pneumatic hold downs to speed up production, as well as add a digital readout.

With the full support of Woodpeckers (and its dedication to high-quality, made in the USA tools) behind this versatile, precision

joinery machine, you won't have to worry about spending your hard-earned money on a machine without a support team to back it up.

— Andrew Zoellner



■ **Multi-Router**
Woodpeckers
woodpeck.com
Price: \$2995

Edge-Sanding Guide

Sanding the edge of a table or interior of a face frame with a power sander can be a fraught affair. There is huge potential for tipping or losing control. Festool's edge-sanding guide pairs with their 5" random orbit sanders to make edge sanding more precise.

This guide uses the top of a workpiece as a reference surface in its fixed position to guide your sander at 90° along the edge (or any angle between 43° and 90°). There's also a soft mode, where the angle of the sander moves to accommodate changing surfaces.

The base of the guide has changeable pads to keep finished surfaces free of marring, and you have full access to change paper on the sander with the guide attached. Keep those crisp lines and bevels that you worked so hard to cut. — AZ

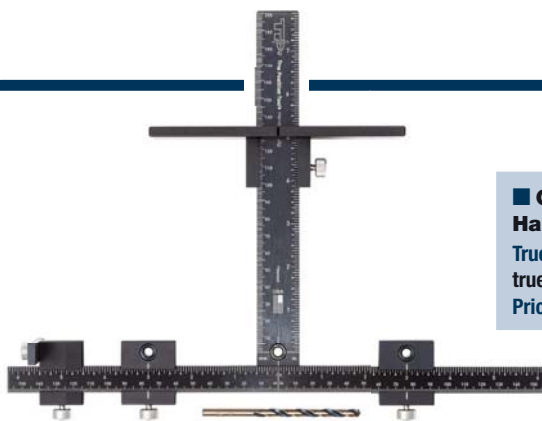


■ **Edge-Sanding Guide**
Festool
festoolusa.com
Price: \$99

No-Fuss Hardware Installation

Installing cabinet pulls can be a bit daunting. It's usually one of the last steps in the process, and when you're close to finished. Making a measure, marking or drilling mistake this late in the game can really be a bummer. And installing a handle with two mounting points? That's where a dedicated hardware jig really shines.

The True Position Tools original cabinet hardware jig is celebrating 25 years since its launch, and it's still one of the most versatile yet easy



■ Original Cabinet Hardware Jig

True Position Tools

truepositiontools.com

Price: \$189, extension set \$129

to use dedicated hardware jigs out there. The genius is in its T-square design. With the jig, you can dial in any hardware spacing from a single knob to a 3'-wide handle and perfectly place and align the mounting holes.

The standard cabinet hardware

jig tackles spacing up to 12" center to center, and additional accessories get you wider spacing. A separate set of guides can be used for drilling standard 32mm spaced holes for shelf pins and other hardware based on the 32mm cabinet system. — AZ

Geared-Up Drill Press

The newest drill press from Powermatic incorporates a very interesting motor design, combining an electronically controlled variable speed motor paired with gears. This gives the machine incredible torque, and it's all controlled with a simple interface to dial in the correct bit speed.

The low-speed setting gives you 150-870 rpms, and the high speed gives you 600-3600 rpms, which means you can quickly switch from drilling a bunch of pilot holes at a higher speed, to a low speed for a big Forster bit, to drilling out a piece of metal where you need more torque.

The other area where this drill press stands out is its large, cast-iron table with included extruded aluminum fence with an adjustable stop. It tilts to nearly any angle and is also quickly removable for drilling oversize parts or other fixtures.

Speaking of tables, Powermatic offers two accessory tables: one is a clamping table that incorporates MicroJig dovetail slots and clamps. The other is a downdraft table insert, which puts dust collection directly below the bit. While not a perfect solution to every drill press



dust collection scenario, it definitely helps for many drilling tasks and is indispensable for when using the drill press as a spindle sander.

It's definitely a premium tool, but it's truly a lifetime investment, and the versatility can't be beat. — AZ

■ PM2820EVS Drill Press

Powermatic

powermatic.com

Price: \$2000

NEW TOOLS

Circular Saw Crosscut Station

It can be tricky to do precision work with a standard circular saw, which is why it's usually relegated to breaking down material before you do the detail work with other machines in the shop. But it's often one of the first tools a DIYer purchases because it's affordable and versatile.

Kreg's new crosscut station takes the inexpensive circular saw and gives the tool a way to do accurate, repeatable cuts.



Your circular saw rides on a pair of rails (adjustable to securely fit your saw's base) that guide the saw over a cutting surface with integrated clamps and a miter fence. At 90° you get 12" of cutting capacity (more than on a 12" miter saw). — AZ



■ **Crosscut Station**
Kreg Tool
kregtool.com
Price: \$59.99

Redesigned Pocket Hole Jigs

Kreg's name is nearly synonymous with pocket hole jigs. This affordable, easy-to-use way to mechanically fasten wood has inspired generations to start their journeys into woodworking. These redesigned and reengineered offerings from Kreg are a more intuitive and faster system for drilling pocket holes.

The core of the flagship Pocket-Hole Jig 720PRO is the one-motion Automaxx clamping, which automatically clamps and sets the material thickness setting for pieces 1/2" to 1 1/2" thick. (In previous jigs, setting the material thickness and clamping the material in place were done with two separate operations.) That means you can switch material thicknesses mid project and all of the adjustments are made automatically.

Kreg has also improved dust collection (just connect to your shop vacuum) and really thought through the accessories. In particular, the support wings (which hold bits and screws) detach to give more support on longer pieces. And, there's an included clamp that lets you secure the jig on just about any surface.



■ **Pocket-Hole Jig 720PRO**
Kreg Tool
kregtool.com
Price: \$149.99

The automatic adjustment and clamping is available on stripped down versions of this jig, too. The 720 model is the same as the 720PRO, without the support wings and a couple accessories. The 520PRO has three presets for material thicknesses married to a trigger clamp. All three models work with the optional plug cutter, too. — AZ



■ **Pocket-Hole Jig 520PRO**
Kreg Tool
kregtool.com
Price: \$99.99



■ **LINK and XTRA 2.0 Headphones**
 Isotunes
 ISOtunes.com
 Price: \$79.99 (LINK)
 \$59.99 (XTRA 2.0)

Bluetooth Hearing Protection

The ISOtunes family of hearing-protection headphones has grown by two recently, with the addition of the XTRA 2.0 and LINK. Like other ISOtunes headphones, these are compliant with OSHA and NIOSH regulations and feature a noise reduction rating of 27 and 24 dB respectively, while limiting the max volume to 85 db. In plain English that means you can enjoy your tunes while still protecting your ears from damage around loud activities, like woodworking.

Both of these Bluetooth headphones are clearly well made and filled with thoughtful touches. I personally found the LINK to put a bit too much pressure on my temples (but I have yet to find a pair of over-the-ear earmuffs that are comfortable long-term). The XTRA 2.0 comes with several sizes of eartips, ensuring comfort no matter your ear canal size.

One of my favorite features of the XTRA 2.0 was the magnetic earbuds. Loose cords of any sort in the shop are a risk, so the earbuds clipping securely together when I removed them provided peace of mind. As an added bonus, clipping them together would automatically pause whatever I was listening to.

Once I started using the XTRA 2.0 around the shop, they became my go-to earbuds in the house as well. Kids on a zoom call for school? Earbuds in. Kids running around the living room? Earbuds in. Kids start an impromptu rock band? Earbuds in. Turns out I didn't need quieter children, just some noise-reduction headphones with all-day comfort. — Collin Knoff



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- Wall mount saves space

99% of Dust Here!

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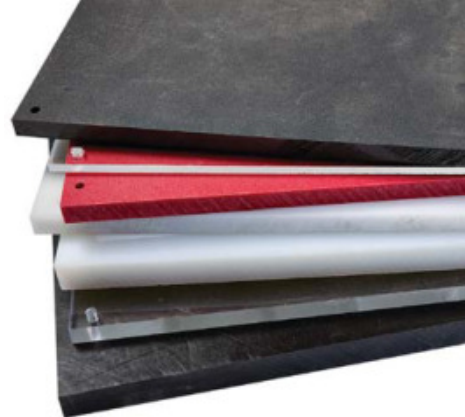
See a video of how it works at oneida-air.com

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Cutting & Carving Plastics with a CNC Router

Add this flexible material to your shop repertoire.

By Chris Fitch



Plastics are amazing materials.

Their lightweight grain-less structure gives them uniform strength in all directions making it an ideal material for all sorts of parts and projects. Available in clear, translucent and opaque plastics add a whole new level to your workshop's repertoire.

While there are dozens of different kinds of plastics, I recommend you try acrylic and polyethylene.

Acrylic plastic is manufactured in either a cast or an extruded form. Both offer good machinability, impact strength and tensile strength. Extruded Acrylic is available in many thicknesses, mostly less than $\frac{3}{8}$ " and in clear or a wonderful assortment of translucent colors. Cast acrylic is typically clear and available in much thicker dimensions, up to 4". Cast acrylic plastic is tougher and harder than extruded acrylic while extruded acrylic offers more flexibility and formability.

Woodworkers are already familiar with UHMW polyethylene as it is commonly used for table saw and router fence faces and for various jigs. This type of plastic has very good machinability, excellent impact

resistance, good tensile strength. It's also super slippery and wear resistant. HDPE polyethylene is almost as strong as UHMW, comes in several colors and has the bonus of being outdoor rated.

Plastics are grouped as either hard or soft. Cast acrylic is a hard plastic, extruded acrylic, UHMW polyethylene and HDPE polyethylene are soft plastics.

So, let's talk about how to work with soft and hard plastics. When machining plastics our goal is an efficient cutting operation with no welding of chips (the biggest problem cutting plastics) and an excellent surface finish. This requires a few considerations: the right type of bit, the right size of bit, the right combination of feed and speed and good work holding.

The Bits

Soft plastic works best using a single flute "O" style bit. Use $\frac{1}{4}$ " bit whenever you can and a $\frac{1}{8}$ " for tight situations. Larger bits simply work better.

For hard plastics, choose a two flute "O" style bit. The two flutes will produce a superior edge finish.

Once again, try to use a larger bit.

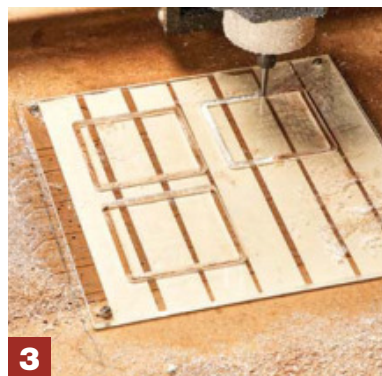
In both cases use a spiral bit for work on thick materials to lift out the chips and clear the cut. A straight bit is best for thin materials because it won't tend to pull the material off the spoil board causing chatter and a poor edge finish.

Carving work requires two bits, one for the roughing pass and a second for the finishing pass. A $\frac{1}{4}$ " two flute spiral "O" style bit will handle the roughing pass. A good choice for the finishing pass is a tapered spiral ball-nosed bit. I think $\frac{1}{16}$ " diameter is a versatile size that gives good detail. A tapered bit for plastic will have two flutes, no more. (My best advice for plastic carving is to carve hard plastics which have higher melting points such as cast acrylic and stay away from soft plastics!)

1 $\frac{1}{4}$ " bits seem to work best for plastic, though an $\frac{1}{8}$ " is sometimes needed for tight situations.

2 Carving a soft plastic to make gears. A single flute bit works best.

3 Harder acrylic is easier to machine with a two-flute bit.



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Cutting & Carving Plastic

Chip Load, Feed and Speed and Depth of Cut

Bit selection is important, but the wrong chip load can spoil the cut. Plastic is sensitive to heat and routing generates a lot of it. Maximizing the size of the chip (chip load) transfers the heat into the chip and away from the workpiece. The right chip load will help reduce knife marks and rough, cratered surfaces.

$$\text{Chip load} = \frac{\text{feed rate}}{\text{RPM} \times \# \text{ of flutes}}$$

For plastics the ideal chip load falls between .004 and .012. Faster feed rates help reduce the heat of friction, however, small parts, carving and hobby sized machines will limit the feed rate. Here are some combinations to test:

$$.005 \text{ chip load} = \frac{80 \text{ IPM}}{16500 \text{ RPM} \times 1 \text{ flute}}$$

$$.005 \text{ chip load} = \frac{160 \text{ IPM}}{16500 \text{ RPM} \times 2 \text{ flutes}}$$

$$.004 \text{ chip load} = \frac{60 \text{ IPM}}{15000 \text{ RPM} \times 1 \text{ flute}}$$

$$.004 \text{ chip load} = \frac{120 \text{ IPM}}{15000 \text{ RPM} \times 2 \text{ flutes}}$$

When cutting plastics on your CNC router increase the feed rate first then try slowing the rpm to obtain a good cut. Remember formulas are a place to start—results will be the final guide.

QUICK TIP: If you are having problems with melting on small parts, consider putting the plastic in the freezer for an hour or more.

The last parameter of bit set up is the depth of cut. Generally, $\frac{1}{2}$ the bit diameter is a good place to start.

Workholding

For the bit to operate, clear the chips while producing an excellent edge, the work must be secure. For thick sheets of plastic this is not a problem. Screws and various hold downs will work fine. Thin materials often require a combination

of methods. One solution is to use double sided tape combined with hold downs or screws. Just don't rely on tape alone. With plastic that comes with a protective coating spray adhesive is a handy option.

