

Popular Woodworking

OCTOBER 2023 | #274

Dust Extractor

SHOWDOWN



SHOP-MADE COPING SAW

An Heirloom Tool Built
Right In Your Shop

MID-CENTURY TABLE

Michael Crow's Take On
The Eames Surfboard Table

DISAPPEARING MAGIC BOX

This Trick Box Will Leave
Everyone In Awe

6" 1½ HP Jointer with V-Helical Cutterhead

MADE IN AN ISO 9001 FACTORY

- Motor: 1½ HP, 110V, single-phase, 18A
- Cutterhead: 4-row V-helical, 24 indexable carbide inserts
- Table size: 7¼" x 60"
- Max. width of cut: 6"
- Max. depth of cut: ⅛"
- Fence size: 29¼" L x 4" H
- Precision-ground cast-iron table



G0526A40 ONLY \$1550

\$249
FREIGHT

17" 2 HP Bandsaw

MADE IN AN ISO 9001 FACTORY

- Motor: 2 HP, 110V/220V (prewired 220V), single-phase, 20A/10A
- Cutting capacity: 16¼" left of blade
- Max. cutting height: 12⅝"
- Blade size: 131½" long
- Blade width range: ⅛"–1" wide
- Blade speeds: 1700, 3500 FPM
- Table size: 17" x 17" x 1½" thick
- Table tilt: 10° left, 45° right
- Fence size: 6" H x 23" L
- Floor to table height: 37½"
- Precision-ground cast-iron table



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FREIGHT

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of Excellence**

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10" 5 HP Cabinet Table Saw with Built-In Router Table

- Motor: 5 HP, 240V single-phase, 23A
- Rip capacity: 32" right of blade
- Max. depth of cut @ 90°: 3"
- Table size: 48" W x 27" D
- Floor-to-table height: 34"
- Arbor: ⅝", 4200 RPM
- Precision-ground cast-iron table



G1023RLA40 ONLY \$2125

\$329
FREIGHT

10" 2 HP Hybrid Table Saw with Built-In Mobile Base

- Motor: 2 HP, 120V/240V (prewired for 120V) single-phase, 15A/7.5A
- Rip capacity: 30" right of blade
- Max. depth of cut @ 90°: 3¼"
- Table size: 40¼" W x 27" D
- Floor-to-table height: 35¾"
- Arbor: ⅝", 3450 RPM
- Precision-ground cast-iron table



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FREIGHT

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13" 2 HP Benchtop Planer With Helical Cutterhead

MADE IN AN ISO 9001 FACTORY

- Motor: 2 HP, 120V, single-phase, 15A
- Maximum width of cut: 13"
- Minimum stock length: 6"
- Minimum stock thickness: 1/8"
- Maximum stock thickness: 6"
- Maximum cut depth full width: 1/32"
- Maximum cut depth 6" wide: 3/32"
- Cutterhead type: 2" helical with 2-row spirals, 30 inserts
- Cutterhead speed: 8500 RPM
- Feed rate: 25 FPM
- Table size: 13" x 28"



G0940 ONLY \$895

15" 3 HP Planer with Spiral Cutterhead

- Motor: 3 HP, 240V, single-phase, 15A
- Maximum stock width: 15"
- Maximum stock thickness: 8"
- Minimum stock thickness: 3/16"
- Minimum stock length: 8"
- Maximum cutting depth: 1/8"
- Cutterhead diameter: 3"
- Cutterhead type: 4-row spiral, 74 inserts
- Cutterhead speed: 4800 RPM
- Feed rate: 16 & 30 FPM
- Table size: 15" x 42"



G0453Z ONLY \$2595

\$329
FREIGHT

6" Benchtop Jointer with Spiral-Type Cutterhead

MADE IN AN ISO 9001 FACTORY

- Motor: 1 1/2 HP, 120V, single-phase, 10A
- Maximum width of cut: 6"
- Maximum depth of cut: 1/8"
- Minimum workpiece length: 10"
- Minimum stock thickness: 1/2"
- Number of cuts per minute: 72,000
- Cutterhead type: 6-Row spiral-type
- Cutterhead diameter: 2"
- Cutterhead speed: 11,000 RPM
- Cutter insert type: Indexable HSS
- Number of inserts: 12
- Table size: 6 1/4" x 30"
- Fence size: 19 3/4" L x 4 1/4" H



G0946 ONLY \$395

CSA
C 262149 US

14" Heavy-Duty Floor Drill Press

MADE IN AN ISO 9001 FACTORY

- Motor: 3/4 HP, 120V, single-phase, 7.5A
- Swing: 14"
- Spindle taper: MT #2
- Spindle travel: 3 1/4"
- Spindle speeds: 12, from 140–3050 RPM
- Drilling capacity: 3/4" steel
- Drill chuck: 3/64"–5/8"
- Table tilt: 90° L/R
- Table swing: 360°
- Table size: 11 3/8" x 11 3/8"
- Table has lock levers and coolant trough
- Crank handle operated rack-and-pinion vertical table movement
- Built-in light



G7944 ONLY \$625

CSA
C 184841 US

\$199
FREIGHT

1 1/2 HP Shaper

MADE IN AN ISO 9001 FACTORY

- Motor: 1 1/2 HP, 120V/240V (prewired 120V), single-phase, 12A/6A
- Maximum cutter height: 2 1/2"
- Maximum cutter diameter: 5"
- Spindle diameters: 1/2", 3/4"
- Spindle lengths: 2 3/4", 3 1/2"
- Spindle capacity under nut: 2", 2 1/2"
- Spindle speeds: 7000, 10,000 RPM
- Spindle travel: 3"
- Table insert openings: 1 1/4", 3 1/2", 5"
- Table counterbore: 5" dia. x 7/16"
- Table size: 18" x 20 1/4"
- Floor-to-table height: 33 1/2"



G1035 ONLY \$995

CSA
C 177335 US

\$199
FREIGHT

1 1/2 HP Cyclone Dust Collector

MADE IN AN ISO 9001 FACTORY

- Motor: 1 1/2 HP, 110V, single-phase, 15A
- Intake hole size: 6"
- Impeller: 12 3/4" aluminum
- Airflow capacity: 868 CFM @ 1.8" SP
- Max static pressure: 9.7"
- Filtration: 1-micron
- Filter surface area: 28.1 sq. ft.
- Collection size: 20-gallon drum
- Sound rating: 78dB
- Pleated filter with paddle brushes and crank handle
- Vacuum equalizer built into collection drum
- Wireless remote control



G0860 ONLY \$1175

\$199
FREIGHT

Contents

OCTOBER 2023 | VOL. 43, NO. 5

■ Build

30 Mid-Century Console Table

This Mid-Century table is a great way to blend woodworking with modern materials. The aluminum base and rounded top is based on an Eames Surfboard table.

BY MICHAEL CROW

38 Laminated Coping Saw

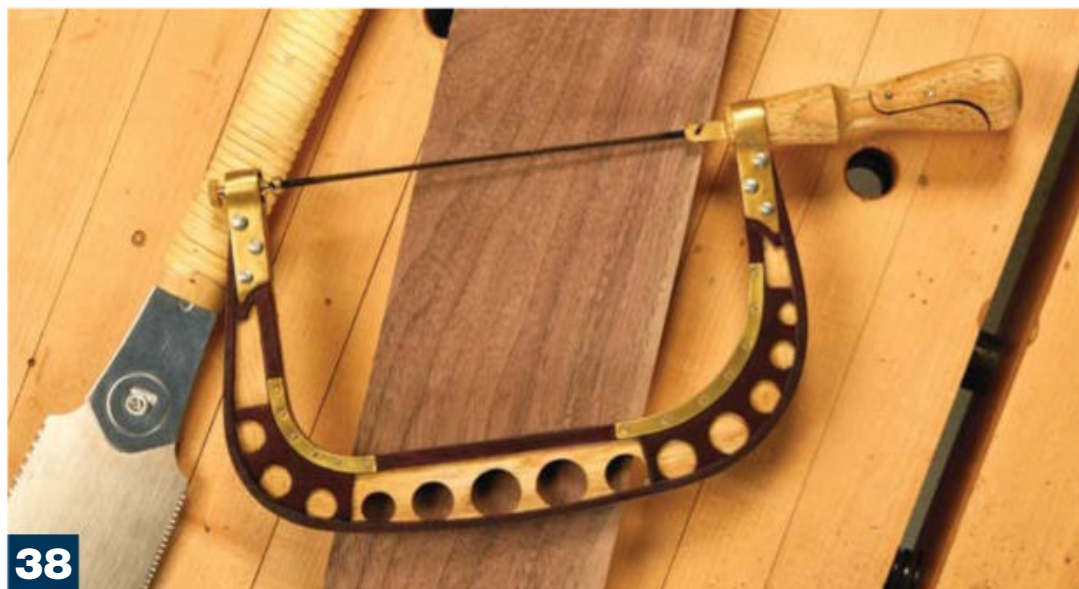
Building this project brings together a diverse set of skills that includes epoxy work, bent lamination, metalworking, turning, and riveting. The end result is a great-looking, heirloom quality tool.

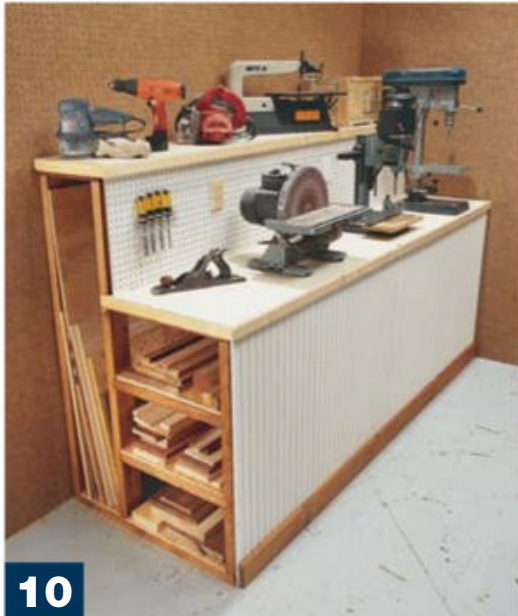
BY RYAN CARPENTER

48 Crafting Magic

Let the tricks begin with one of magic's oldest box tricks, a drawer box. Quickly make any object placed in the drawer disappear and reappear at will.

BY LUPE NIELSEN





10



06



60

■ Connect

04 From the Editor

Specialty woodworking and another vintage tool.

BY LOGAN WITTMER

06 New Tools

New Tools from SawStop and Grizzly, including an all electric bandsaw mill.

BY COLLIN KNOFF &
BOB REYNOLDS

10 Workshop Tips

Tips from our readers on gluing, storage, and finishing.

BY PW EDITORS

■ Craft

16 Calling All Dust Extractors

An overview on some of the top dust extractors and which one is right for you.

BY COLLIN KNOFF

60 Rocking Chair Restoration

Bring new life to a tired antique. Check out my steps to restoring an old rocking chair.

BY WILLIE SANDRY



16

Number 274, October 2023, *Popular Woodworking* (USPS #752-250) (ISSN 0884-8823) Canadian Agreement No. 40025316 is published 6 times a year, February, April, June, August, October, and December, by the Home Group of *Active Interest Media HoldCo, Inc.* The known office of publication is located at 2143 Grand Avenue, Des Moines, IA 50312. Periodicals postage paid at Des Moines, IA, and additional mailing offices. **POSTMASTER.** Send address changes to *Popular Woodworking*, P.O. Box 37274, Boone, IA 50037-0274. Send all UAA to CFS. (See DMM 507.1.5.2); NON-POSTAL AND MILITARY FACILITIES: *Popular Woodworking*, Circulation Department, PO Box 37218, Boone, IA 50037. **PRIVACY STATEMENT:** *Active Interest Media HoldCo, Inc.* is committed to protecting your privacy. For a full copy of our privacy statement, go to aimmedia.com/privacy-policy.