QUICK TIP: When using tape or spray adhesive with very thin materials, it can be a challenge not to damage the part when removing them. Consider adhering the part to a small, sacrificial board. This can be removed easily where you can use a solvent to soften the tape's spray adhesive's bond.

Experience is the best teacher to get the feel of cutting and carving plastics. As you gain confidence, you'll find a whole new world to explore. **PW**

Chris Fitch is Popular Woodworking's resident CNC routing expert and co-host of The Woodsmith Shop on PBS.



4



5

4 Carving a relief in hard plastic starts with a surfacing pass to establish a perfectly flat carving area.

5 Next, the roughing pass is done with a $\frac{1}{4}$ " bit, and you start to see the outline of the relief.

6 The finishing pass is done with a smaller $\frac{1}{16}$ " tapered ball nose bit. This pass takes much longer than the roughing pass.

7 The final product after the finishing pass and a little polishing.



6



7

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Pizza Rocker

Your handmade pie deserves more than a generic roller.

By David Picciuto



Handmade pizza is a mainstay at my house, but I never knew how much fun cutting up a freshly cooked pie could be until I made a rocker. This baby doesn't fool around; the hefty blade cleanly slices the thickest of crusts and layers of toppings. After three or four stylish passes, your slice of bubbling hot pizza slides free without dragging that annoying extra cheese or its unsuspecting neighbor. This project also makes an excellent gift for your pizza-loving friends.

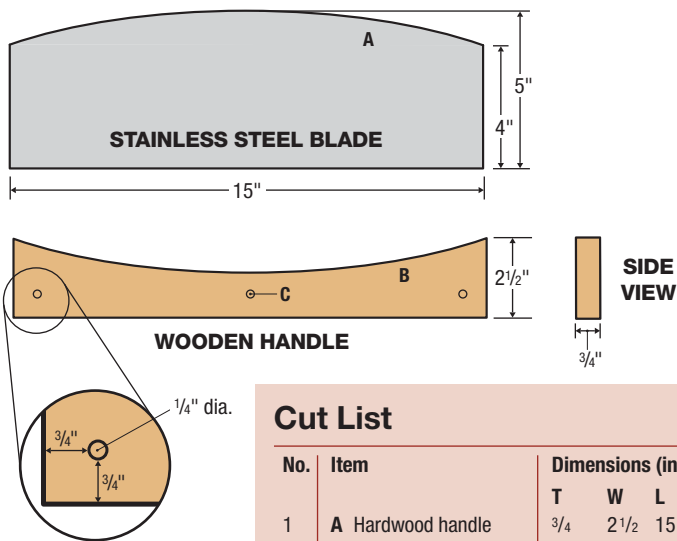
Begin with Metal Cutter

1. Start your drawing. Mark a 4" x 15" rectangle on your stainless steel. Draw a second line at 5" and make the center at 7½" to indicate the crest of the curve. Freehand a rounded edge from the center of the crest to the 4" marks. You can also use a cardboard template and trace it.

2. Cut out the steel shape. Make sure to use a new metal cutting blade on your jigsaw, take your time, and take breaks to allow the blade to cool. Cut as close to the line as possible without touching it.



Pizza Rocker



Cut List

No.	Item	Dimensions (in.)		
		T	W	L
1	A Hardwood handle	3/4	2 1/2	15 1/4
1	B Stainless steel sheet	20ga.	5	15
3	C 1/4-dia. Brass dowels*	-	-	*

*Length of the dowels should be slightly longer than the assembled handle.

3. Clean it up. Smooth the edges of the cutting blade to the line with 80-grit sandpaper on a belt sander or a disc sander. (Sheets of sandpaper on a flat surface also work if you've got the elbow grease.) Be sure to wear hand, eye, and lung protection when sanding steel.

4. Mark the cutting bevel. Use a permanent marker to draw a line that matches the rounded edge about 3/16" in.

5. Sand the bevel. Angle the blade and use a belt sander (or sandpaper and block) to sand the bevel on each side to the 3/16" marker line.

6. Make it shine. Sand the faces of the blade to your desired sheen. The higher grit you go, the more mirrorlike the finish.



Next Create the Handle

7. Begin the handle. Cut a piece of hardwood to $\frac{3}{4}$ " x $2\frac{1}{2}$ " x $15\frac{1}{4}$ ". This is cut slightly longer so it can be sanded down to the finished size.

8. Create a decorative look. To give your pizza rocker a better look, draw a curved line instead of a straight line on the wood where the handle will meet the blade. Use the curvature of blade as your template.

9. Cut along the curved line. Use a bandsaw or jigsaw to cut along the curved line you just drew. Follow that up by sanding the curve smooth.

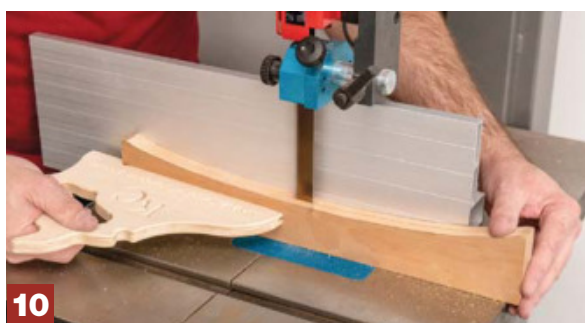
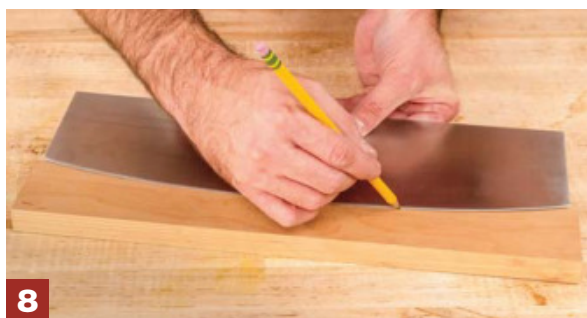
10. Cut the handle in half down the middle. With it cut to a curve and sanded smooth, resaw the handle right down the middle to make up the two halves that will sandwich the cutting blade.

11. Give the curved edge a roundover. Add a small $\frac{1}{8}$ " roundover on the outside face of each piece. Do not round over the inside that will make contact with the blade. This roundover is easier to do before assembly.

Attach and Finish

12. Glue it up. Use five-minute epoxy to glue to blade between the two handle halves. Clamp it together and allow to dry for 24 hours.

13. Mark the holes. With the glue dried, mark the holes to be used for the brass dowels. Make a horizontal line $\frac{3}{4}$ " in from the top and the two outside dowels inset $\frac{3}{4}$ " from the edge. Put the third hole directly in the center.





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14. Drill it out. Use a drill to bore a 1/4"-diameter hole completely through the three markings.

15. Cut the brass dowels. Using a hacksaw, cut some 1/4"-diameter brass rods slightly longer than the thickness of your assemble handle.

16. Add the brass dowels. Apply some epoxy to secure them and pound in the dowels.

17. Sand everything smooth and round over.

Once everything is dry, sand all handle edges so the steel and wood create a nice flush edge. Use the belt sander to flush brass dowels as well. Round over the outside edges of the handle so the cutter has a nice feel when using it. Use a 1/8" roundover bit like you did in Step 11.

18. Give it one final sand and finish. Do a few passes with your sander or sandpaper up to 220 grit. Finish the hardwood handle with a food-safe oil. Any off-the-shelf cutting board oil will do the trick. **PW**

David Picciuto currently resides in Toledo, OH where he creates energetic, funny, and highly informative woodworking videos on his YouTube channel "Make Something."

■ **MAKE YOUR OWN KITCHEN TOOLS: Simple Woodworking Projects for Everyday Use**

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Plywood Lounge Chair

A Single Sheet of Plywood Yields Enough Parts for Two Chairs. By Dillon Baker



PROJECT #2104

Skill Level:
Intermediate
Time: 2 Days
Cost: \$100

During my senior year of design school, I was presented with the challenge of creating a piece of furniture using a single sheet of Baltic-birch plywood. The objective being: utilize as much of the sheet as possible with minimal amount of waste. Easy enough—or so I believed.

Here we are, a whole decade later and the substance of this objective continues to fascinate me. Part of this allure could be attributed to nostalgia, or just sheer frontal lobe engagement; however, I am convinced it's a bit more idiosyncratic and applicable than that.

One of the unique elements of this assignment is the nature of its framework, which forces one to design within the limits of spatial availability; thus, presenting its own set of inherent challenges. The material is limited, high scores in Tetris are valuable (although not requisite), and if you are not using the aid of a CNC machine, feasible cut paths for handheld tools are imperative. It's like designing a giant jigsaw puzzle—oh, and by the way, you have to create all of the pieces.

To expand upon this original concept, and to make good on any past failed collegiate attempts, I went

a step further by designing a piece where two chairs can be assembled from a single 4' X 8' sheet of plywood using mostly handheld power tools—you are welcome, Professor Martin. Let us get started.

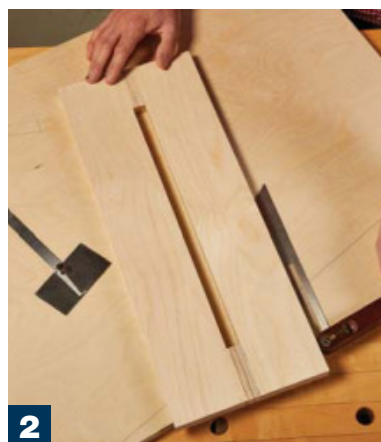
Create a Cutting Diagram

An essential component to this project is establishing the layout of each piece in relation to one another on the plywood sheet. This begins with a process known as “nesting” which aids in not only eliminating waste, but also helps establish the procedure in which each piece is cut from the sheet.

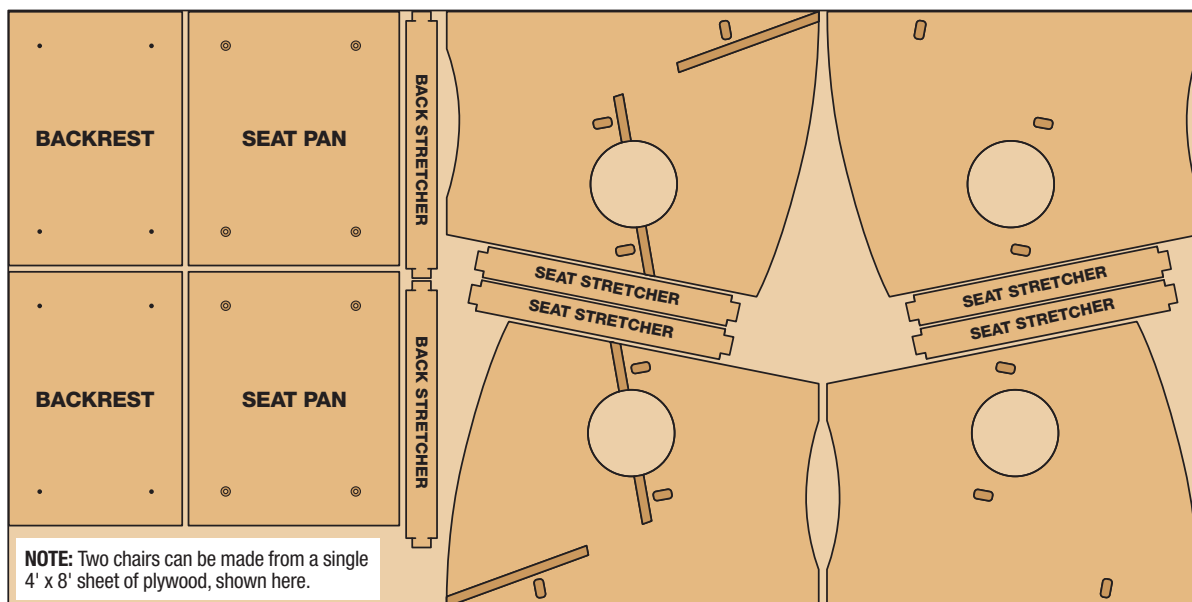
To make the pieces more manageable, cut the plywood into three separate sheets. Here, a track saw was used, but a circular saw along with a cutting guide will work just as well. Once this is complete, proceed to cut the individual pieces to their final dimensions (with the exception of the stretchers – leave these long by $\frac{1}{4}$ ").

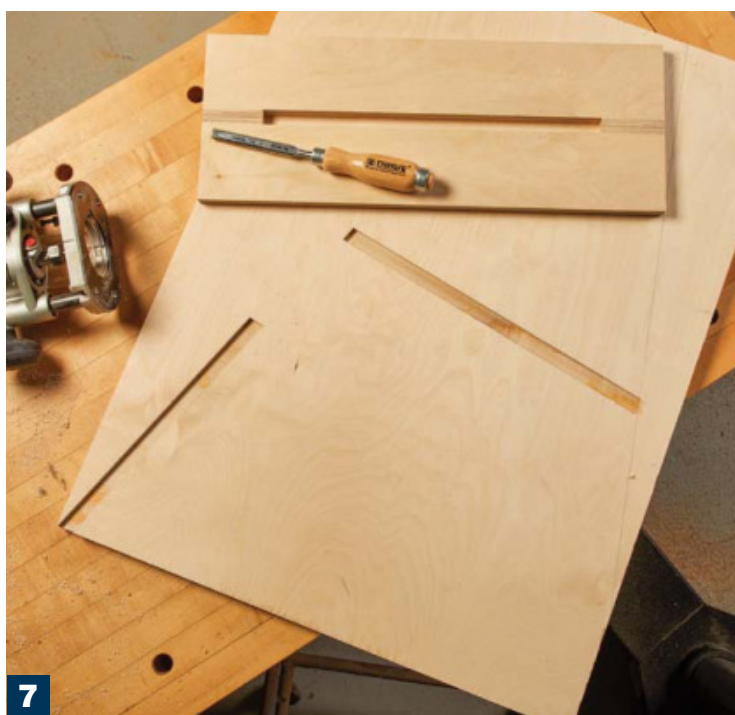
A Master Template for All

Begin by laying out the locations of the stopped dadoes along with the mortises on all four sides. Once the joinery layout is established, I went



1-2 Lay out the stopped dadoes first. A couple of bevel gauges help nail the angles. I use a dado template to mark the dado (and cut it later).





3 Use the dado template to rout the seat dado on the chair side. The template is held in place with double-sided tape.

4 Then reposition the template to cut the dado that will house the back.

5-6 Square up the ends of the dadoes with a chisel.

7 Move on to the rest of the layout. You'll use this side as a template for the other.

ahead and built a couple of jigs to help assist with the two types of joinery which will be implemented. This not only aids in joinery expediency, it ensures repeatable accuracy when making your cuts.

Using the reference lines, apply the stopped-dado jig to one of the side panels using double-sided tape. For this process, I used a handheld router with a plunge

base and a $\frac{1}{2}$ " diameter pattern bit (bearing towards the shank). Make sure that the bearing has plunged below the surface of the jig before you begin to make passes; any contact the flute of the bit makes with the walls of the jig without the guidance of the bearing will render your cut inaccurate—just remember, slow and steady wins the race. Once the stopped dadoes have been

made, square up the ends of the grooves using a $\frac{1}{2}$ " bench chisel.

Now, swap out the stopped-dado jig for the one created for the mortises. Draw a line ($13\frac{7}{8}$ " from the panel's back edge) through the center of the groove created for the seat pan. You will notice there is another line drawn at 80° on center, between the two mortise slots on the jig—use this reference in conjunc-



8

8-9 I used a flexible metal ruler to lay out the curves on the chair side, starting with the bottom curve.

10 Then drew the curve on the arm rest of the chair using the same technique. Both curves are just cut with a jigsaw and then refined with some sanding.



9



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11-12 The mortises are cut with another jig and the router. For ease of use, I spaced the two mortises for the seat supports directly on the jig.

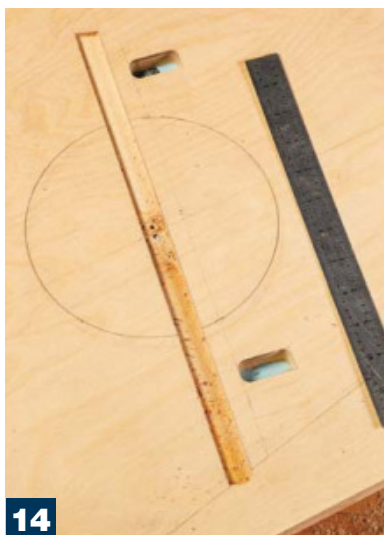
13 Then cut the upper mortise for the back rest support.

tion with the one drawn on the panel. Again, using double-sided tape, apply the jig to the panel and start creating the mortises. Proceed to create the mortise for the back stretcher using the pre-applied layout marks.

Now that the joinery is complete, it's time to create the circular cutout. With a scrap piece of $\frac{1}{4}$ " plywood, I created a makeshift trammel for the palm router. Locate center on the

seat pan groove, screw the jig down, and begin to rout the cutout removing about a $\frac{1}{4}$ " material at a time.

NOTE: Do not route all the way through the thickness of the material; half to three-quarter the way will do. Once this is achieved, follow the path created with the router using a jigsaw to dislodge the cutout—clean up any irregularities left with the pattern/flush-trim bit.



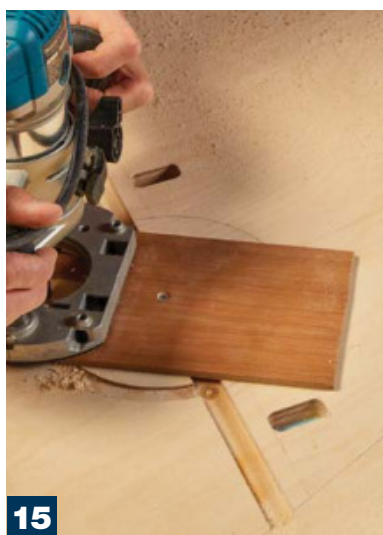
14

Next up is creating the arcs that make up the profile of the sides. It's worth mentioning that I will do just about anything to avoid the introduction of an extra hand; even if the process to achieve the same result (solo) takes twice as long. This character flaw is well exhibited in the proceeding steps. Using a couple bar clamps, an aluminum ruler and a center point, rest the ruler between the two clamps. Start bending the ruler towards the designated center mark and follow the contour of the curve with a pencil. Repeat this process for the shallow reveal at the base of the panel. Following the profile lines created, use a jigsaw to remove the waste and then clean up any irregularities with a sanding block.

With one fully completed side, you can begin to use this as both the template and the mortising jig to complete the remainder of the side panels.

Strength and Aesthetic

With the four side panels complete, it is time to turn our attention towards the three stretchers. As mentioned previously, these were left extra-long as they will be trimmed flush once the chair is fully assembled. This exposed tenon will reveal the even layers of laminated veneer, thus providing a



15

14 Lay out the circular cutout in the chair side. You'll use the center-point to attach a router trammel.

15 The router trammel (just a board with a center point and the router mounted to one side), you can cut the circle. Take shallow passes.

16 When you're close to breaking through, switch to a jigsaw to finish the cut. You can use a pattern bit in the router to clean up the cut.

17 Last, I cut the front edge of the side. With one side completed, use this as a template for the other.

subtle contrast between construction and aesthetic. Start by creating the shoulders of the tenons at the table saw. If feasible, you can proceed to cut the cheeks here as well. If not, a hand or band saw will work just as well.

As I am sure you have already noticed, the mortises were left with radiused corners so, we will need to create a profile on the four edges of our tenons to accommodate this detail. Using a $\frac{1}{4}$ " round-over bit, start applying the profile by pushing the tenon into the bit from the right side. Flip the piece on end and repeat this step. During this process you will have to back-rout four of the eight total edges by feeding the tenon into the bit from the left side. This is



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perfectly safe as you are removing a minimal amount of material.

The last detail to address is the 10° bevel on the backrest stretcher. Since all of the mortises are aligned with the angle of the seat pan (which is at 20°), a small bevel is created on one side to couple with the corresponding angle of the backrest.

Oblique Angles and the Goldilocks of Comfort

The designing of a chair is much like the designing of a shoe: it must be visually appealing, structurally sound, and of course, comfortable. It's these three ingredients that will help ensure a successful end product. Now, one could argue that



18



19



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18-19 The trickiest part of using one side as a pattern for the other is routing the second side hole. Use a top-guided pattern bit in the router. Make your first plunge deep enough that the bearing will run along the pattern.

20 Rout the cutout in multiple passes. I used a sheet of foam insulation as a backer to minimize blowout on the back of the piece. You can repeat this process for the mortises.

anyone of these three elements are subjective, thus rendering an endless discussion of what makes a chair “great,” however, fortunately for us, there is a litany of references that already exist when it comes to furniture dimensional standards. It’s this framework from which we can begin the design process with a certain level of confidence.

Now onto the construction of the seat pan and backrest. These two pieces would have been cut to their final dimensions in the beginning, although there are a couple more alterations that need to be done. First, create a 10° bevel on one side of each panel using the table saw. This angle should correspond with the stopped dado created earlier in the construc-

tion process. Second, drill four 1/4" by 1/4" counterbored holes in each panel, followed by a 5/16" through hole (spacing listed in the plans). These holes are created to accommodate an optional, upholstered backing for the seat pan as well as the backrest. Once this is complete it is onto the assembly process.

Assembling the Puzzle

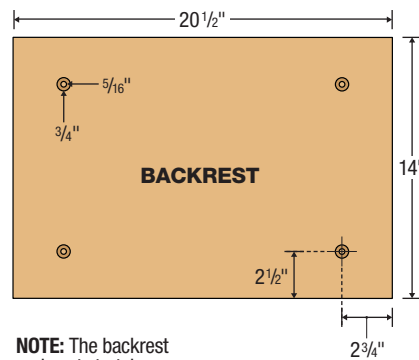
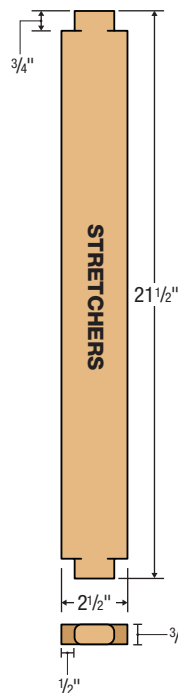
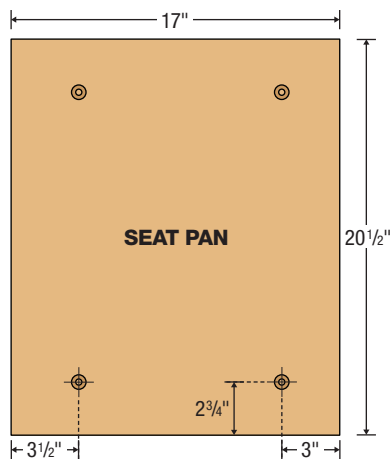
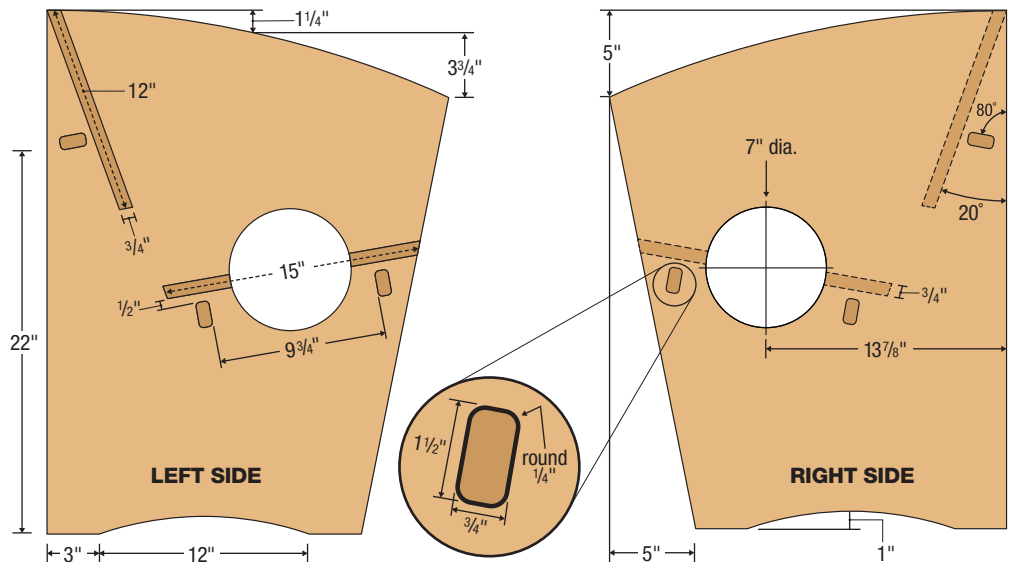
With the pieces complete, it’s time to bring it all together. I found that laying one side of the panel flat on the workbench is the best place to start. Apply glue to all of the joints and begin to insert the three stretchers (not fully seated) into their respected mortises and tilt the side panel up on end. Bring the opposing side panel

in and loosely fit the tenons into the mortises. This process will free up both hands so that you can continue to place the seat pan and backrest into their designated grooves. Now that everything is placed, use some persuasion from a rubber mallet and get everything clamped together. Once the glue has dried, take this opportunity to flush-trim your tenons and do any necessary sanding prior to applying finish.

Finishing Indecision

As with any project, the end is imminent—and you if you are like me, you put off finishing decisions on all projects until there is absolutely nothing left to confront. As both an act of defiance and a remedy

Plywood Lounge Chair



NOTE: The backrest and seat stretchers are the same except the backrest stretcher has a 10° miter on one end.

Cut List

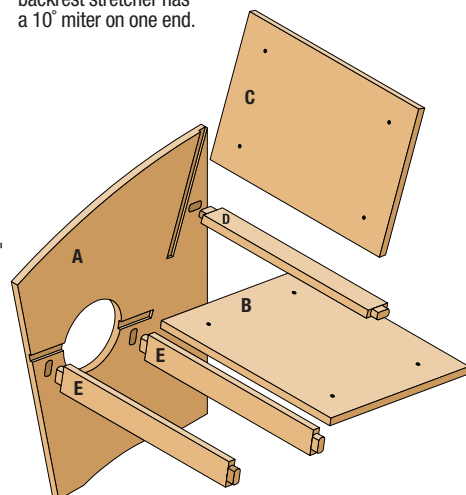
No.	Item	Dimensions (in.)		
		T	W	L
4	A Sides*	3/4	23	30
2	B Seat pans**	3/4	17	20 1/2
2	C Backrests**	3/4	14	20 1/2
2	D Back stretchers**	3/4	21 1/2	21 1/2
4	E Seat pan stretchers	3/4	21 1/2	21 1/2

Upholstery Boards

2	F Backrest board	1/2	11	17
2	G Seat pan board	1/2	14	17

*Left and right sides are mirrored.