FROM THE EDITOR

Faces of Woodworking

By Logan Wittmer

Over the last several years, I've had the opportunity to meet and work with various people, and sharing their stories through this magazine is one of the things that I genuinely enjoy. For example, I'd like to introduce you to my friend Lupe Nielsen. Her short bio is below.

I met Lupe through my friend Jimmy Clewes, who you've seen contribute to this magazine. Lupe is one of those people that, whatever she decides to do, executes it at the highest degree. Her woodworking is no exception, but that's no surprise considering her day job.

Lupe runs *Nielsen Magic*, where she builds and sells magic props for magicians worldwide. And I'm not talking about small tchotchkes you'd pick up in a magic store. I'm talking about the top level magic acts and props that magic collectors pay big bucks for. The level of precision and detail needed to execute these items (which are, in



Another acquisition for our new shop — a never used (leave it to US Government to buy doubles) 1955 Crescent 36" Bandsaw. It's still covered in the factory anti-rust Cosmoline and is bolted on the original pallet.

essence, woodworking projects) is unparalleled. This is why I asked Lupe to develop a fun magic project for us to include in the magazine. When Lupe first showed me the box and trick, I was speechless, which, if you know me, is saying something. I hope you enjoy it as much as I do!

Logan Wittmer

ABOUT THE AUTHORS

RYAN CARPENTER:

Laminated Coping Saw – pg. 38



Ryan Carpenter, an engineer in Portland, OR, spends his free time designing and building furniture in his workshop. He has a passion for exploring techniques from across the craft. Beyond his projects, he helps students discover woodworking through his green woodworking course

at the Sitka Center for Art and Ecology. You can see more of his work on his Instagram @bornacarpenter.

MICHAEL CROW:

Mid-Century Media Console – pg. 30



Michael Crow is the author of several woodworking books, including *Mid-Century Furniture* and *Mackintosh Furniture*. Over the last several years, Michael has been a contributor to several woodworking magazines. When he's not working in his

shop, he's often found working on his Craftsman bungalow. You can follow Michael's journey on his website, 1910craftsmen.com.

LUPE NIELSEN: *Magic Box – pg. 48*



Lupe Nielsen is a full-time magic prop builder in Las Vegas, Nevada. While her training is in magic and theater, Lupe is in love with the craft of woodworking. When she takes a break from her day job (nnmagic.com), she's often found attending woodworking classes for several weeks at

a time. You can view Lupe's work on Instagram at @nnmagic.lupe.

WILLIE SANDRY:

Rocking Chair Restoration – pg. 60



Living in the Pacific Northwest, Willie Sandry is a long time fan of Arts & Crafts furniture. He enjoys taking inspiration for his projects from antique furniture exhibitions as well as "old barn finds." Never one to do a job partway, Willie has developed a

vast skill set to elevate his projects. From sawing lumber and kiln drying it to finishing a chair with top-notch upholstery, Willie sees a project through from the start until finish. YouTube: *The Thoughtful Woodworker*.

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SUBSCRIPTIONS:

For subscription questions or address changes, visit www.popularwoodworking.com/customerservice or call (877) 860-9140 (U.S. only). U.S. subscription rate \$24.95, single price \$6.99. Canadian subscriptions rate \$34.95 USD. Canadian Agreement No. 40025316.

CUSTOMER SERVICE:

P.O. Box 842, Des Moines, IA 50304-0842, subscriptions@aimmedia.com

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TN21L1
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23
GA

TN11G1
1 3/8" Headless Pinner

SENCO®

Grizzly Electric Sawmill

As a sawmill owner, I cut lumber for a variety of outlets. Most, I cut for myself. I then dry it and sell it to woodworkers like yourselves. (Heck, I even horde some of it for my projects, but don't tell my wife that). Other times, I cut for clients—they'll contact me saying they have logs they'd like cut. Usually, these logs are of decent size, around 16-30" logs that are over 6 feet long... exactly what my *Woodmizer* likes to eat. Sometimes, however, someone brings logs too small to cut on my sawmill. When *Grizzly* announced they were releasing a small, electric sawmill (the G0960), I knew that it would have a place at Reynold's Sawmill.

The mill, as I mentioned, runs off of electricity—110v, to be precise. This means that you can set it up in a garage or shop to cut your own lumber. And trust me—milling in a heated (or air-conditioned) space makes it much more enjoyable during extreme temperatures. The size of this mill is perfect to set up indoors—the mill's capacity is a 13"-wide cut, and the bed will hold logs about 43"-long. If you wanted to go longer, you could add additional sections of track to get to nearly 8' length capacity. The assembled mill takes up about 4'x 7' in the shop, so with a pallet jack, it's easy to stash out of the way when not in use (it's about 64" tall, depending on how you have the leveling feet set).

The *Grizzly* G0960 arrives in a small crate, about 3'x3'x4' as you see below. Assembly takes a little while, but it's not difficult. It takes about two hours for two guys to get it done. I was pleasantly surprised with how stout this little mill is. The carriage and frame are well-designed and rigid, and there's very



little movement or rocking during a cut. Dialing in the mill is similar to setting up any other sawmill, but if you're unfamiliar, don't worry—the *Grizzly* instructions walk you through it. The saw uses a blade that is 84 1/2" long and 3/4" wide. With a blade of this size, buying a carbide-tipped blade for the added longevity would be worth the cost.

The mill bed has a pair of log stops that slide up and down, as well as cam-style log clamps. All of these are held in place with threaded knobs. While taking more time than a production mill clamping system, that's not the intent behind this mill, so it's not a problem. The mill can be equipped with a dust port (as seen in the photo above) for dust collection. If you opt not to use a dust collector, you'll spread a bit of dust around, but it's not too bad. For heavier-duty sawing, *Grizzly* offers a misting system for the blade, which would help reduce pitch buildup.

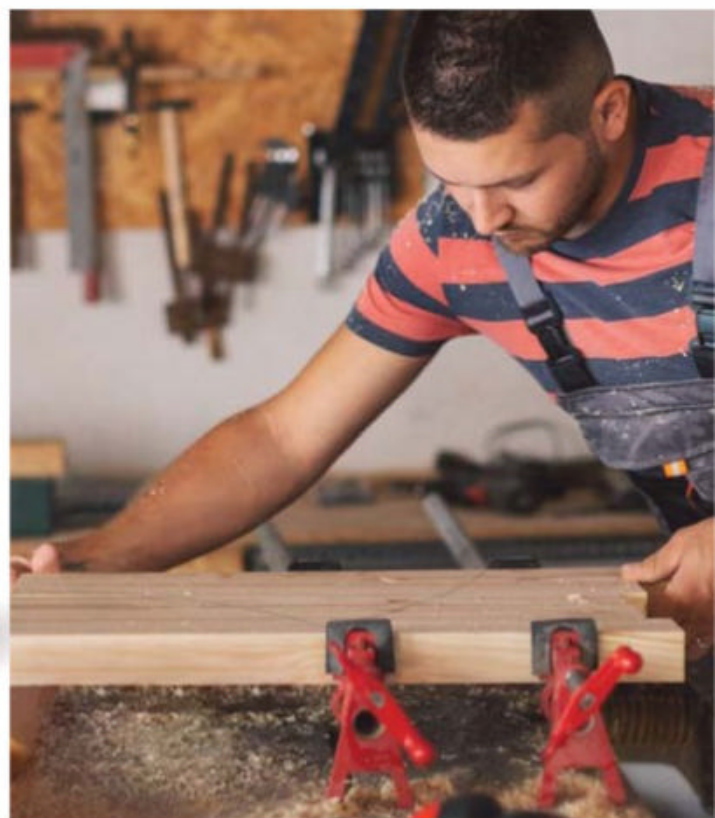
Overall, the G0960 is a great little mill, especially for someone wanting to mill in their shop without investing in a full-sized milling setup. It's an extremely accurate mill (we were able to saw off 1/32" veneers on pine, which is saying something) and is the perfect size to handle most hobbyist tasks, cutting turning blanks, or for processing the smaller logs my customers bring me. — *Bob Reynolds*





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NEW TOOLS

SawStop Compact Table Saw

Most woodworkers are familiar now with the *SawStop* line of table saws. They have a patented safety system that stops the blade in less than 5 milliseconds when it comes in contact with human skin. *SawStop* has recently expanded its lineup to include a compact table saw I've been putting through our tests.

I'll address the elephant in the room right away — yes, it's expensive. But, you're not paying a premium solely for the safety technology. *SawStop* has designed a high-quality saw with thoughtful features that are as good, or better, than any compact saw on the market today.

Take, for example, the location of the push stick. *SawStop* could have stuck it anywhere on the saw, maybe down on the right opposite the on/off switch, as some manufacturers do. (The exact spot you can't reach if you forgot to grab it before starting your cut). Instead, it's nested in the top of the fence, just inches from where your hand will be when you need it.

And speaking of fences, this one is outstanding. The fence rides on a set of rails attached to a rack and pinion system. Simply pull on the adjustment knob, and the fence unlocks. Set your fence distance, then push it in to lock it once it's set. I went to a hardware store and tried out half a dozen different rack and pinion fence systems on other saws, and not a single one felt as nice or was as intuitive to use as this one. The thoughtfulness carries over to the bevel system, which can be quickly set to the desired angle by squeezing the handle, then micro-adjusted to your exact specifications by rotating it once closed.

I'd also be remiss if I failed to mention the storage compartment on the back that holds accessories like the blade guard, wrenches, and (somewhat underwhelmingly-designed) square. Not only does it prevent you from losing those parts in a tool bag, but it also protects them from dust and damage. It's such a no-brainer that I can't believe it's not standard practice across the board.

Performance-wise, the saw took everything I threw at it, though I was considerate of the fact that it was a compact saw, not a cabinet saw. I found I could cut hardwoods with no problem using a fresh blade, but it can't take a dado stack. Dust collection was also great, with almost no cleanup needed after the fact. *SawStop* recommends using a dust collection system at all times with the saw to reduce

the buildup of sawdust and debris in the body, which could shorten the life of the motor.

I tested the saw using the CTS-FS folding stand, a \$129 addition. It was rock-solid and featured the ability to adjust the legs for uneven terrain, but I would have liked wheels to increase the portability factor. With the saw weighing a not-insignificant 68 lbs, that little addition would have helped quite a bit.