**10° miter on one edge.





21



22



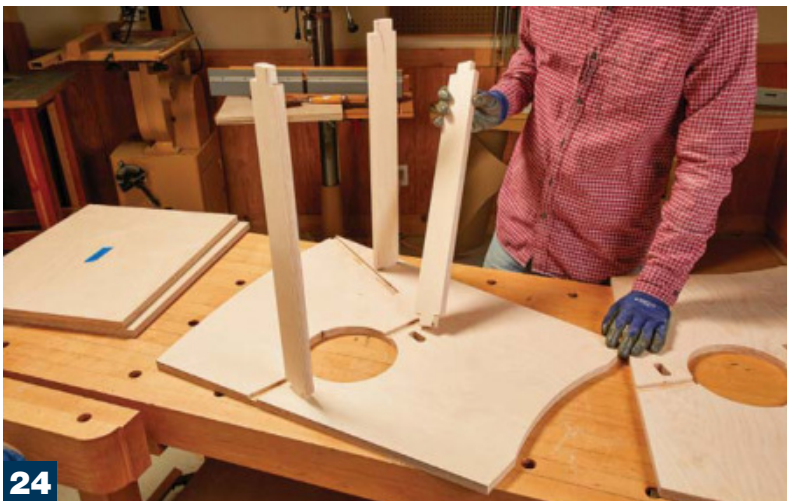
23

21-22 I cut the cheeks of the tenons on the table saw, then finished the cut on the bandsaw. In order to make these square tenons fit in the rounded mortises, I rounded over the edges on the router table and refined the fit with a chisel.

23 To attach the seat and back cushions, I used T-nuts and binding screws.

24 With all of your pieces cut, assembly is pretty quick. Start with gluing in the seat and back stretchers to both sides, but don't fully seat them.

25 The little bit of extra room is helpful for sliding in the seat and back. Then use a mallet to drive everything home.



24



25

to my procrastinations, I chose to introduce an application that is relatively new to me, however quite common in practice in the world of furniture. I went ahead and created a couple of upholstered pads, which were applied directly to the seat as well as the backrest using t-nuts and binding screws.

A trip to the local fabric store, a minimal number of tools and a couple how-to articles later, this simple process not only made the chair more inviting, it made for a much more comfortable sit. Once the decision was made to upholster the chair, my finishing anxieties subsided. Two coats of catalyzed lacquer later (nothing to distract from the fabric accent) and the project is complete.

With all of its built-in challenges, what I have come to appreciate about this project is that its objective gives the initial impression of a limiting condition. However, when confronted, it impels one to take a more conscientious and method-based approach to the design process—initiating the conversation in which all good design begins. **PW**

Dillon Baker is a furniture maker and Popular Woodworking's projects editor, based in Des Moines.

■ Timber Frame Child's Bed

Practice Traditional Building
Joinery on a Smaller Scale
By Jason Stephens



PROJECT #2104

Skill Level:

Advanced

Time: 2 Weeks

Cost: \$300

During my 14 years living in Europe, I marveled repeatedly at how these beautiful timber framed structures had withstood the test of time—I remember one awe-inspiring timber framed house near Wiesbaden, Germany, with a placard on it that indicated it had been built approximately 500 years ago. Unlike modern structures built with manufactured materials, this one actually grew stronger with age. It incorporated the fantastical attributes of trees—nothing less than one of the world’s most awe-inspiring materials in terms of engineering potential and beauty—which, under the direction of master craftsmen, ensured the building’s natural settling caused the joints to grow stronger as gravity worked upon the structure over time. If there is a more profound example of form following function in craftsmanship it doesn’t come immediately to my mind. I knew I had to build one eventually.

Our son was growing out of his infant bed, so my wife asked me to make a bigger one. “Just make it simple,” she said, naively. Thus far the time hasn’t been right to timber frame our dream house, but it occurred to me that this might be an opportunity to build a tiny house as my first real foray into the art of timber framing. Any mistakes I made on this first attempt would therefore be restricted to a much more manageable (and correctable) scale.

My main source of reference was *Building the Timber Frame House* by Tedd Benson. Over the years I’d pored over the pages of this book but had never put any of the author’s techniques into actual practice. I did a lot of planning and double-checking of dimensions, as this particular point was continuously stressed in the book. As the process unfolded it became clear why this was so vital.

One of the main challenges I had to overcome was the fact that the dimensions I chose for the bed require

that it be knock-down, so it would fit through a standard doorway. But at the same time, I wanted to keep this as traditional as possible—I didn’t want a bunch of metal hardware diluting the effectiveness and beauty of mechanical joints. The construction of an actual house using timber frame methods doesn’t have this particular challenge, since to my knowledge there is no giant doorway through which a full-size house must fit.

I found a way to incorporate knock-down hardware into the joints that would need to be disassembled when moving, such as the shouldered mortise & tenons, as well as in the collar ties. The hardware allows for breaking down the bed when needed, without diminishing the strength of the joints.

The structure of the bed isn’t very complicated. It’s the joinery that’s the real fun, so we’ll focus on that.

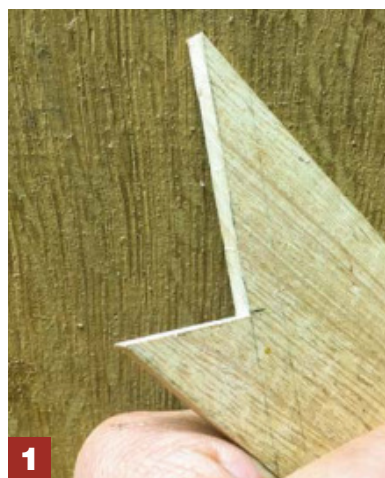
Bird’s Mouth with Tenon at Post

For me, getting the angles in the bird’s mouth and in the top of the rafters correct was probably the

biggest challenge of this project. This joint connects the roof with the rest of the frame, so it’s a good one to start with. After constructing the first of the six examples of this joint I realized with a bit of horror that, due to my slight misunderstanding of one of the Benson book’s illustrations, I had missed a small but important detail in the joint’s anatomy during layout. There’s no decrease in the functional strength of the joint, but as a result of my criminal malfeasance there is now an eternal visual reminder, which I chose not to correct (see image 5).

I did revise my layout technique for the subsequent examples. Although I don’t intend to ever disassemble these particular joints for moving, I chose not to use glue here. Instead, these tenons are draw-bored with a walnut peg to keep the joints tight, while the brilliant anatomy of the joint itself easily deals with the worst shocks and stressors an energetic boy can conjure.

The rather complicated layout of timber framed structures is greatly



1 A template for the bird's mouth. Once I dialed in the exact angles, this template helped me mark out and cut the joint on the six rafters.



2 I left about a third of the thickness of the rafter for the tenon. The tenon is laid out separately after the bird's mouth is cut.



3

3 The completed bird's mouth and tenon. You can see some of the joinery I pre-cut on the post.

4 The first assembled bird's mouth and tenon on post. The tenon is completely hidden.

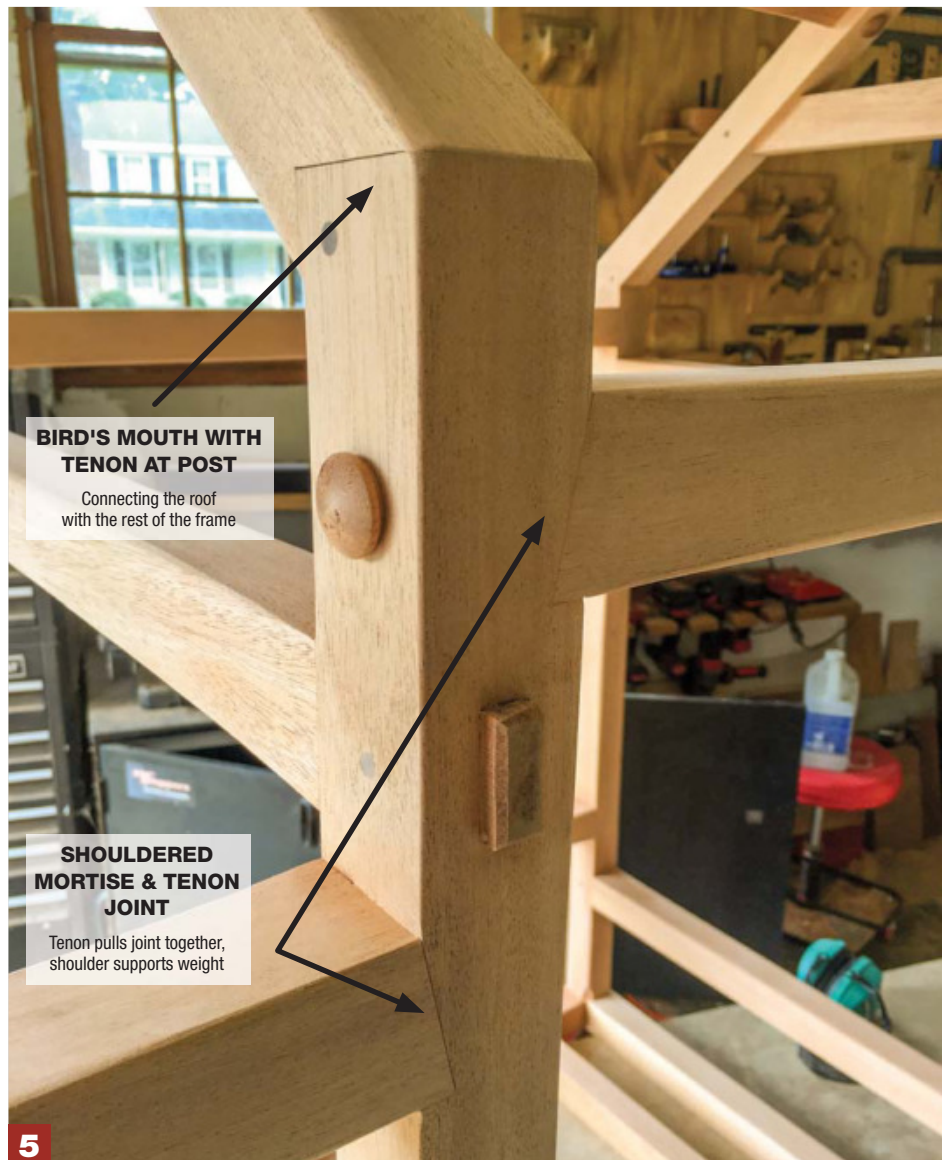
5 I drawbored the bird's mouth joints with a walnut peg, going through the walls of the mortise and the tenon.

simplified through the construction and use of templates for each type of joint, which ensures accuracy and easy repeatability. With furniture we fit certain parts with other parts to ensure accuracy (such as with drawers, various joint such as dovetails and mortise/tenons, etc.), but with a large structure this particular technique is impractical or impossible, because of the sheer scale of the timbers.

For me part of the point of this project was to build according to the timber frame method—using templates for the joinery. But I also wanted the joints to be as clean and well-fitted as possible, as with fine furniture, so I struggled a bit to come up with a method of satisfying both requirements. I chose to fit some joints as I would with normal furniture, but to use templates whenever possible, as I did with this particular joint.



4



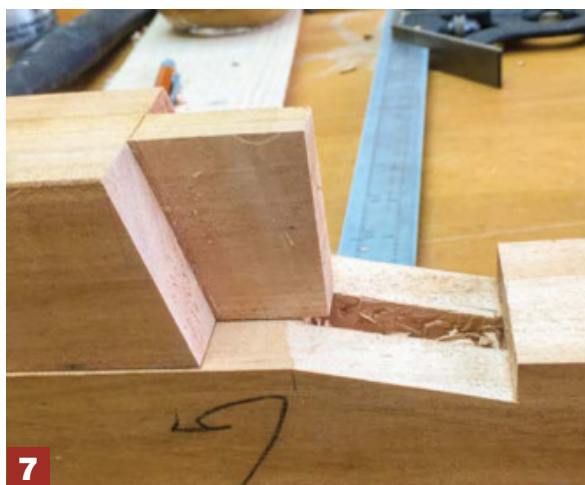
BIRD'S MOUTH WITH TENON AT POST

Connecting the roof with the rest of the frame

SHOULDERED MORTISE & TENON JOINT

Tenon pulls joint together, shoulder supports weight

5



Shouldered Mortise & Tenon Joint

I have no doubt simple mortise and tenon joints would have been plenty strong for this application, but since the goal here was to use traditional timber frame joints, I chose shouldered tenons. In a house these beams are very large and heavy and must be able to bear some serious weight from the roof, and possibly also another level or more from above. The shoulder is the load-bearing portion of the joint, and the draw-bore tenon pulls the joint together.

I determined this was one of the joints that I would need to be able to take apart for moving, so instead

of glue I needed to use knockdown cabinet hardware that would merely keep the joints drawn together during use, but wouldn't diminish the effectiveness of their load-bearing properties, no matter how many times the bed is disassembled.

15 years ago I made a corner cabinet for some friends of mine as a surprise gift, and after two weeks or so of careful work I loaded it into my truck and drove it to their house to deliver it to them. They were very pleased and surprised, but I think the bulk of the surprise was my own upon discovering it would not fit through their front door. One might imagine the lifelong effect this has had on my

6 The shouldered mortise and tenon can support a lot of weight (though it's not strictly necessary here).

7 I cut the angled shoulder and mortise first, then cut the tenon to fit.

8-9 Fitting one joint was fairly easy. But making sure all of them fit and the frame was square took more planning. These joints will be disassembled, so they'll be bolted through the end.

woodworking since then. Since that terrible moment there has not been a project I have done where this disaster has not been at the forefront of my mind during the planning stage.



11



12

11 The purlin is joined with a simple half-lap joint to the middle bent.

12 The two end bents connect to the purlin with half-lap dovetails, which stop the bents from pulling outward.

13-15 The purlins will need to be removed to get the bents through the door, so they're held in place with a single bolt on each end, covered by a walnut plug.

Half-lap Dovetail at Purlin

This long beam (and its mate on the other side of the house) ties all three of the a-frame structures (called “bents”) together. I wanted the dovetail joints to be tight and strong, so that they perform their mechanical functions well, but I also needed to be able to repeatedly disassemble the bed without weakening the joint. I accomplished this through the use of threaded brass inserts and Allen-style bolts.

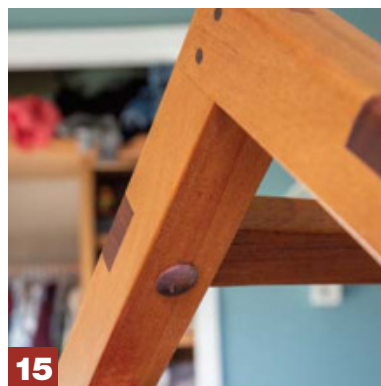
If the fitting of this bed through doorways weren't a concern I would have glued this joint, but since doorways exist, and generally occupy their time daring you to disrespect them, I didn't have that option. So instead of glue I installed a threaded brass insert into each purlin, which receives an Allen-head bolt from each rafter below, allowing repeated assembly and disassembly without weakening the joint.



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16 The collar ties prevent the rafters from sagging and spreading.

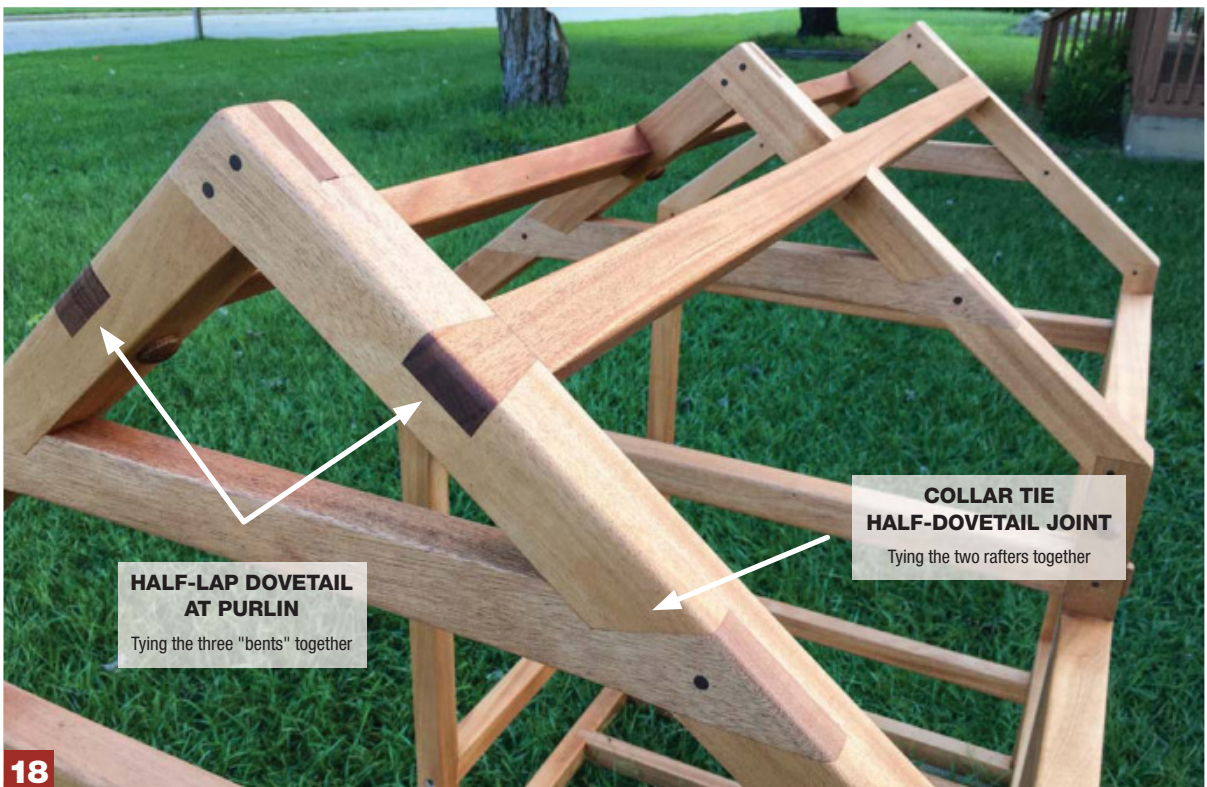
17 The joint combines a half dovetail and a lap joint, pinned with walnut.

18 The collar ties and purlins work together to create a very strong roof frame.

Collar Tie Half-Dovetail Joint

This joint ties the two rafters together, helping to resist the rafters sagging or spreading. With a piece of furniture of this size there might not be much call for a collar tie, but when considering the amount of force an actual roof must withstand, especially when laden with snow, etc., it

becomes apparent what a vital purpose this serves. In this case, my son eventually hanging from the rafters like a monkey is a stand-in for the weight of snow on a roof. As is the case with dovetails, the complementary geometry of the male and female portions of this joint means that the more force that acts against the joint, the stronger the joint becomes.



HALF-LAP DOVETAIL AT PURLIN

Tying the three "bents" together

COLLAR TIE HALF-DOVETAIL JOINT

Tying the two rafters together

Housed Dovetail Joint

I used housed dovetail joints for the load-bearing floor (mattress) joists. I cut these joints with a combination of power tools to hog out the waste, and hand tools for refinement. This joint is often used in floors in traditional timber framing because the dovetail portion of the joint resists lateral movement, but the hidden load-bearing portion can support

absurd amounts of weight.

Instead of measuring and marking each of the 14 housed dovetail joints, I made a template. This minimized the risk of costly errors, and aside from the initial time investment it took to make it, layout of the 14 joints was quick and accurate. I did this for the bird's mouth rafter and shouldered mortise & tenon joints, as well.

19 The mattress platform is designed to mimic traditional floor framing. To connect the joists to the frame, I used housed dovetail joints. The dovetail portion of the joint keeps the frame from spreading, while the hidden load-bearing portion of the joint supports all the weight.





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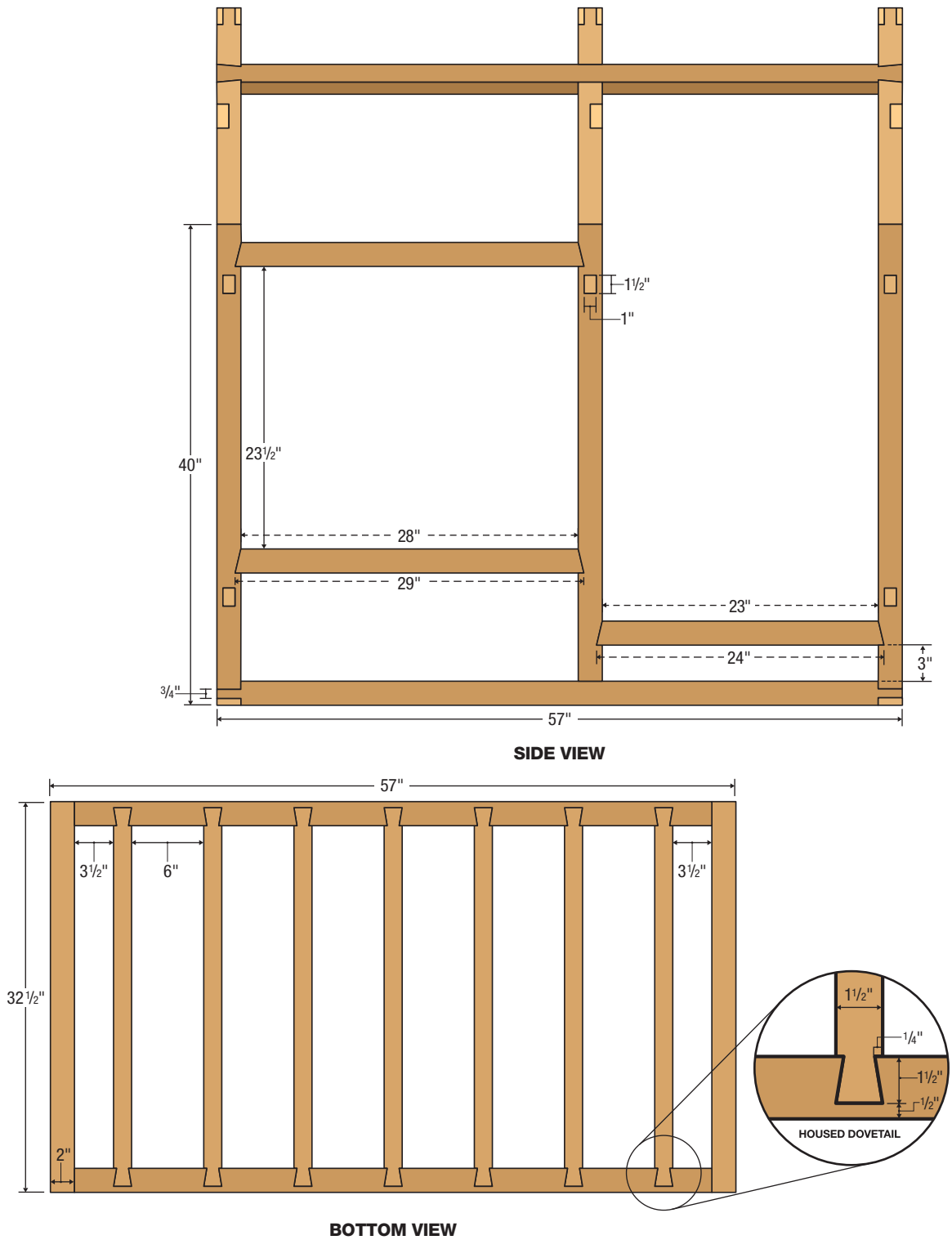
20 To aid in cutting the 14 housed dovetail joints I made a template.

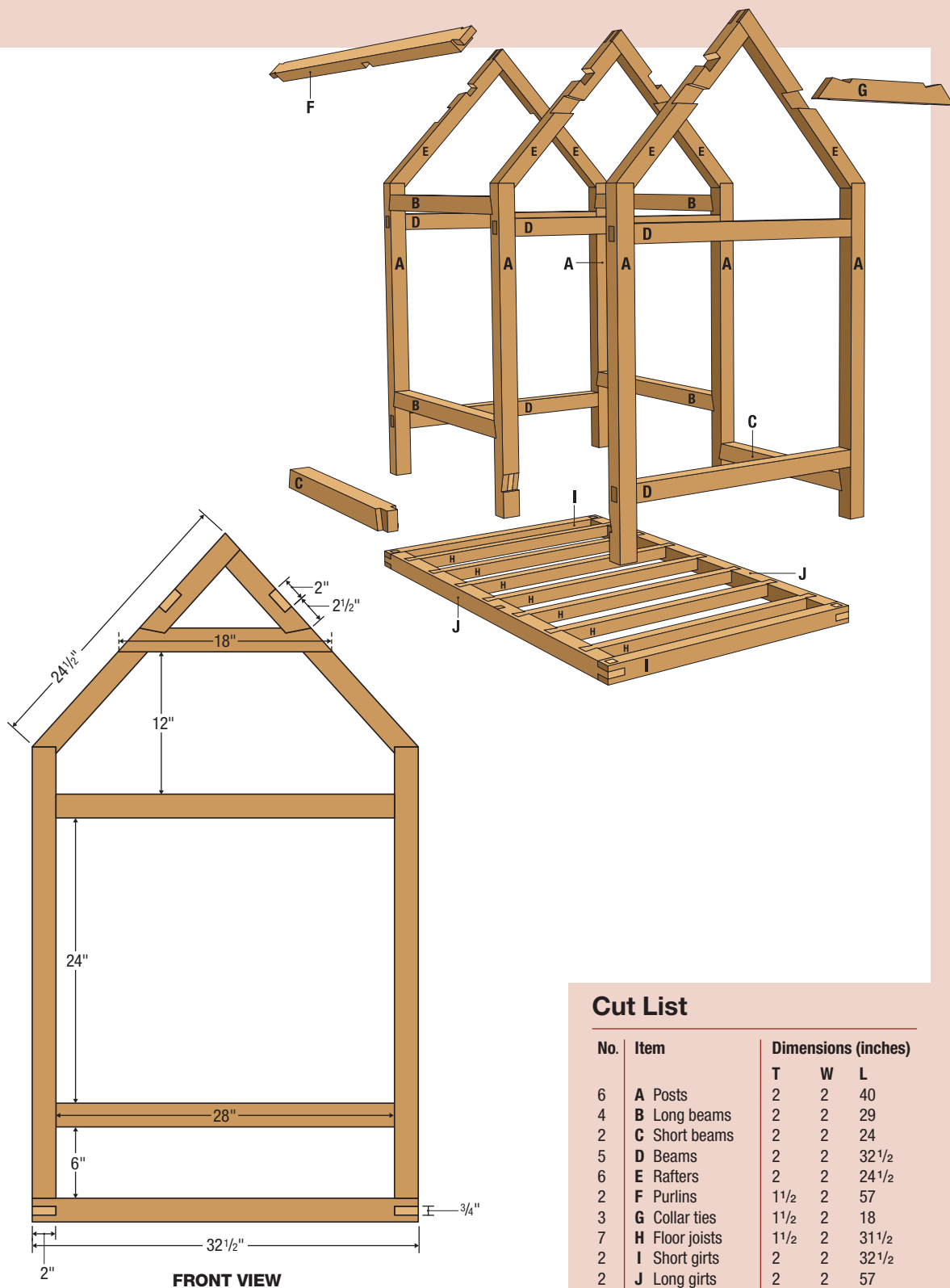
21 I used a trim router freehand to hog out most of the waste, then pared to the layout lines with a chisel.