At \$899, the *SawStop* CTS isn't in everyone's budget. But if it is, it gets you an excellent table saw that features a level of quality and precision that woodworkers desire. And that's not including the potential value of the limb-saving safety system that gives *SawStop* its name. — *Collin Knoff*



■ CTS-120A60

SawStop

SawStop.com

Price: \$899 (without stand)

+ \$129 CTS-FS Folding Stand



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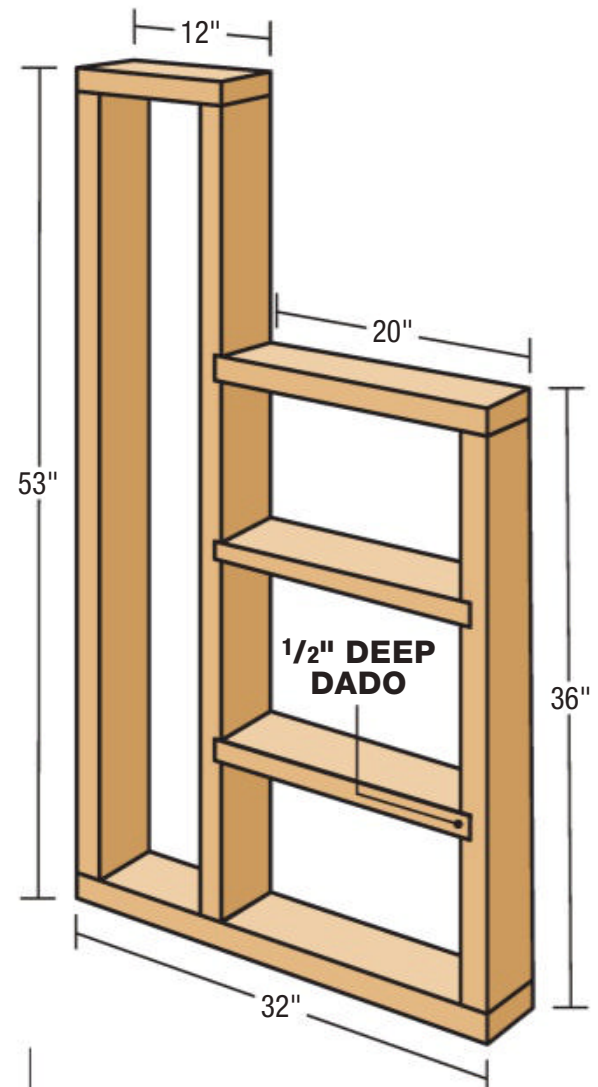
WORKSHOP TIPS

Lumber Storage Workbench

I felt like I won the storage-space lottery when I came up with this bench design for my shop. I wanted a way to store lumber and my bench-top tools. The backbones of this bench are the 2x4 frames. For my 8-ft. bench, I made four frames. The rest of the materials were mostly scrap I had lying around. — *Paul Smith*



PHOTOS BY RAMON MORENO



Recycle Old Gloves

Here's a simple way to protect your chisels from getting nicked and rusty while rattling around in your toolbox. Cut the fingers off some old leather work gloves. Poke holes with an awl at the open end, and thread a drawstring through them. Slide the chisel's blade into the finger and close it tight with the drawstring. To keep the chisel rust-free, drizzle a little 3-in-1 oil into the finger and let the oil soak in. Wipe the chisels with a clean cloth before use so the oil doesn't get on the wood. — *Daniel Losinger*

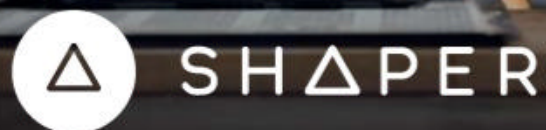


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Releases New Compact Marquetry Saw



Knew Concepts releases its new compact marquetry saw. This smaller saw has the same tilting ball bearing guide tower and counterweight system as the Lee Marshall Edition marquetry saw, for easy, precise cutting. More compact, it uses an 8" saw instead of 24" but has the same space saving dovetail attachment. Stating from \$615.

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WORKSHOP TIPS

Heat and Scrap Glue off Tenons

New glue doesn't adhere very well to old glue, so you have to remove the old stuff before reassembly.

Turn a heat gun on old glue, and it reacts just like old paint, becoming soft, gummy, and easy to scrape off. Remember that a heat gun is designed to destroy finishes and can even ignite wood. To counteract these possibilities, keep three things in mind. Shield the

nearby finish with a broad putty knife as you apply heat to the old glue. If your heat gun is adjustable, start out using the lowest heat setting. And most importantly, have a wet rag handy to keep things cool.

Scrape away the softened glue immediately. It will cool and harden in just a few seconds. Any leftover glue will residue can be removed with light sanding.



WORKSHOP TIPS

Lathe Dust Hood

Why be a dust-bowl refugee? Sanding on a lathe makes a storm of dust that can really irritate your nose and lungs, especially if it comes from spalted or exotic wood. Funnel that obnoxious stuff into your collector with this shop-made system. It uses a flexible metal hose that stays put without clamps, so you can easily aim the funnel right at the dust source.

Make the funnel from a 10" diameter aluminum light shield. You can find one at any hardware store for cheap. Remove the cord and socket, and you have a funnel with a small hole at the base.

The trick is to enlarge the hole to the size of your collector's hose. No problem. Use the same technique as you would for turning the bottom of a bowl or plate. Hold the light shield in a rim chuck made of solid wood or plywood. Fine-tune the groove of the rim chuck with a parting tool until the shield fits snugly within it. If the groove is too large in diameter, just make it a bit deeper and smaller. Add tape for insurance.

Now cut out the hole. Set your lathe to its lowest speed and score the thin aluminum shield with the point of your skew chisel. It will cut through in no time. Wear a heavy leather glove for protection. Voila! A 4" hole. Now insert aluminum dryer vent hose into the shield, and you have a dust hood for your lathe!



A Great Sawhorse

These sawhorses are sturdy, and they 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 an 1 1/2" continuous hinge and locking table leg braces.



PHOTOS BY BILL ZUEHLKE



PHOTOS BY BILL ZUEHLKE & KRIVIT PHOTOGRAPHY



■ Next Tool Review?

Have a suggestion on what tool we should review next? We'd love to know!

cknoff@aimmedia.com

The battle against dust is one that every power-tool woodworker faces when they go into their shop. Dust in the air, in their lungs, embedded in the finish they worked so carefully on. If you have the space and money, an industrial-grade dust collection system is great, but not everyone has that luxury. A simple wet/dry vac works, but they simply aren't designed for the volume and type of dust woodworking generates. So today, we're looking at the mobile dust-fighting champions of the woodworking world: portable dust extractors.

As with most things these days, we're spoiled for choice, so we picked a few parameters to narrow

things down. We wanted plug-in dust extractors for all-day functionality, and we wanted each of them to have an onboard power outlet that could be used to activate the extractor with an attached tool. If you've had a sander battery die mid-project, you understand why plug-in models are the go-to for professionals.

Now before anyone gets too caught up in the numbers and testing terminology, I want to make a few things clear. Every dust extractor here has enough airflow to suck up more dust than you can generate with any tool plugged into it. And every dust extractor here will gradually see a reduction in airflow as it fills up. With that in mind, this article focuses more on what it's like to use the

PHOTOS BY LOGAN WITTMER



■ Tools 101

Calling all Dust Extractors

By Collin Knoff

We take a look at eight dust extractors to see which ones stand out and which ones suck the most.

dust extractors and what features are important, as opposed to a performance-based shootout.

Why an Extractor Over a Wet/Dry Vac?

When considering your dust collection needs, you need to look at your personal use case. If you're running a professional cabinet shop with a 24" planer that has a 4" dust port, these aren't the tools you're looking for. If you're a handyman who occasionally cuts some 2x4s with a circular saw, your old hardware store wet/dry vac will be fine. If you're reading this magazine though, you're mostly like a hobbyist woodworker with a spouse, 2.5 kids, and a 2.5 car garage that is also your shop

space. And that old wet/dry vac isn't cutting it anymore.

Woodworking generates two types of particles—larger sawdust shavings that fall to the ground and smaller particles that are airborne. A study by *Proto, Zimbalatti, and Negri* in the *Journal of Agriculture Engineering* from 2010 showed that 88% of those airborne particles were smaller than one micron. Do you know how many microns the average wet/dry vac filter is rated for? Because we don't, and neither do the manufacturers. In most cases, they aren't given a micron rating at all, it's just a bit of paper to catch the biggest chunks of dust.

What you want to look for is something that's HEPA (high-efficiency

particulate air) rated. According to the EPA, HEPA filters "theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns." Every extractor in this test besides the *Kärcher* has a filter that is either HEPA rated or has HEPA filters available. It's not just the filters in play either. All of these dust extractors feature tighter tolerances between the motor and reservoir to prevent dust from escaping as well.

The other, less scientific reason is that dust extractors just suck more than wet/dry vacs. Some higher-end vacuums may meet or surpass the extractor's CFM ratings, but for all-day consistency and power, a true dust extractor can't be beaten.

Power to the Tools

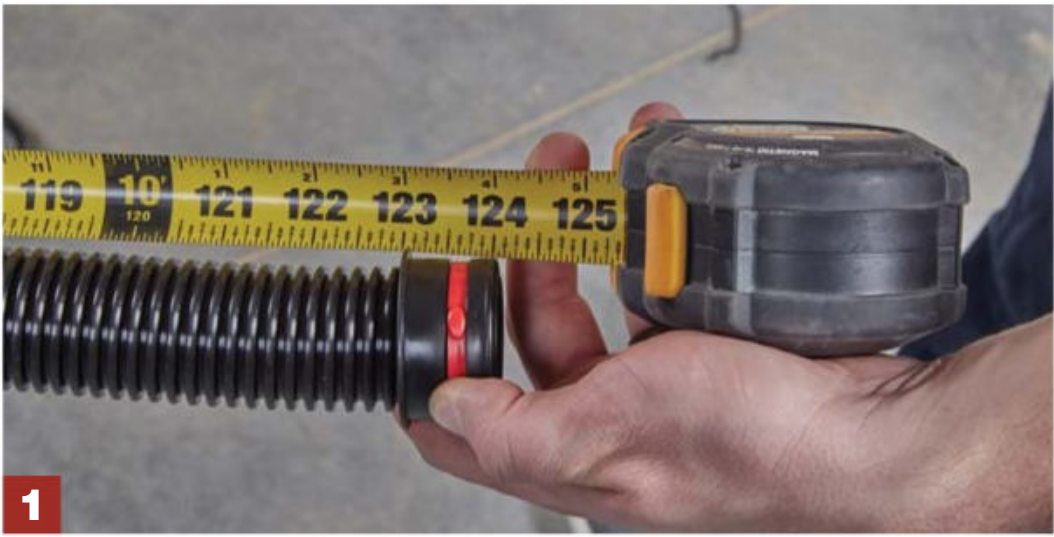
Every extractor in this test features an onboard power outlet for plugging smalls tools into. Small is the key word here—you don’t want to melt your extractor, and you definitely don’t want a fire. The *Makita*, *DeWalt*, *Karcher*, *3M*, *Festool*, and *Unedea* have set power requirements, with the dial used solely for airflow adjustment. The *Bosch* and *Metabo* actually allow you to adjust the current of the motor for the tool you have plugged in.

Both motors draw about 10-11 amps at full power, meaning you can use a tool that draws 3 amps or so, like a 5" random orbital sander. If you want to use a larger tool, say a 7.2 amp jigsaw, you simply adjust the power dial and go. As with most things in life, applying a liberal dose of common sense is going to yield the best results and keep you out of danger.

Three extractors, the *DeWalt*, *Festool*, and *Makita*, are designed to be used with proprietary Bluetooth systems so a cordless tool can activate the extractor. This is great if all your tools are in the same ecosystem but less useful if you have a mix of tools. I’d like to see toolmakers set standards that allow universal compatibility, but I’m not holding my breath.

Testing Results

At the start of the test, our goal was to really break down how each tool performed in depth, testing hard numbers first, then collecting some major dust. Once things got underway, we realized there weren’t going to be any clear winners or losers. The most powerful extractor in the world is going to be inefficient if the tool it’s attached to has poorly-designed dust collection. And short of hooking them up to a planer, every extractor was more than capable of drawing away as much sawdust as we could make. With that in mind, we did pick up a few interesting tidbits to share with you.



1 To ensure a level playing field we conducted a lot of our own measurements, which is why you might find small differences than the “official” specs.

DUST EXTRACTOR STATS

	3M Xtract™	Bosch VAC090AH	DeWalt® DWV015
COST	\$743	\$549	\$699
GALLONS	9 gallons	9 gallons	10 gallons
BAG MATERIAL	Plastic	Cloth	Cloth
PNEUMATIC	Yes	No	No
SELF-CLEAN	Automatic	Automatic	Automatic (cannot be turned off)
WET/DRY	No	Yes	Yes
WEIGHT (LBS)	37.9 lbs	30.3 lbs	37 lbs
OUTLET POWER (MFR STATED)	15 amp	7.5 - 5.5 amp (adj)	15 amp
BYPASS POWER	Yes	No	No
HOSE LENGTH	16'	10' 4"	16'
HOSE DIA. OUTSIDE	1" - 1 1/4", 1 1/2"	1.41"	1 3/8" - 1 1/2"
HOSE LOCK	Yes	Yes	Yes
HOSE STORAGE	Folding hook	Molded hook with elastic band	Clip
DB*	79.5	76.9	80.8
AIR SPEED AT BODY (MPH)	40.5	36	41.2
AIRFLOW ADJUSTMENT	Yes	Yes	Yes
MANUFACTURE CFM RATING	157	150	155
CORD LENGTH	26'	13' 11"	7' 2"
CONNECTIVITY	No	No	Yes, with adapter
WARRANTY	1 year	1 year	3 years
ACCESSORY STORAGE	On the back	On the back	None
SPECIAL FEATURES	Push handle	Good hose storage, current control	Easy to move

Red = best in comparison, *max decibels with saw attached



2

2-3 Every extractor featured stepped or tapered hoses to fit a variety of tools. No uniform standards exist though.



3

	Festool CT 36 E	Karcher WD 6 PS	Makita® VC4210L	Metabo® ASR 35	Uneeda® EKASAND Series 2
COST	\$865	\$350	\$679	\$655	\$1,488
GALLONS	9.5 gallons	8 gallons	11 gallons	9 gallons	10 gallons
BAG MATERIAL	Cloth	Cloth	Both	Plastic	Paper
PNEUMATIC	No	No	No	No	Yes
SELF-CLEAN	None	Manual	Automatic	Automatic	Manual
WET/DRY	Yes	Yes	Yes	Yes	No
WEIGHT (LBS)	34 lbs	22.9 lbs	39.8 lbs	33.4 lbs	58.3 lbs
OUTLET POWER (MFR STATED)	3.7 amp	6 amp	4.6 amp	4 - 10 amp (adj)	4.2 amp
BYPASS POWER	No	Yes	Yes	Yes	-
HOSE LENGTH	11' 5"	11'	14'	11'	16'
HOSE DIA. OUTSIDE	1 ³ / ₈ " - 1.41"	1" - 1.28", 1.4"	1 ³ / ₈ " - 1 ¹ / ₂ "	1.41" - 1.45"	1.40" (threaded)
HOSE LOCK	No	Yes	No	Yes	No
HOSE STORAGE	Top bay	None	Molded hook and elastic band	Folding hook	Hook on rack
DB*	76.8	84.2	74.8	77.6	78
AIR SPEED AT BODY (MPH)	42	34.7	33.5	38.9	37.3
AIRFLOW ADJUSTMENT	Yes	Yes	Yes	Yes	No
MFR CFM RATING	137	Unlisted	148	157	-
CORD LENGTH	24' 7"	25'	24' 7"	25' 1 ¹ / ₂ "	16' 8"
CONNECTIVITY	Yes, with adapter	No	Yes, with adapter	No	No
WARRANTY	3 years	2 years	1 year	3 Years	-
ACCESSORY STORAGE	Various	Various	Hooks and trays	None	Rack system
SPECIAL FEATURES	Kickstand, best hose	Blower attachment, Drain for wet functionality	AWS capable	Current control	Storage Rack

Red = best in comparison, *max decibels with saw attached



4

4 An airspeed gauge was used at the body of the extractor to remove variance from the hoses.

5 All of the extractors were over 70db. The OSHA cutoff for hearing protection is 85db.



5

SPEED VS VOLUME

In real-world practice, CFM is the volume of air that can be moved, and the airspeed is how fast it moves. Both are important when collecting dust, especially from larger machines — a table saw generates a large volume of dust and can do so quickly. Think of your home furnace — it moves a large volume of air, but it does it fairly slowly.

Generally speaking there's an inverse relationship between airspeed and CFM. It takes more power to maintain speed as CFM increases, and that's generally visible in our test results. The two outliers are the 3M and the DeWalt, which had high airspeed and CFM, though they didn't perform any better in our shop testing.

PORTABILITY

Most extractors are bigger and heavier than you'd expect from the photos. Keeping them in one place is great if you can, but if you have to move them, there are some winners and losers. The Karcher was lightest overall, and the Bosch was lightest of the true extractors, but not by much. Neither is great to pull around though. The Karcher is a bit tippy, and the Bosch suffers

from small casters in the front. The Metabo weighs a bit more but has the smallest overall footprint.

The Unedea is both very heavy and suffers the same small front caster issue, but one look at the tall shelf system shows that portability isn't the main objective. The Makita, 3M, and DeWalt were all standouts for how well they moved, thanks to high-quality rubber casters and nice push handles for the latter two. The handles also doubled as a great place to wrap the cord or hose in a pinch.

STORAGE

Improvised storage aside, all of the extractors had at least a hose storage or cord/accessory storage spot. The Makita, Festool, Bosch, and DeWalt all feature the ability to mount storage containers on top. We packed each extractor up between each test, which made clear pretty quickly that none of them completely solved the problem of what to do with a hose and cord that didn't result in any sort of entanglement. The Bosch did a great job overall, but the large recess at the top of the Festool ended winning the day ... assuming you don't attach a systainer and cover the storage.

Final Observations

If forced to choose between a longer cord or longer hose, I'll take the longer hose. The 3M is the runaway champ for both of those however. Between the hose and the cord, you can get a whopping 42 feet away from a wall outlet.

Even though each extractor has a tapered or stepped end to the hose, there's no rhyme or reason to what tools they'll fit. For best results you may need to cut them shorter or buy rubber bushings to fit your tools. Replacement tips and bushings are available online for most of the brands.

The Karcher exists in a sort of no-mans land between true dust extractor and a wet/dry vac. For a lot of hobbyist woodworkers that's probably all you need.

Most of these extractors can be used either as an extractor or for general use around the garage and home. But let's be fair — that's not their prime environment. On the flip side, if you're doing some major home renovations (such as drywall work), the level of filtration they achieve is just as important there as it is in the woodworking shop.

PW — Collin Knoff



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3M Xtract™: *Pneumatic Compatible*

While electric sanders are popular with the home woodworking crowd, many professionals prefer pneumatic for a variety of reasons. The 3M was one of only two extractors in the test with pneumatic hookups, which helped it stand out a bit in a crowded field. It also had a nice push handle, and the hose was second only to the *Festool*.

We were a little less enamored with the purchase experience, as there is some wild price variation listed online, to the point where it's unclear if there's a difference in what's included from each seller.

If you prefer pneumatic sanders and want to save some dough, though, this is the extractor for you.



KARCHER: *Entry-Level Affordability*

Like I mentioned previously, the *Karcher* isn't quite in the same league as the other dust collectors on paper. It lacks a manufacturer's CFM rating and HEPA certification and, by Karcher's own admission, is part of their home lineup instead of professional. (None of Karcher's professional collectors feature onboard power so we chose the WD 6 instead.)

The Karcher also has a few small design quibbles; it's tall and bit narrow, and I don't love the use of metal for the container. It'll probably pick up dents and dings, and a seam along the bottom is going to get gummed up beyond any help.

When we actually started testing though, none of the small stuff mattered — all day long the Karcher sucked up sawdust with the best of them. We appreciated the variety of included attachments and good on-board storage. At \$200 less than the next-cheapest option, it's a screaming bargain for the home woodworker with a garage shop who doesn't need OSHA-certified extraction.



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BOSCH: *Bargain Champ*

The *Bosch* VAC090AH isn't the cheapest dust extractor here, but it is the lowest-priced option that checks all of the boxes for professional use. HEPA-compatible? Check. Automatic filter cleaning? Check. Wet/Dry functionality? Check.

There are a few areas where cost-cutting concessions were made: the front casters are awfully small, and the hose feels cheap (and isn't anti-static). *Bosch* sells a higher-quality anti-static hose (VH1635A) if you'd like to upgrade, but that wipes out most of the cost savings.

Don't let those small drawbacks discourage you, though. The *Bosch* has plenty of power and suction. Plus, the onboard storage was top-notch for both convenience and portability, and the light weight made it easier to move around the shop than most.



DEWALT®: *Almost Flawless*

One of the things I appreciate about *DeWalt* products, in general, is how well thought-out they are. The DWV015 exemplifies this mindset in several ways. The wheels and portability are hands-down the best, there are multiple ways you can store the hose and cord thanks to the telescoping handle, and the 16' hose features a great locking mechanism.

There are a few weaknesses: the cord is relatively short, and tip of the hose makes an incredibly annoying sound. The cord I can forgive but the sound is a literal pain. Turn on the *DeWalt* without a tool attached and you'll be greeted with an unrelenting, high-pitched whistling noise.

No other extractor in our test suffered this same issue. From the reviews online it sounds like it wasn't an isolated occurrence.

If you can get past that sound, the *DeWalt* is among the most livable day-to-day options here.



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METABO®: *Well-Rounded*

Design and performance-wise, the ASR 35 seemed closely related to the 3M, though there are a few differences. The *Metabo* lacks the pneumatic hookups and, while it has the attachment points for a push handle, doesn't include one. The hose also isn't quite as nice, but the Metabo does gain wet/dry functionality.

The ASR 35 was one of two extractors in the test to allow you to set the amperage when connecting a tool. The knob plainly states how much power the motor is drawing, and instructions are clearly labeled right on the front of the machine. The power activation setting knob is a bit more cryptic, but there are helpful hieroglyphs if you can't remember what the letters stand for.

While the Metabo was rarely outstanding in any way, it was a continually solid and dependable choice in our testing.



MAKITA®: *Everyday Choice*

The VC4210 packs lots of friendly touches into a solid all-around package. The design is top-notch, with hooks and cubbies for the cord and attachments and the ability to mount three different types of containers to the top rack.

It was the quietest in our test by a small amount on paper, though it seemed more noticeably quiet in use.

The Makita lacked any real drawbacks, outside of the hose seems a bit cheap. It didn't exactly inspire us, but then again, none of the extractors had an emotional impact.

At the end of the day, it included all of the features we wanted at a middle price point, which makes it a great option for most home woodworkers.



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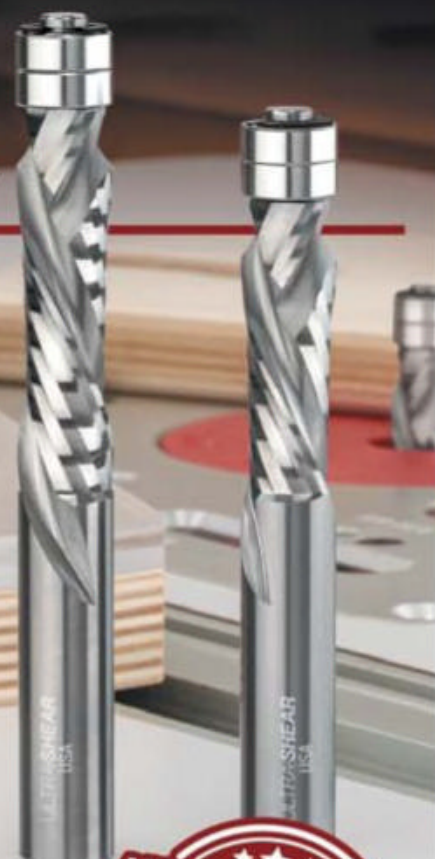
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Router not included.

FESTOOL: *Woodworker's Choice*

The *Festool* is a bit of a ringer in this comparison. Almost every other extractor we tested was designed with the job site in mind, requiring a multi-disciplined approach to features and functionality. The Festool was designed with woodworkers in mind from the start, and it shows.