22 You can see here how the joint goes together. The block portion is what supports all the weight of the floor (or mattress, in my case).

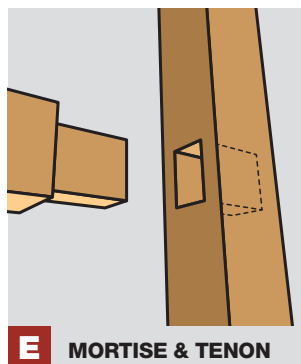
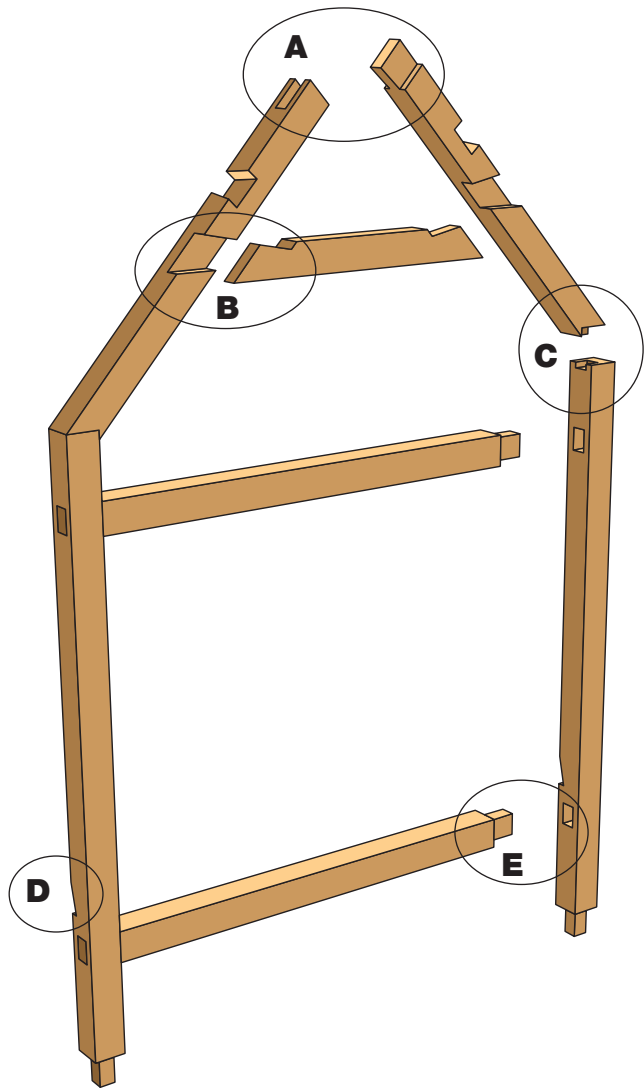
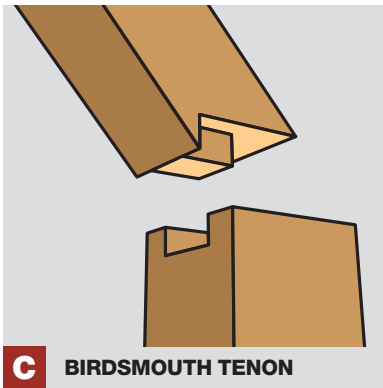
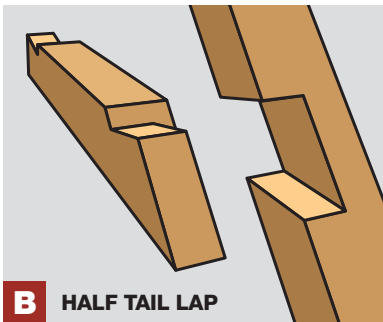
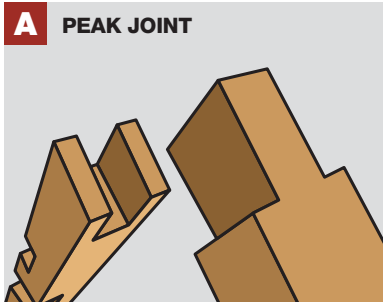
23-24 Seeing all these housed dovetails cut and fitted was one of the high points of the project for me.

■ Timber Frame Child's Bed





■ Joinery of Timber Frame Bed



*PICTURED ON PREVIOUS PG



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27



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25 All of the pieces ready for assembly. You would find a similar stack of parts on a real timber frame job site.

26 The floor frame is joined with single through-dovetails.

27 I rehearsed the assembly process in the shop before heading into the house. The floor and all three bents can be assembled (and each individually fit through the doorway).

28 As a final touch, I added a small cutaway to the bottoms of the posts where they meet the floor/bed frame.

Assembly and Finish

With all the joinery cut, assembly can begin. And, like a timber frame structure, this one can go together without clamps. I did a dry assembly to plan out which pieces I'd glue, and which were getting mechanically fastened to come apart in a future move. Then I gave the whole structure a final sanding and applied my child-friendly finish. **PW**

Jason Stephens is a woodworker, drummer and aspiring welder based in North Carolina.

Mitered Dovetail Box

A few key elements push your hand tool skills.

By Christopher Walker



PROJECT #2106

Skill Level:

Intermediate

Time: 2 Days

Cost: \$50

When my wife asked that I build her a box to contain a growing collection of aroma oil containers and associated accouterments for her piqued interest in aroma therapy, I was thrilled. Besides the house smelling great, I had spousal approval to build something—a win-win proposal.

Design

The requirements were a single box with enough space to store current aroma oil bottles and any new items acquired. My wife purchased a drawer pull that caught her eye and asked that I incorporate it into the build. The final design was a single drawer carcass with a handle on top.

This project was a perfect opportunity for dovetail practice. The outer carcass design was well-suited for a first attempt at a mitered dovetail while the inside drawer was perfect to hone my half-blind dovetails. For the carcass, a groove was to be cut in to support a back panel. The bottom panel for the drawer was to be a panel set into a rebate.

Lumber Selection

Black walnut is a rarity in Japan. It is imported from the United States and I was lucky enough to get my hands on some through an auction. This felt like the perfect project to use it. Prior to this project, I purchased several Japanese ash slabs with the intent of milling them up for drawer parts. The ash would provide a nice contrast to the dark tones of the black walnut while being softer which would perform favorably when knocking the dovetails together.

Cutting a Mitered Dovetail Joint

Stepping up to the bench, a mitered dovetail can seem intimidating. However, if you have experience with a standard through dovetail, you will be fine. With proper planning and a well sorted layout, it becomes a simple matter of finessing away the waste.



1



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1 A design session with my life led to the choice circled in green.

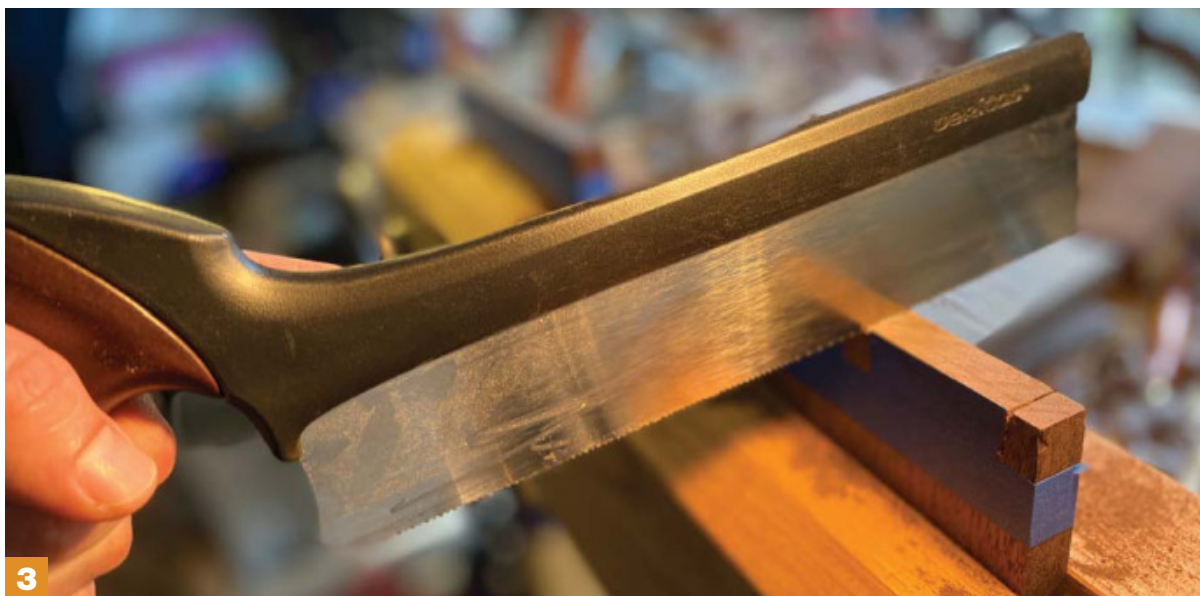
2 Stickered and stacked black walnut, a rarity in Japan.

Outside of the standard tool requirements for through dovetails, you may also need a second marking gauge that will be set to the width of the mitered portion of the dovetails. A 45° chisel guide block cut to precision on a table saw or similar machine will also be useful.

To begin marking out the joint, set a marking gauge to the thickness of the material and mark the baseline all the way around the tail board except for the edge to be mitered.

Then mark both faces of the pin board, skipping the edges, just like in through dovetails. It is important to note that for this joinery method, the material for both tail and pin boards must be the same thickness. Different thickness will create a misaligned miter.

You can reuse the same gauge setting to set the width of your mitered portion but if the width of your mitered area will differ however, use a second marking gauge. I



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3 Blue tape gives a clear indication of where to cut, especially in dark woods like this black walnut.

4 Two marking gauges come in handy for marking the baseline and the miter.

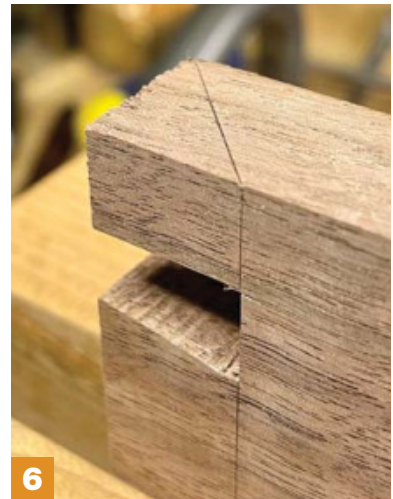
like to keep all marking gauges set for a single purpose until the entire operation is complete. My mitered edge will be a panel that will be inset 15mm from the edge. My material thickness is around 17mm which means two marking gauges are in order. To mark out the tailboard, using the edge where the miter will be, score a line across the end grain followed by a line on the inside and outside face to the base-

line. Then, with a bevel gauge set to 45°, on the edge to be mitered, align the rule against the inside face's baseline and draw a line with a pencil at 45° towards the corner to the outside face. If the baseline was marked correctly these two points should connect.

Starting from the mitered portion's offset from the rear edge, the rest of the board should be treated like through dovetails. Use whatever

layout method you desire. I use dividers to get tail size, starting 1cm in from the edges when I layout dovetails. I then square the points on the end grain with a face edge, use a dovetail marker at 1:8 ratio, mark my waste, and cut. The outer edge of the gap between the mitered edge and the tail is cut to 90°, following the marking gauge line set easier. I leave about 1mm to be chiseled on this corner to make up for potential sloppy sawing.

At this point, the tail board is complete save for the miter. Between the miter and first tail there is a gap that, if not careful when cutting the miter, the saw may plunge into the tail as it drops. To prevent this, I place a scrap piece that fits in the gap and secure it downwards into my Moxon vise so that the scrap rests against the corner to be mitered. With this method, the saw does not drop and only cuts the scrap piece.



5-6 I use a scrap piece of wood under the miter as a backer, to prevent my saw from cutting into the adjacent tail.

7-8 To get an almost perfect miter, use a first class saw cut by paring away some waste before cutting.

9 I check the miter with a combination square.

10 Aligning the tail board to the pins is key. I use the flat back of a chisel against both edges as a reference.

11 Use holdfasts or clamps to secure the guide in place and begin paring. This is the most satisfying activity of cutting this joinery.



12

If attempting to cut a perfect 45°, this is a good opportunity to execute a first-class saw cut. Instead of a pencil, use a marking knife to scribe the line from the baseline to the corner. Start with a shallow stroke followed by a few progressively harder strokes. With a sharp chisel, pare away the waste area to begin a wall to use as a guide with your saw. Make the wall as deep as you are comfortable with and then saw away the waste.

On the pin board, using the edge to be mitered as reference, with the same marking gauge settings (for this particular project, the 15mm setting), score a line on the end grain and the inside face only. Using blue tape for contrast, I transferred the tails and removed the waste.

For the miter on the pin board,

take great care when cutting the edge wall against the pin. The saw should tilt at 45° so as to not cut into the front face of the pin board. Once the cut is established, rotate the workpiece 90° in the vice and cut the miter just like the tailboard, taking care not to cut into the pin.

To finalize the miter, use a 45° block to assist with the paring. It is a simple piece of scrap cut at 45° with a long enough edge to support a chisel for paring downwards. Aligning the guide to the baseline can be tricky. I use my widest plane blade (my No. 7), and lightly set the blade into the marking line. I then butt the guide block into the blade and secure it with clamps or holdfasts. Use a freshly sharpened chisel against the guide block and pare down the miter to fit.

12 Use an arrow to note grain direction for half-blind dovetails. Orient grain to run towards the back of the drawer which allow for easier planing of the pin board end grain when sizing the final fit.

With the miter finalized cut the groove in the fashion you see fit but be careful with the mitered edge as it is a very delicate area. It is easy to bruise or completely chip the edge. The outer carcass is ready for glue up.

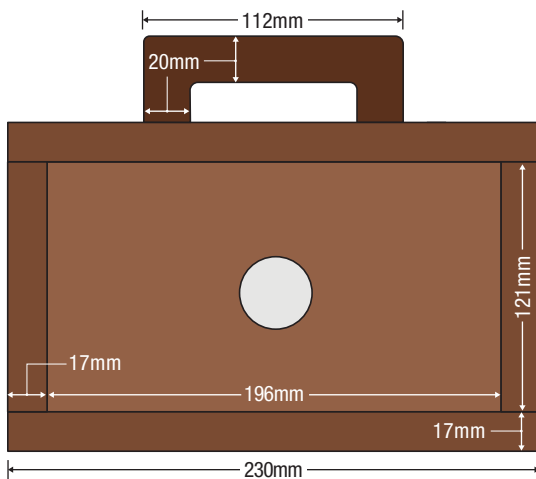
The Drawer

The drawer front is a thicker piece of black walnut perfect for half-blind dovetails. It has a bark inclusion in one of the corners which provides visual appeal. Once the outer carcass had finished drying, I sized it to fit perfectly into the carcass, leaving it a little snug to allow for play room later. I milled up a portion of my ash slab and cut the tails into the ash pieces. The contrasting ash with the black walnut made marking the tails on the pin boards easy to follow.

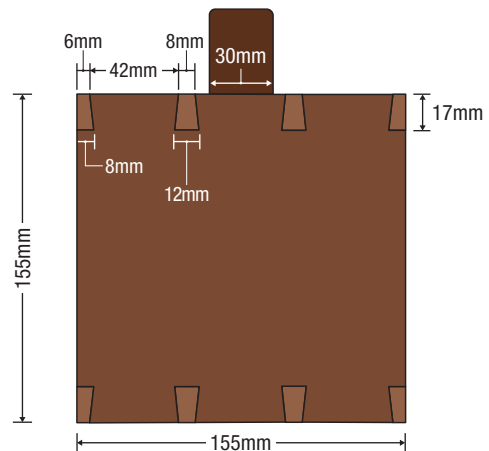
I applied the same technique for the outer carcass back panel for the drawer bottom. This time however, the raised portion sits inside rather than outward. To simplify the drawer, I used a simple rebate to house the bottom, making sure to not cut all the way through to accidentally expose the rebate in the pins.

When marking baselines for dovetails, it's common to aim for the pins to remain proud. However, for this drawer, I made the tail boards proud of the pins. With the drawer front sized to fit the carcass, it was easier to plane the whole tail board rather than risk accidentally resizing the drawer front. It involved some forethought into the layout but after cutting the final through dovetails on the back and finalizing the glue up, sizing was much easier and the drawer fit like a glove.

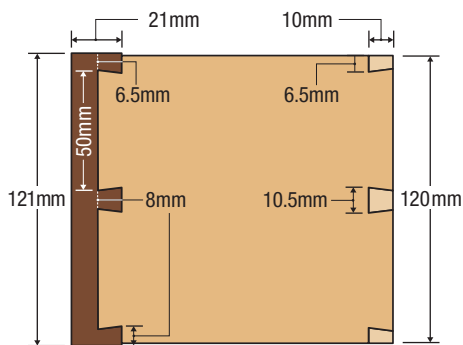
Mitered Dovetail Box



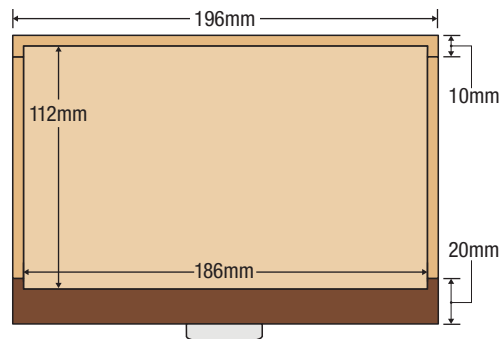
CARCASS FRONT VIEW



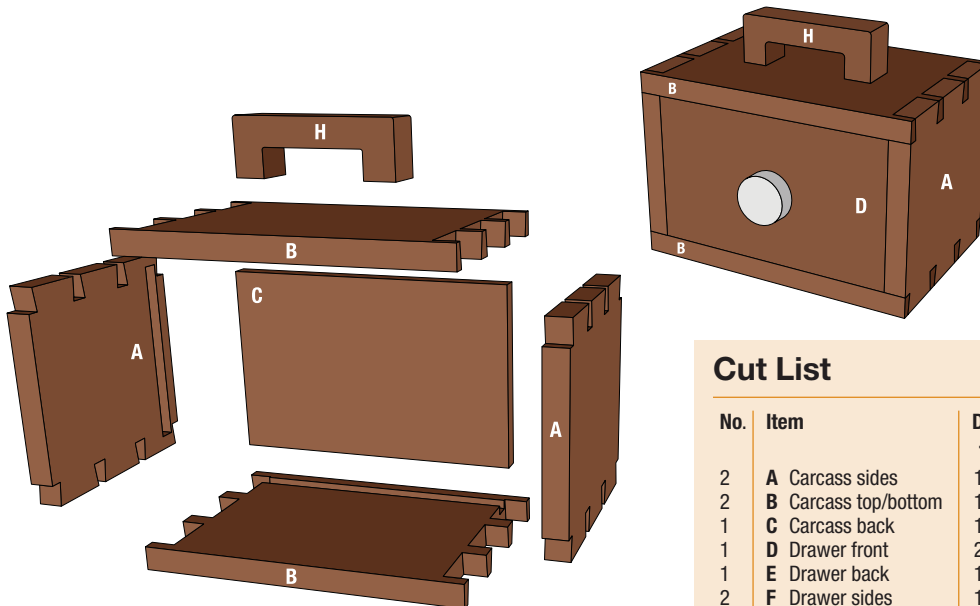
CARCASS SIDE VIEW



DRAWER SIDE VIEW



DRAWER BOTTOM VIEW



Cut List

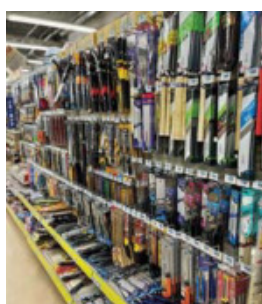
No.	Item	Dimensions (mm)		
		T	W	L
2	A Carcass sides	17	155	155
2	B Carcass top/bottom	17	155	230
1	C Carcass back	12	137	212
1	D Drawer front	21	121	196
1	E Drawer back	10	120	196
2	F Drawer sides	10	112	186
1	G Drawer bottom	10	112	186
1	H Handle	30	40	112

Woodworking in Japan

Living in Japan as an American can be a struggle when pursuing a woodworking hobby. Western-style woodworking is what I enjoy but to set up shop, I have had to make some sacrifices in house space and push my language skills so I can build my projects. The wood gets worked the same as in America and several species are comparable, but where to work and how to acquire it were the two biggest hoops to jump through.

Most houses in the United States have a garage that can convert into a workshop—typically not a feature in most Japanese homes. Here, houses are smaller including the land that they sit on. I am lucky to have a home with space enough for a shed to store my power tools and wood collection. Despite limited size, the workbench is still the center of my 3.5m x 2.5m spare bedroom workshop.

I slowly try to conquer the language barrier. The first time staring down the tool store aisles four years ago, wondering where to get started, was daunting. Fast-forward to now, I'm still learning but it has become easier to find the wood and supplies I need to begin new projects. With every new project, material acquisition is less of a hassle.



My shop (beyond a few power tools in a shed) is a spare room in our home (above). My hardware store carries a full selection of Japanese hand tools (left).

Final Details and Finish

Seeing the box and feeling the weight of it, my wife requested I affix a handle to the top to provide better support for carrying. I had an off cut of black walnut left over that fit the bill. Opportunities to practice with my various shaping tools are rare so I took my time when designing, roughing out, and shaping the piece. The box was designed with 1:8 ratio dovetails so I incorporated that ratio into the inside taper of the handle. Slowly and carefully I used spokeshaves, rasps, files, and sandpaper to round over the edges, added little dimples, in the corner, and created something that my wife could hold easily while also being aesthetically pleasing. With a little finesse, I was able to glue and screw the handle into place. This process would have gone more smoothly had it been completed before glue-up but I managed to make it work.

I chose a simple boiled linseed



13

oil for finish. Yellowing was not a concern since black walnut is dark and ash would rarely be visible. To apply the boiled linseed oil, I did an initial heavy application after sanding to 600 grit. After about 15 minutes, I wiped away excess oil and let it sit for a full 24 hours. I repeated this step 3 times over four days and I was left with a very smooth, beautiful finish that still

13 A handle shaped for the top of the box.

allows for the wood texture to be felt. **PW**

.....
Christopher Walker is a hobby woodworker living in Kanagawa, Japan. His Instagram handle is @imnotanexpertatthis.

Brushing Shellac

Apply this Classic Finish Like a Pro

By Mitch Kohanek



If you aren't brushing shellac, it's either because you've never tried it or you've had a bad experience. Let's see if I can change that. The number one reason people abandon shellac is they expect it to behave like polyurethane. But shellac and poly are different animals. For starters, shellac uses fast-drying 200-proof grain alcohol, or ethanol, as a solvent. The non-toxic ethanol is "poisoned" with small amounts of toxic solvent such as methanol or acetone in order to render it undrinkable and escape liquor taxes. Ethanol evaporates quickly and requires a different method of application and tools than slow-drying polyurethane varnishes.

Like any skill, applying shellac takes practice. Practice brushing on a two-foot square panel before you touch anything of value. It's easy to sand the panel back down to the wood and brush it again and again. After you get comfortable with brushing the panel, go to a garage sale and purchase a small table or chair. Lightly sand it with some 320-grit sandpaper and practice brushing on real furniture.

Shellac's Advantages

There are two reasons for using any finish: The first is to enhance or change the original appearance of the wood; the second is to protect it. Shellac creates a warmth and depth that makes inexpensive woods look expensive and expensive woods look even more impressive. As a rule of thumb, use light colored shellac on light woods and a dark colored shellac on darker woods.

Let's look at the protection issue. Many people refrain from using shellac because they've heard it offers little protection. But how much

protection does the project really need, and from what? A kitchen table needs a whole lot more protection than a jewelry box or a grandfather clock. Shellac may not be the best choice for a kitchen table, but for many other projects shellac offers plenty of protection.

Besides beauty and protection, shellac has other distinct advantages: Unlike polyurethane, shellac is repairable and can be fixed without stripping off the old finish. Also, shellac's rapid cure leaves little time for dust to settle into the wet finish and you can recoat in less than an hour. Finally, shellac does not require sanding between coats saving you time and elbow grease. In recent years, protecting the environment has become another criteria for choosing a finish. Shellac stands out as one of the greenest and least toxic coatings available. Shellac is a pure, natural finish that's often used to coat fruits, vegetables and candy. As always, good ventilation and an organic vapor mask are recommended.

Two Keys to Success

1. Thin your shellac to a water-like consistency. A 1 to 1½ lb. cut is ideal for beginners. Pre-mixed shellac is usually a 3 lbs. cut (the exception is Zinsser Bulls Eye Seal Coat, which is a 2 lbs. cut). This means 3 lbs. of shellac has been mixed into 1 gallon of alcohol.
2. Use a high-quality brush. A good brush will hold a lot of shellac and apply an even coat without leaving ridges or pronounced brush marks. One good starter brush is the Winsor & Newton Regency Gold 580 series made with Taklon synthetic nylon.



1 Thin your shellac before use. Store bought shellac is typically a 3 lb. cut. Mix it 1-to-1 with denatured alcohol for a user-friendly 1½ lb. cut.

2. A 1½ or 2" square flat brush made with golden nylon, or "Taklon" bristles is a great starter brush for applying shellac. It's best on flat surfaces but it can handle a cabriole leg with a little practice, and it won't break the bank.

Brushing Techniques

There are two ways to brush shellac: Lay down a thick layer using a slow gravity-feed method or paint it on thin and work fast. I use both of these brushing techniques on a small tabletop: the gravity-feed method on a molded edge and the rapidbrushing method on a top. I prefer the gravity method on the edges because the brush can cover the whole edge and leave a relatively thick, even coat

Brushing Shellac

without worrying about ridges. I use the fast and thin method on the top of the table because it's less prone to leaving ridges and brush marks.

For this table I will use a 1½ lb. cut of shellac and a 2" Taklon bristle brush. Set up a raking light so it washes across the area you are brushing. Shellac sets up fast and is pretty unforgiving if a brushing defect goes undetected even for a minute. The light will illuminate any runs and "holidays" (missed spots) before the shellac has time to set. If you notice a brush mark or a holiday, and it's been longer than 10

seconds, leave it alone. Going back will only make it worse. A minor amount of sanding with 320-grit sandpaper will get rid of the brush mark. A holiday will disappear when you apply the next coat.