It's all in the way it gets the little details right: the hose is easily the best in the test, the large wheels make it easy to move when you want to, and a kickstand means it won't when you don't. The space at the top by the handle is large enough to stow the hose and have room to spare. This a luxury that everyone else seems to have omitted.

It's not entirely perfect: the model we tested was the only one in the comparison that didn't have filter cleaning, and jumping up to CT 36 E AC adds \$120 to the already-high price. If you can justify the cost though, you're going to be very happy with the results.



UNEEDA®: *The Finisher's Choice*

The *EKASAND* was a bit like a heavyweight prizefighter in this comparison. It was larger, heavier, more expensive, and definitely felt built to a higher level of quality than the rest. It also felt, more than any other unit, to be designed for finishing. This makes sense, as Uneeda is largely known for its sanders.

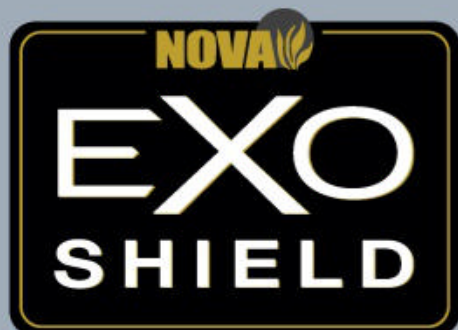
In spite of the great pedigree, there are a few missteps that keep it from true perfection. The rack was great for holding things if the unit was stationary but rattled and bounced a bit while moving the extractor around. There's no CFM rating from Uneeda, which was a bit odd given the price point. And, that price might also be a real issue for many woodworkers.

That being said, if you're a professional finisher or refinisher, the Ekasand is a great choice, thanks to the built-in pneumatic capability. This is why it earned a permanent spot in the finishing area in of our new shop.



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Mid-Century Media Console



PROJECT #2315

Skill Level:

Beginner

Time: 2 Days

Cost: \$125

From massive entertainment centers to modified sideboards, furniture design seems to lag behind the evolution of the TV. Stands were perpetually a step or two behind the current state-of-the-art in screens. I confronted this problem when searching for a stand to complement our new flatscreen. Looking for a design that would accommodate a few components and

look at home under a wall-mounted TV, I found inspiration in the work of Charles and Ray Eames. This husband-and-wife design team create some of the signature pieces of the Mid-Century Modern furniture, including perhaps the definitive version of the surfboard coffee table from 1951.

With its mix of materials — metal, plywood, and laminate — and

minimalist design, the iconic piece epitomizes Mid-Century Design. The elliptical top appears to float over a double pedestal base of welded wire, its beveled edge emphasizing the contrast of laminate and substrate and highlighting the Eames's interest in experimenting with materials. The long, low design makes for an attractive table, but the welded base presents



This Mid-Century table is a great way to blend woodworking with modern materials.

By Michael Crow

a challenge for typical shops. My design preserves the floating top and mix of materials but substitutes a glued aluminum base for welded steel and adds a lower shelf for additional storage. The design doesn't require much in the way of materials or time and provides a good introduction to pattern routing and basic metalworking using materials available at home centers.

No Welding Required

The same carbide tools you use to cut lumber work equally well on non-ferrous metals like aluminum and brass, but working metal requires extra care. Clamp the work well. Take cuts slowly. Let cutting heads come to a complete stop before unclamping your work. Watch for cross-contamination. Clean carefully after cut-

ting and drilling metal. Skip the dust collector in favor of a shop vacuum. The same utility knife and double square can be used to mark both wood and metal, but you need to augment those with an automatic center punch to mark before you drill. These are just a few tips that I have learned. You'll pick up your own best practices as you work.

PHOTOS BY LOGAN WITTMER & COLLIN KNOFF

The Base

We will start this build with the aluminum base, which consists of two rectangular frames captured in half-lap joints cut into the upper and lower stretchers. Because the 1" square tubing doesn't have much surface area, wooden plugs help to reinforce the mitered frames.

Construction of the base begins with the frames. I cut these joints on the miter saw with the blade at 45° to the fence. To ensure consistent, repeatable cuts, use stop blocks on the auxiliary fence. Make the first cut, then flip the piece end over end, double-checking that your miters are facing the right direction before making your second cut. You'll cut 4 short frame pieces and 4 long ones, changing the position of the stop

block between each group.

Next, rip some scrap stock to create some wooden plugs that will slide into the tubing. These plugs, along with epoxy, is what makes it possible to assemble the frames without welding. The plugs need to be slightly smaller than the inside perimeter of the tubing and cut into 1 1/2" lengths. Lastly, scuff sand with 80 grit paper to give the wood some tooth.

With the pieces cut, it's time to begin assembly. Each frame is joined in stages, with 1 rail and 1 stile glued into an L-shaped sub-assembly, then two of these halves are glued together to complete each frame. Gluing aluminum is much like gluing wood, with epoxy standing in for wood glue. Do a dry run to make sure

the pieces fit and that you have all materials near at hand. Now's the time to lightly scuff sand the faces and the inside surfaces of the miter joints. Sanding is completed immediately before assembly so that aluminum doesn't have a chance to oxide. Don't forget to wipe the metal clean before continuing.

After donning safety glasses and disposable gloves, I mix enough five-minute epoxy for one joint following the manufacturer's instructions and spread it on the inside of one tube end, and insert a plug. (TIP: If you want more open time as you work, buy an epoxy with a longer cure time.) I then spread more epoxy on the exposed end of the plug and slide the other tube over the plug. Epoxy should fill the gaps between the aluminum tubing and the wooden plug, creating a strong joint. If you prefer, you could use an inexpensive corner clamp to help stabilize these



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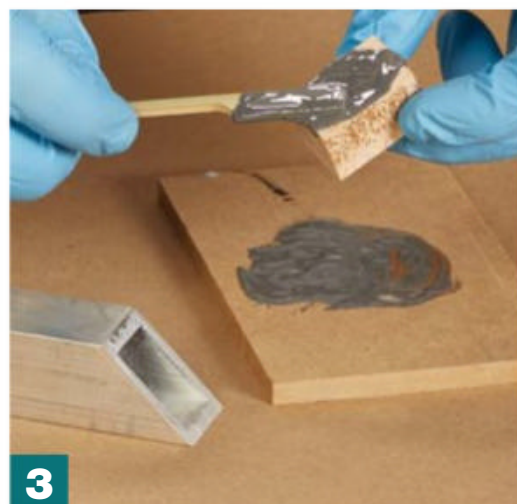
1 Use a stop block on an auxiliary fence to cut identical parts.

2 Grey colored epoxy helps mask any gaps in the joints.

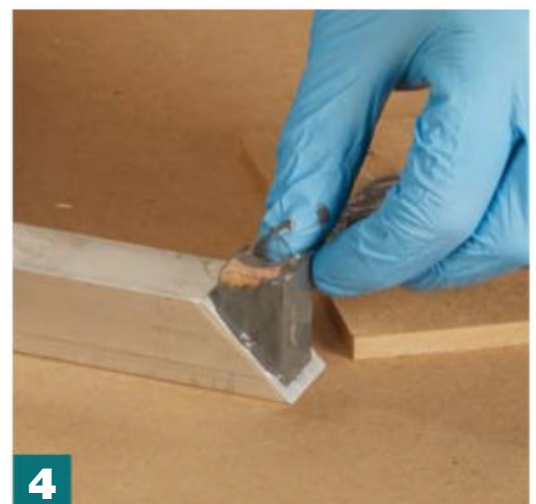
3-4 Apply epoxy to the end of the wood plug and insert it into the tubing. Then spread more epoxy on the exposed joinery before joining the second piece of the tubing.



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5 A simple jig guides the router when cutting half-laps in the stretchers. Align the notch in the fence with marks on the stretchers.

6-7 A dado bit cuts clean notches. Move the router slowly into the tubing, especially at the start and end of the cuts where there's more material.

8 Cutting both half-laps at once helps guarantee that the assembled frame will be square.

miter joints. You don't need a lot of clamping pressure when gluing with epoxy—the clamps would simply be there to help stabilize the joint together while the epoxy cures. You may get some squeeze out, but that can be wiped with a rag soaked in denatured alcohol or scraped off with a razor blade once dry. Once the 4 L-shaped sub-assemblies have cured, join them into frames. Remember that each frame should have a top and a bottom. While the epoxy cures on the frames, turn your attention to the stretchers.

I gang-cut each stretcher pair to keep the parts consistent, clamping them together when beveling and notching. To cut the bevels, I set the blade to a 45° angle to the table. That angle is arbitrary; you might prefer 30° or 60°. Cut one end, then flip the pair, again double-checking that my bevels will be oriented the right way before cutting to length. To notch the stretchers, a router and a basic dado jig works well. The jig's fence is aligned with the joint, and the rails control the base of the router as you cut. Take multiple passes to bring the cuts to the final 1/2" depth.

To finish the raw stretcher ends, I epoxy a slightly oversized piece of flat bar stock to each end. Since these joints won't receive any stress, a plug is not required. Deburr the cut and scuff sand the end of the joint and the back side of the cap. Mix some epoxy and apply it to the stretcher, then press the cap into place, securing it in place with masking tape. After the epoxy has cured, remove the tape, and scrape any squeeze out before filing the cap to the final size. You should end up with an almost seamless transition between the stretcher and cap, creating the impression of a solid stretcher. Repeat for the other stretcher ends. Set the frames and stretchers aside and work on the shelf and tabletop.

Surfs Up

The Eames table features a top of laminate over plywood with the edge beveled to emphasize this interaction. I cut my top and shelf from some pre-finished birch plywood I had in the shop. While the birch's light color and minimal grain doesn't distract from the distinctive shape, the top presents a good opportunity to experiment if you're inclined, mixing materials like the Eames or perhaps using an exotic veneer (I'd be tempted to do a version using solid surface material).

The shelf is made from two pieces to simplify the final assembly. Rip plywood for the two halves and crosscut to length. This can be done using several methods. Whatever your approach,

keep close to your layout lines for a tight, attractive joint.

The elliptical top presents more of a challenge than the shelf. Rather than fumbling with a multi-pivot jig or trying to draw an ellipse with a loop of string and two nails, I choose to rout the top to the final shape with a pattern. Although pattern routing is often used to duplicate multiples of the same part, you can also use a pattern to make multiples of the same cut on a single piece. Because the top is symmetrical on its long and short axes, I could use a $\frac{1}{4}$ pattern, flipping it to reproduce the four arcs that form the ellipse.

Begin by preparing the pattern. I drew the ellipse to my desired size in SketchUp, then quartered it, leaving a 1" overlap on the long

and short sides. After printing it out, I traced the arc onto my pattern stock. I then cut close to my layout lines on the bandsaw and sanded the curves fair. Take care when preparing the pattern since any irregularities will be reproduced four times on the top.

Prepare the top blank by cutting a rectangle slightly wider and longer than the ellipse, then mark long and short centerlines on the bottom of the piece. You'll use these lines to place the pattern when cutting and to align the top on the base during final assembly. Trace the pattern on the base, flipping and rotating to trace the complete ellipse. Once you've marked the top, cut close ($\frac{1}{8}$ " to $\frac{1}{16}$ ") to your layout lines with a jig saw.



9 Mark horizontal and vertical lines on the top. Align the pattern and trace the ellipse.

10-11 After roughing out the tabletop using a jig saw with a fine-tooth blade, use double-sided carpet tape to secure the pattern.

Align the pattern with the top's center lines and attach the pattern to the top using double-sided carpet tape. Using a bottom-bearing flush cut bit, cut the first arc, taking care at the start and end of the cut to keep the bit on the pattern. The bearing will follow the shape of your pattern, reproducing it perfectly. Work your way around the table, flipping the pattern as needed to finish the ellipse. With the top cut to the final size, you can shape the edge to your taste. To create a bevel like the Eames, use a chamfer bit. I chose to play with the idea of the surfboard by rounding over the top edge with a $\frac{1}{4}$ " bit, then sanding the exposed edge of plywood. You can also consider rounding over the bottom edges as well to continue that surfboard look.

Finish before Assembly

It's easier to finish the base and top before the final assembly. Since I was working with prefinished plywood, I just had to sand the exposed edges and apply a couple of coats of water-based polyurethane. If you've chosen another material, apply a suitable finish and turn your attention to the base. For a pop of color, you could spray paint, anodize, or even powder-coat the base. I opted for a brushed finish. You can achieve a number of different effects with various grits of sandpaper and sanding. I used 220-grit paper on my random orbital sander for a matte appearance. There's no need to work through grits before final sanding, but the paper does clog quickly. Wipe the base clean with a damp rag.

15-17 Use a center punch to mark your placement for the feet. Then, drill the hole and insert the foot. The dimple left by a center punch allows precise placement of the holes in the metal.



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12-13 A flush cutting bit brings the top to final size. Take care at the start and end of the cuts to keep the bearing on the pattern.

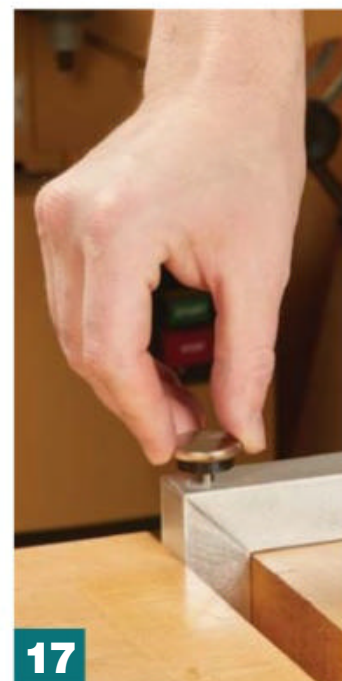
14 Swap the bit out for a roundover bit and soften the edges.



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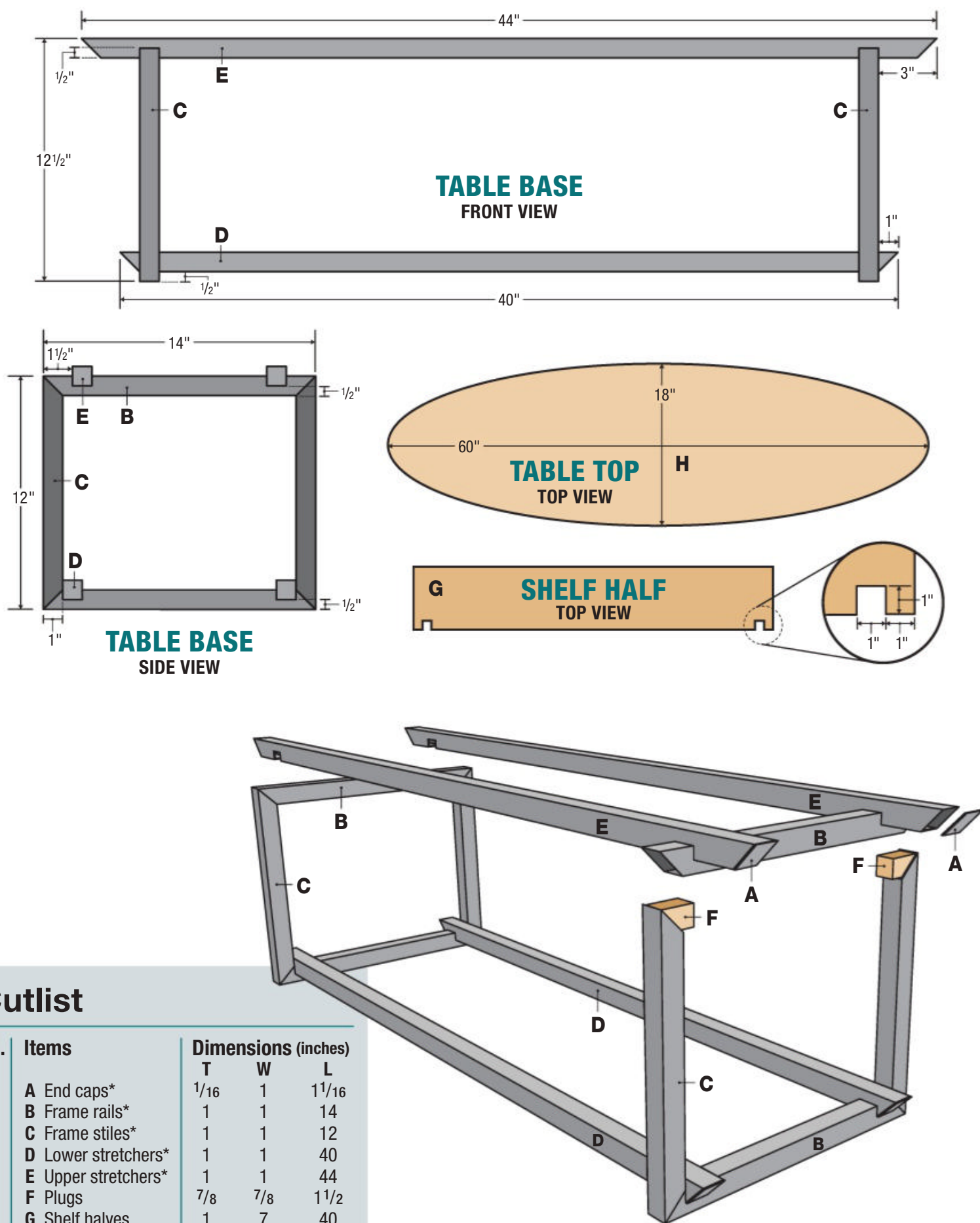


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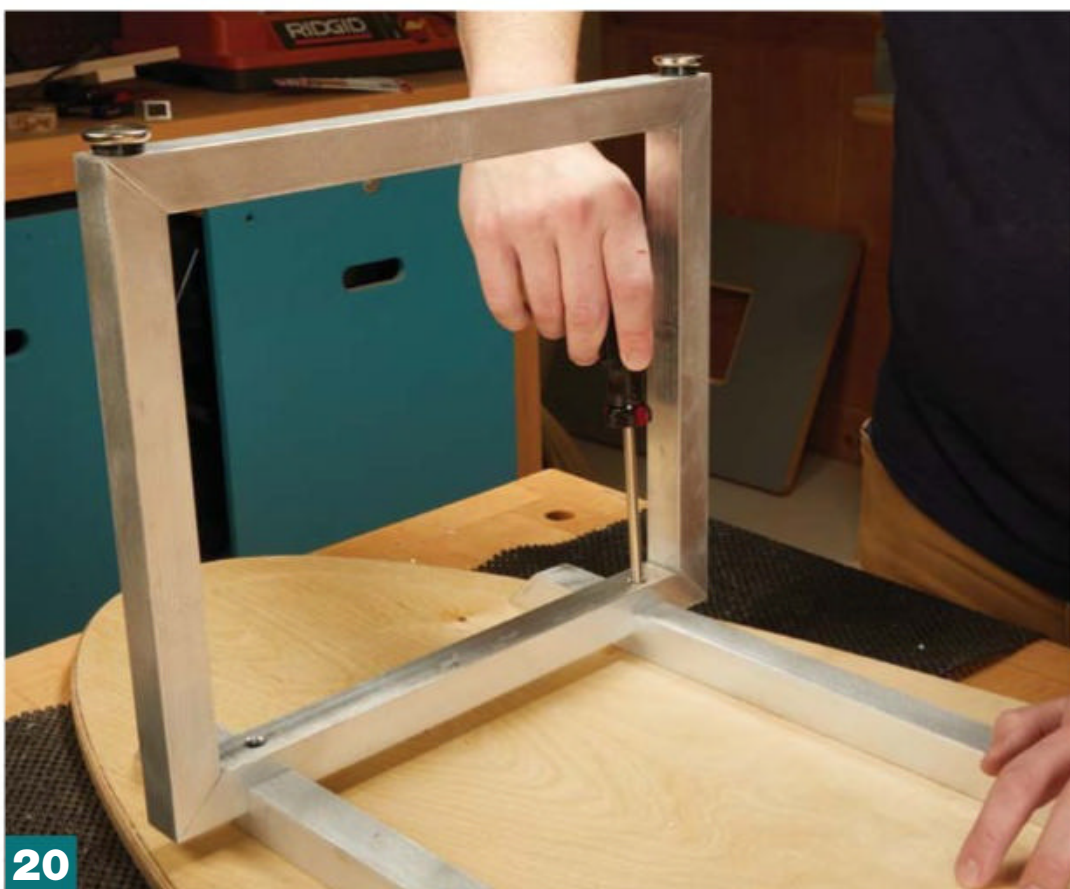
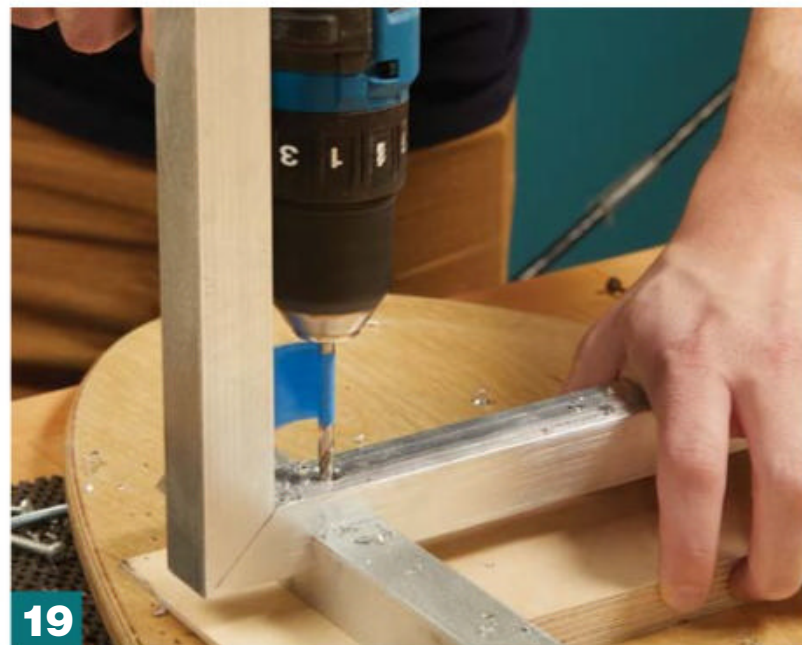
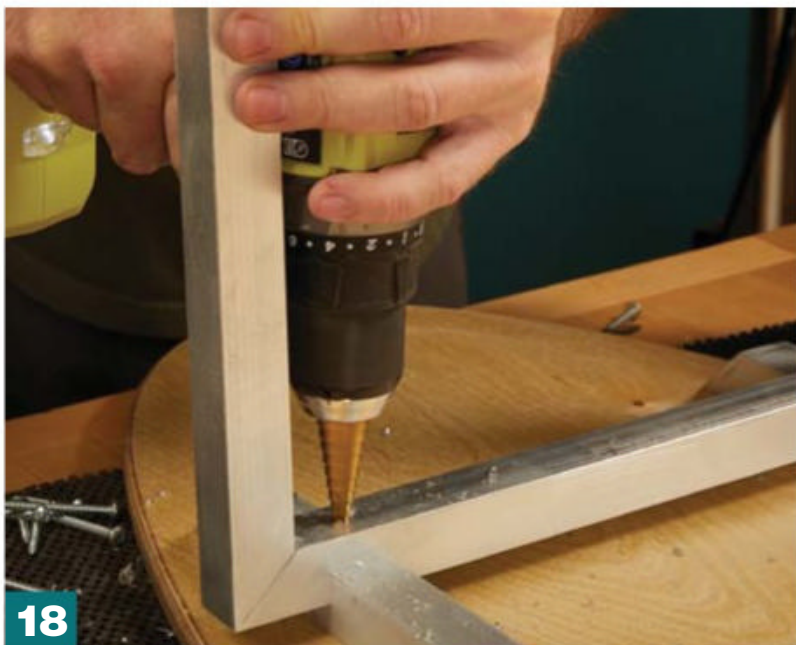
Mid-Century Media Console



Cutlist

No.	Items	Dimensions (inches)		
		T	W	L
8	A End caps*	1/16	1	11/16
4	B Frame rails*	1	1	14
4	C Frame stiles*	1	1	12
2	D Lower stretchers*	1	1	40
2	E Upper stretchers*	1	1	44
8	F Plugs	7/8	7/8	11/2
2	G Shelf halves	1	7	40
1	H Top	3/4	18	60

*Parts are 1" aluminum tubing.