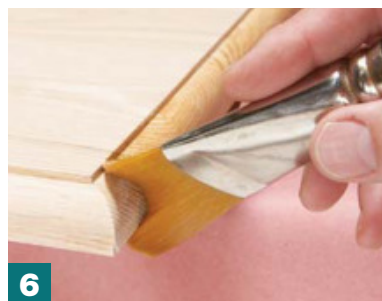
Charge the brush with some denatured alcohol. Then brush some clean paper to draw out the excess alcohol. Dip your brush into the shellac ¾ of the way up to the ferrule. Hold the brush with your fingers firmly on the ferrule. When brushing a tabletop, I do the edges first using the gravity feed technique. Don't lay down the shellac so heavy

that it forms a run, but do maintain a consistent wet look. End the stroke by exiting off the edge of the table like an airplane taking off. Return to the corner where you began and land your brush in the opposite direction like an airplane touching down.

Aim for a few inches inside the wet shellac and run the brush past the corner, taking off as you did in the first stroke. Work your way around all four edges, taking off and landing as you go. If you should accidentally hit the top, immediately wipe it off with a clean rag. Switch techniques to brush the flat part of the top and use small rapid strokes to lay down a thin coat. Start the stroke by landing your brush near an edge. Brush on the shellac with a rapid back and forth motion. Shoot for three 10" strokes every second. When the brush begins to empty, recharge the brush and land it in the dry area just ahead of where you left off.

Do the airplane takeoff stroke once you reach the table edge. Don't let the brush hit the edge of the table on a return stroke or you will create a drip for sure. Brush with the grain all the way across the table. On a large surface it is necessary to overlap your strokes. Unlike the gravity feed method that lays down a heavy coat in one continuous motion, this technique lays down a thin layer of shellac with multiple brush strokes. A thin layer sets up fast and does not leave brush marks. By the time the first coat is done the shellac will be dry enough to apply a second coat.

You can take advantage of shellac's fast drying time to apply three coats one after another with no time for dust to settle in and ruin the finish. With a 1 or 1½ lb. cut of shellac it will take about three coats before you start to develop a noticeable build. I generally try to give the object three light coats for the first setting to seal the wood. I like to lay down a minimum of 9 layers in 3 or more settings for a good build. The time frame for additional coats is dependent on temperature and humidity.



3 Set up a light source at a low angle so it rakes the work area. A raking light will show defects like drips and "holidays" (places you missed) before it's too late to correct them.

4 Charge the brush by soaking it in denatured alcohol for a few minutes before use. This helps the shellac flow better from the brush.

5 Shellac the edges first. Start the brush stroke an inch or two from the end. Move the brush slowly to lay down a long, consistent wet layer of shellac. Nestle the edge of the brush in the fillet to keep excess shellac from accumulating and running when your back is turned.

6 Come back to finish the bare spot where you started the stroke. Think of your brush as an airplane. Land the brush near the unfinished end and then lift off right at the edge to avoid snapping the bristles over the edge. Lifting off prevents pools of shellac from being left at the edge and turning into drips.

7 A different brushing technique is used on the top surface. Instead of a long and slow stroke, use short fast strokes. Land the loaded brush in a dry area and with rapid back and forth strokes work the shellac back into the wet area. Aim for a thin, even layer of shellac.

8 Finish the stroke at the edge. Lift the brush as it passes over the edge just like an airplane taking off. This prevents the brush from pushing shellac over the edge and dripping down the freshly finished edge.



If your bristles seem to be dragging while applying another coat, then the previous coat has not yet cured—give it more time to dry. The first setting will leave the surface of the wood rough. A light scuff sanding with some 600-grit sandpaper will remove the whiskers. After that, sanding is not necessary until after the final coat has cured and it's time to rub out the finish. Allow the shellac to fully cure for a few days. Then, do a final rubout. Shellac can be rubbed out to any sheen you want, high gloss or matte.

9 Overlap your strokes on a large surface. Any time you re-wet the brush, land the brush in a dry area. Use a back and forth stroke to blend the new stroke into the wet shellac ahead of it and beside it and lift off right at the edge to avoid snapping the bristles over the edge. Lifting off prevents pools of shellac from being left at the edge and turning into drips.

10 When the brushing is over, cleaning your brush is a breeze. Just swish it around in a container with clean denatured alcohol. This will clean out most of the shellac from the brush. Unlike varnish or water-based finishes, it okay to leave some residue in the brush.

11 Pull the brush across a folded paper towel or rag to remove the excess alcohol. Form the bristles so they dry in their proper shape. The brush will dry stiff from the shellac left in the brush. To use again, soak brush in alcohol for a few minutes.



With enough practice, you will develop your own preferred blend of shellac and alcohol, your own speed for brushing and your own feel for how wet and thick to lay down the shellac. Eventually, you'll get into the different types of brushes and shellacs that are at your disposal. Trust me, it's a lot of fun.

Brush Cleaning

A few sloshes in some clean alcohol will get 95% of the shellac out of the brush. Pad the brush with a paper towel or clean rag. Then form the bristles in their proper shape and you're done. The next time you need to use the brush, place it in some clean alcohol for a few minutes, wipe off the excess on a paper towel and rock and roll. Finishing with shellac is like any other aspect of woodworking—it takes time and practice to develop the skill.

Ultimately, you will find yourself joining the ranks of those who enjoy using a finish that is safe, fully repairable and has a proven historical track record for stability and beauty. That's something really nice to pass on to future generations. Good luck, and have fun! **PW**

Mitch Kohanek is a member of the American Institute of Conservation and has interned at the Smithsonian Museum Conservation Institute in Washington, D.C. Visit his website for more at www.woodfinishing.org.



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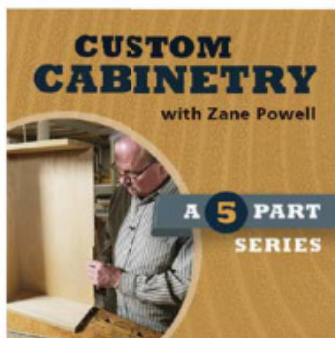


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Aspen Golann

Marrying traditional and conceptual work.

Interview by Collin Knoff

How did you get started woodworking? Who were your mentors?

I didn't start woodworking until a few months before my 30th birthday. I have always been an artist and a maker but never a woodworker and certainly not a furniture maker. I did take a few functional sculpture classes in college which were really eye-opening for me, but nothing that dealt with hardwood or joinery. My commitment to woodworking began when I enrolled at The North Bennet Street School (NBSS) in Boston, Massachusetts back in 2018. I wanted total immersion in traditional techniques, and I got it! I figured if I learned how to design

and make things from raw materials and with hand tools, then I could make anything I wanted.

NBSS is all about traditional skills—dovetails, curved veneers, acanthus leaves, hand planes, Windsor chairs, etc. I arrived not knowing what a hand plane was and left with a powerful skill set, strong community of makers, and amazing mentors. I met my first real mentor, Peter Galbert, the famed Windsor chair maker, while I was in school. After I graduated, I had the privilege of working out of his shop in NH for a few months. Working alongside a maker like Pete was inspirational and provided me with an extended education in woodworking tech-

niques. After school I've been able to cultivate an incredible network of weirdos and nerds who support and inspire my work—artists, historians, restorers, architects, timber framers, toolmakers, and of course other furniture and object makers.



PHOTOS COURTESY OF ASPEN GOLANN.

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What advice would you give to someone that wants to start woodworking or pursue it as a profession?

1. Try to cultivate a variety of craft communities. There are a number of schools and shops where you can take classes, do residencies, meet makers, develop skills and collaborate.

2. Allow your personal interests and identities to manifest in your designs. I try to let my background in art and my experiences as a minority in the field sneak into my work—I think that allowing my pieces to be personal makes them stand out.

"Keep pushing yourself!"

I'm trained as a traditional maker so it is essential that I continue to develop my own design sense outside of the mandates of tradition, and that I hold on to who I am as a maker. I try to let my traditional training guide and bolster my work, but I don't let it completely define me."

- Aspen Golann



What do you think is your best or favorite work? What kind of work do you do the most?

I think my best pieces are the ones that ride the line between traditional furniture and conceptual sculpture. I like to be playful with traditional forms! I love appropriating iconic American furniture forms and incorporating contemporary imagery using enameled glass, marquetry and inlay. I blend forms and imagery to turn cabinets into chest cavities, clock movements into hearts, and chair backs into reclining torsos with faces and arms. The result is work that blurs the line between furniture and figure sculpture.

What's your best hands-on tip or woodworking technique?

My favorite woodworking technique is an old-school hand tool rounding technique called the 5/7 rule. I learned it in school but haven't seen any articles or videos on it, which is surprising because it's amazing! All you have to do is create a simple system of lines on square stock that allow you to cut

■ ASPEN GOLANN'S SHOUT-OUTS TO FOLLOW

A Workshop of Our Own is a workshop for women and non-binary makers in Baltimore, Massachusetts. Learn more at aworkshopofourown.com or Instagram [@aworkshopofourown](https://www.instagram.com/aworkshopofourown).

Even Berding creates just amazing original work inspired by traditional forms. Learn more at evenberding.com or Instagram [@evenberding](https://www.instagram.com/evenberding).

Yuri Kobayashi is doing the wildest things with steam bent wood that is elegant and obsessive and stretches the boundaries of the medium. See these pieces at yurikobayashi.com.

Arcburn Furniture is made by Sophie Glenn who creates traditional wooden furniture in steel! Learn about these pieces at sophieglenn.com or Instagram [@arcburn_furniture](https://www.instagram.com/arcburn_furniture).

Eleanor Anderson is a beautiful and whimsical fiber artist! Learn more at eleanor-anderson.squarespace.com or Instagram [@eleanor_anderson_studio](https://www.instagram.com/eleanor_anderson_studio).

Bern Chandley makes smart and elegant updates to traditional Windsor chair designs. See these updates at bernchandleyfurniture.com.

Ellie Richards expresses pure joy and whimsy in her wooden objects. See her work at ellie-richards.com.

and shape your way to perfectly round and symmetrical shapes that taper and twist in any way you can imagine. I use the 5/7 rule constantly—really any time that the shaping is too complex or dangerous for a router bit. **PW**

.....
Aspen Golann is an artist and a 17th and 18th century-style furniture maker from Boston, Massachusetts. See more of Aspen's work at aspengolann.com or Instagram [@aspengolann](https://www.instagram.com/aspengolann).

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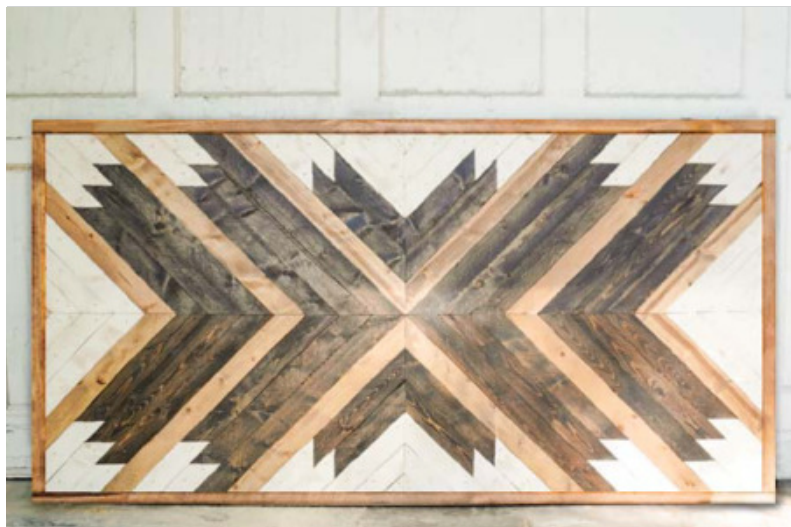
Loni LaCour

Starting with Dad's tools.

Interview by Collin Knoff

How did you get started woodworking? Who were your mentors?

It's an interesting story. I had never thought I would make a career or even a hobby out of woodworking. My father was a carpenter and worked with wood. I remember building simple things like doll houses or wooden hearts when I was a kid, but that was all my experience with working with wood. It wasn't until he passed away 5 years ago, and I was given what remained of his tool collection that I actually started experimenting on my own. It started with small things, like wood signs or planter boxes. I have since moved onto larger art pieces or pieces of furniture. I would say my dad was my mentor. He was great at his work and as a businessman. When I'm thinking of efficiency, designing, and building, I like to imagine what advice he would be giving me. I use woodworking as a way to still feel connected to him.



"Don't be afraid to ask for help if you're just starting out."

As a young woman in woodworking, it can get discouraging — you feel as if your work is constantly being compared to the work of men. I often get so frustrated with myself, some projects take me extra-long because of the mistakes I make. It makes it easier when you speak up and ask other woodworkers for their tips and tricks. No question is too simple and YouTube Tutorials are extremely helpful." - Loni LaCour

What do you think is your best or favorite work? What kind of work do you do the most?

It sounds silly, but one of my favorite things I've made so far was a blanket ladder out of old furring strips I had no use for. It's the simplest thing to make but I was so happy because I hate wasting any type of material. Now the pieces I make the most are wood mosaics; I love the versatility mosaics offer and being a part of others homes with my wall art.

What's your best hands-on tip or woodworking technique?

I like to think my best technique is giving everything the good old "LaCour blueprint." I don't ever really start with a full-proof plan but somehow it all works out. Don't overthink your designs, sometimes your best work comes from less planning and more doing! **PW**

Loni LaCour is a designer and woodworker from Missouri. See more of Loni's work at lonilacour.com or on Instagram @lonilacour.

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