18 Drill the clearance hole on the bottom side of the rail.

19-20 Next, drill the pilot hole all the way through the tubing and insert the screw to secure the base to the table top.

Put It All Together

First, drill for the adjustable feet. The bottom of each frame is drilled twice, with the hole centered on the tube running directly above it. Deburr these holes and install the feet.

Begin by marking the location for the screws that will join the

base to the top and shelf. They should be $2 \frac{1}{8}$ " from the long end of each miter and centered on the width of the tubing. Drill clearance holes on the bottom side of the top and bottom rails, using a bit large enough for your screw heads. Change your bit to one sized to clear the threads of your

screws (I used a $\frac{3}{16}$ " bit), and drill through the top and bottom piece. Lastly, use sandpaper or a file to deburr any rough edges to prepare for final assembly.

Lay the top bottom up and fit the frames into the notched stretchers. The frames should overhang the stretchers $1 \frac{1}{2}$ ". Mark the centers of the rail and stretchers and align these marks with the center marks on the top. Anchor the base to the top using pan head screws through the clearance and pilot holes. Then flip the table and place the bottom stretchers and shelf. To screw the shelf down, you can try working from below the table or clamp the shelf and stretchers to the frame and flip the table back over for easier access to the bottom rails.

With the table complete comes the hard part: deciding on the optimal arrangement for your AV components. Of course, if you don't have a need for AV components, the shape and style of this table also lend itself to being used as a coffee table in your house — such as the main photo in this article. It think looking at it, you'll agree that the blend of aluminum and plywood is the right amount of modern while still being able to use all of our woodworking tools and skills.

PW – Michael Crow

■ Laminated Coping Saw



This project brings together a diverse set of skills including epoxy work, bent lamination, metalworking, turning, and riveting.

By Ryan Carpenter

PROJECT #2316

Skill Level:

Intermediate

Time: 4 Days

Cost: \$75

LEAD PHOTO BY LOGAN WITTMER /
ALL OTHERS BY THE AUTHOR

Chopping vs. coping dovetail waste can be a fiercely debated topic, but I find coping better fits my workflow. Debate aside, I find hardware store coping saws have clunky ergonomics, insufficient tensioning mechanisms, and difficult scroll angle adjustments. After looking at some antique saw designs, the answer was obvious—why not make a coping saw out of wood? Add in some metalwork and a little epoxy, and you will have a lightweight saw that cuts fast and true.

A bearing at the top allows you to continuously adjust the scroll angle as the cut progresses; this may take a while to get used to, but I find it much faster to switch angles as I cut dovetail waste. A quick-release blade allows fast blade changes and adjustments without your hand leaving the handle. Lastly, the rigid saw frame allows significantly more tension than hardware store saws, all while weighing in at just under 7 oz.

Begin with the Bow

It all starts by cutting accurate veneers. A freshly jointed face against the fence, a well-adjusted bandsaw with a Wood Slicer blade and full feather-board produces veneers that require minimal planing. Use calipers to ensure veneers aren't thinner than specified.

Next, align the templates onto the veneer. But first, careful consideration is needed to ensure the grain direction wraps around the saw. I do so by aligning each piece with the grain, as seen in photo 2 while keeping holes away from the edges to minimize splitting. I don't adhere my template directly onto the veneer. Instead, I use spray adhesive to adhere my templates to a layer of painter's tape for residue-free removal. While you are gluing, attach the assembly fixture to 3/4" plywood.

Time to cut and glue the pieces. Both types of wood are strong but

very brittle; I find that pilot holes, sharp Forstner bits, a 6-tpi band-saw blade, and a zero-clearance insert reduce splitting and tear-out. I like to saw pieces slightly oversized to accommodate small shifts during glue-up, then carefully trim any joints for a tight, dry fit on the assembly fixture. Before gluing, transfer the joint lines to the side of the assembly fixture to aid in alignment and coat the entire assembly fixture in packing tape to prevent the epoxy from sticking. Glue on the first side of the bracing and allow the epoxy to

fully cure before scraping and gluing on the opposite side. For more tips on mastering epoxy, check out the column on page 40. Once fully cured, sand or file the exterior and interior surface until it is square and matches your fixture. This is where the excess material hides minor shifts during glue-up.

Set this aside and cut four pieces of thinner purple heart veneer to laminate for the spine. Use a scraper to quickly remove irregularities caused by the bandsaw. Apply four layers of aluminum foil duct tape to the outermost veneer



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1 Resaw the veneer at the band-saw using a resaw blade.

2 Mount the templates on the veneer using spray adhesive.

3 After drilling the veneer, cut the veneer to shape.



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to prevent cracking when bent. This tape can be easily removed after gluing. To laminate the spine, use epoxy to glue the spine in two stages. First, glue the laminates together and clamp to the assembly fixture to achieve the outer shape. Once cured, remove the spine, scrape off the excess epoxy on the inside, and glue it to the core. Start clamping at the center and work towards the outside, minimizing gaps.

To finish the bow, plane the spine laminates to width. You want the final spine to be $\frac{7}{16}$ " wide in the middle, $\frac{3}{8}$ " on the corners, and $\frac{5}{16}$ " at the ends. Once done, give the entire bow a light coat of epoxy, and wipe off the excess, lightly sanding when cured.

6 A cabinet scraper brings the veneers down to the final thickness.

7 Glue the spine to the core.

8 Use a block plane to plane the spine down to final width.

Mastering Epoxy

Strong joints are crucial for a lasting saw and only takes a few simple steps:

- 1. PROTECT.** Wear disposable gloves. Follow the manufacturer's safety guidelines.
- 2. USE HIGH-QUALITY EPOXY.** I use *West Systems 105* with *206* and measure each part carefully.
- 3. MIX PARTS** together for 1 minute.
- 4. COAT EACH SIDE OF THE JOINT.** Use as-mixed epoxy so it can seep into the grain.
- 5. THICKEN REMAINING EPOXY.** Mix in *West Systems 406* filler until it is the consistency of ketchup.
- 6. APPLY THICKENED EPOXY.** Spread a thin layer to the joints and apply gentle clamping pressure.
- 7. CLEAN UP.** Remove as much squeeze-out as possible before it cures using paper towels and cotton swabs dipped in acetone.
- 8. CURE.** Follow the manufacturer's instructions.
- 9. CLEAN OFF THE WAXY RESIDUE.** Wipe down using white vinegar.

4 Use a two-part epoxy to glue together the first half of the core.

5 Scrape off the excess epoxy in between glueups.



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Start Metalworking

Refer to the plans on page 43 to mark critical dimensions. Use machinists' dye or permanent marker to make the layout marks more visible. Accuracy is critical for marking the #42 cross hole on the lower bracket—it needs to be centered on the edge of the $\frac{5}{8}$ " through-hole for the keeper pin to work correctly. This keeper pin prevents the handle from falling out when a blade is not installed and can be skipped if the accuracy is too much of a hurdle. Scribe all other lines deeply, as they will be your references for filing later. Leave extra material near the large holes to avoid deformation during drilling.

Time to begin drilling holes. Start with the keeper and rivet holes, as they are more likely to drift if drilled after the larger

holes. Accurately drilling large holes can be challenging—use cutting fluid, secure your vice to the table, and drill pilot holes. Use a $\frac{1}{2}$ " counterbore bit to drill the top hole to the prescribed depth and flip the bracket and drill from the other side, leaving an $\frac{1}{8}$ " thick ledge. Larger pilot holes are recommended prior to drilling the $\frac{5}{8}$ " hole with a twist bit to prevent catching or drifting. Alternately, a $\frac{5}{8}$ " counterbore bit can drill the bottom through-hole in one pass.

Now start shaping the scallop—a hacksaw, sharp files, and sandpaper help you to quickly work to your marked line. Use the hacksaw to rough cut the legs, then file and sand to your lines. If you have access to a metal cutting bandsaw, it will greatly speed up the roughing process.



9 Mark the bracket holes and the profile. Using layout fluid or a marker increases visibility.



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10 Drill the small cross-holes.



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11 Counterboring the top leaves a ledge for the bearing.



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12 Drill a larger through-hole for the bottom bracket.

13 Use a file to form the scallop on the end.

14 Remove the waste using a hacksaw.

15 Shown here is the before and after the final filing and sanding is complete.



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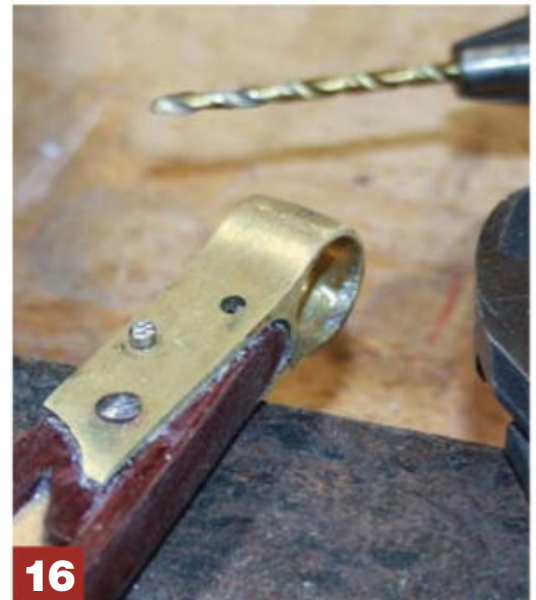
15

With the brackets complete, it's ready to secure them to the bow. First, fine-tune the laminated bow so the brackets slide snugly on. Then, use epoxy to secure them in place and fill any gaps. Prepare the rivets by taking 11ga. finishing nails and filing the heads so only 1/16" remains. Drill through the bow using a #31 bit and rivet the brackets in place. For tips and tricks on riveting check out "Rivets Made Easy" below.

Now we're on to the guards, which are cut out of 0.032" brass sheet. Scribe the lines of the saws interior curve and use a pair of dividers spaced at 1/4" to mark the far side. Guards should extend be-

yond the corner braces 3/8" in both directions. Give your old coping saw one last hurrah by fitting it with a metal cutting blade and roughing out the guards. Leave excess material on the inside curves then file/sand the outside curves.

Lastly, rivet the guards into place. First, use dividers to mark evenly spaced rivet holes less than 1/2" apart. Next, carefully drill through the entire assembly using a #59 bit with a small drill bit adapter. CA glue or epoxy holds the guards in place during drilling and riveting. Once drilled, use #19 finish nails to rivet them in place. After riveting, give the bow a coat of varnish to prevent the epoxy from yellowing.



16

16 The rivets are cut to length before they're peened.

Rivets Made Easy

Making a strong riveted joint is a lost art, but it's easier than it looks:

Any nail can be a rivet.

Copper works best, but steel will be used here for added strength.

Start with an accurate hole.

Slightly under-sized holes prevent the rivet from bending in the joint.

Drive in the nail.

Hammer the nail through the assembly until the head contacts.

Finding a "bucking iron."

Make sure a heavy piece of steel/anvil always contacts the back of the rivet.

Set the rivet.

Support the rivet head and snug assembly. A slender piece of wood with a hole just larger and deeper than the exposed nail works well for setting.

Clip the exposed end.

Use the side cutters to clip the rivet leaving 3/4 of a nail diameter in length.

Peen the head.

Many light taps (30-100) with a 13oz genno hammer form the exposed end into a dome, ideally hitting the rivet at different angles working around the circumference. Hitting too hard will crack the wood. Once the top is domed, flip the piece, and peen the bottom if needed.



17



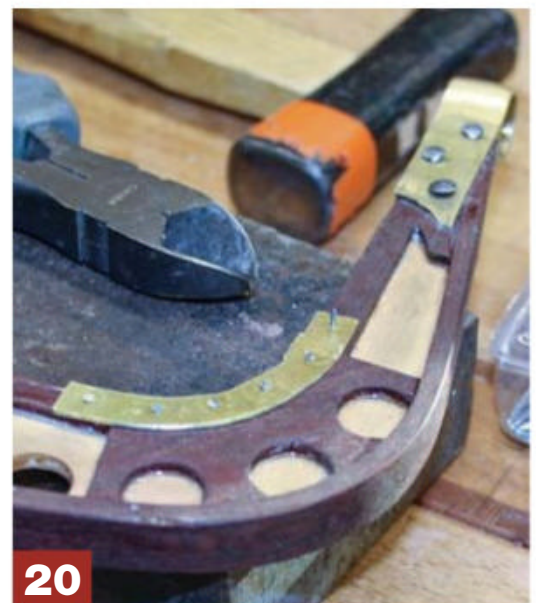
19

17 Scribe the bow shape onto the brass plate.

18 Use dividers to form a parallel cut line.



18



20

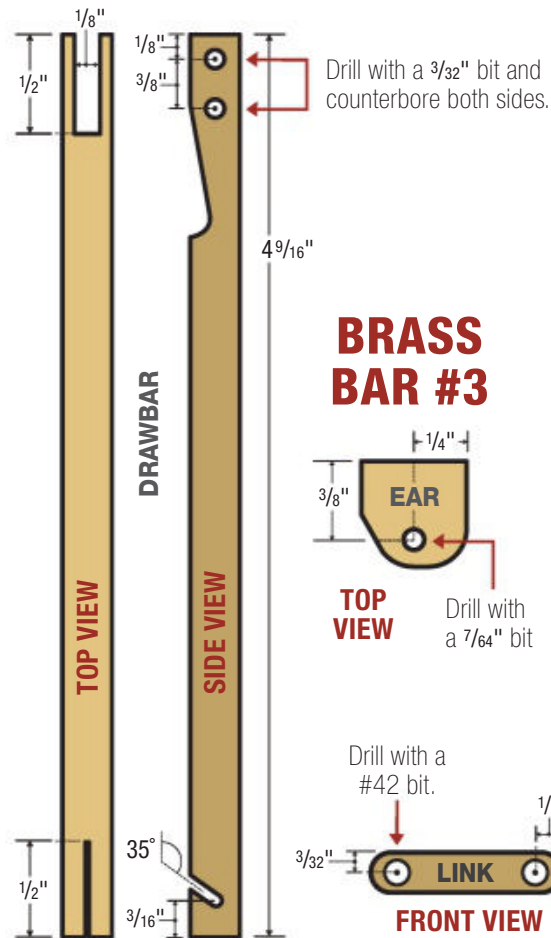
19 Drill rivet holes through the brass and frame.

20 Small rivets are peened over and attach everything.

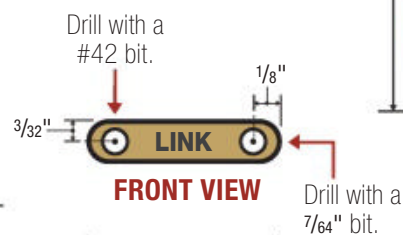
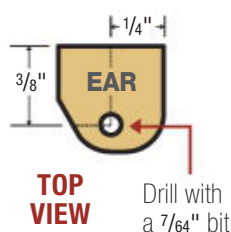
Laminated Coping Saw

For full-size templates, visit PopularWoodworking.com.

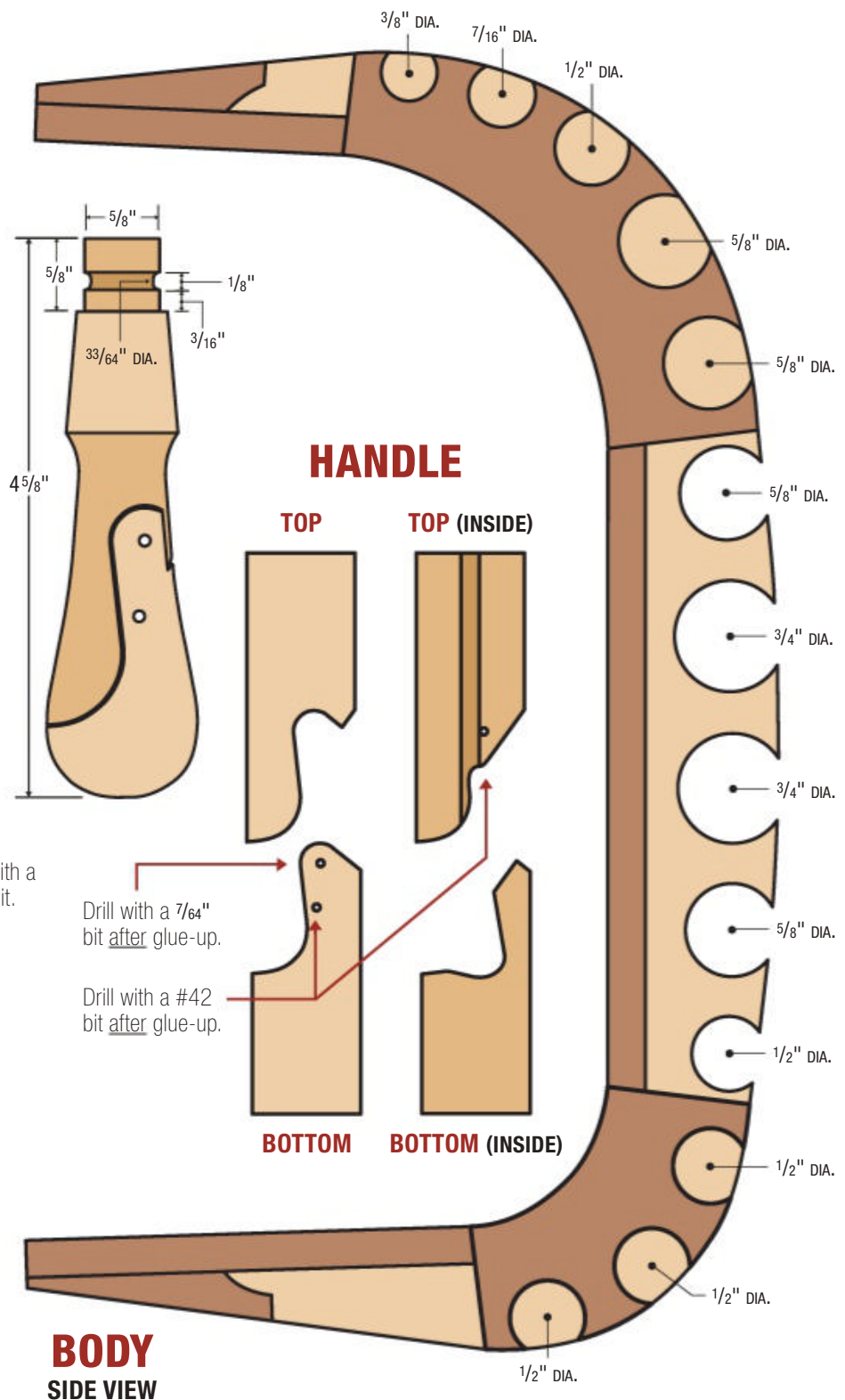
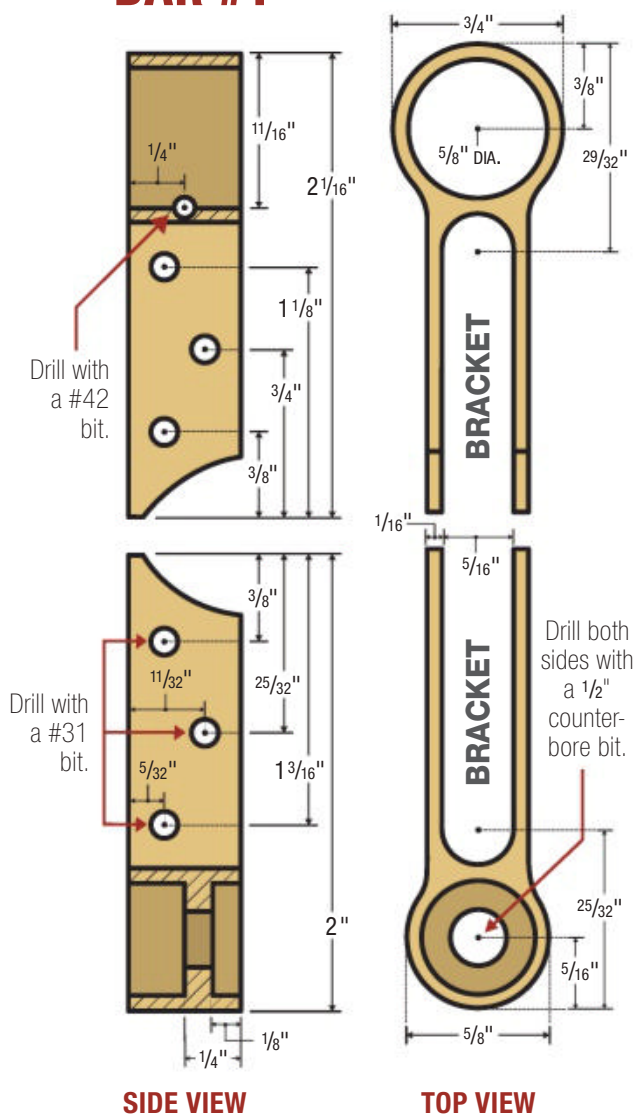
BRASS BAR #2



BRASS BAR #3



BRASS BAR #1



Supplies List

No.	Items	Vendor	Part #
1	A 4/4 Hickory, 8" x 12" (bow core, handle)		
1	B 4/4 Purpleheart, 4" x 20" (bow bracing, spine)		
1	C 1/2" x 7/8" x 6" brass bar #1 (brackets, link) *	McMaster	8954K25
1	D 1/4" x 1/4" x 6" brass bar #2 (draw bar) *	McMaster	8951K13
1	E 1/2" x 1/8" x 6" brass bar #3 (quick-release ear) *	McMaster	8954K25
1	F 0.032" x 6" x 6" brass sheet (guards) *	McMaster	8954K25
1	G Thrust bearing	McMaster	6655K12
1	H #8-32 x 1" brass flared collar thumb screw	McMaster	92421A199
1	I #8-32 brass flanged knurled-head nut	McMaster	92741A120
4	J 3/32" x 1" dowel pins	McMaster	98381A443
-	- 1/2" counterbore bit (optional)	Amana Tool	55286
-	- Small-hole drill chuck adapter (optional)	McMaster	30505A5

* Half-hardness shown, avoid annealed or soft brass.

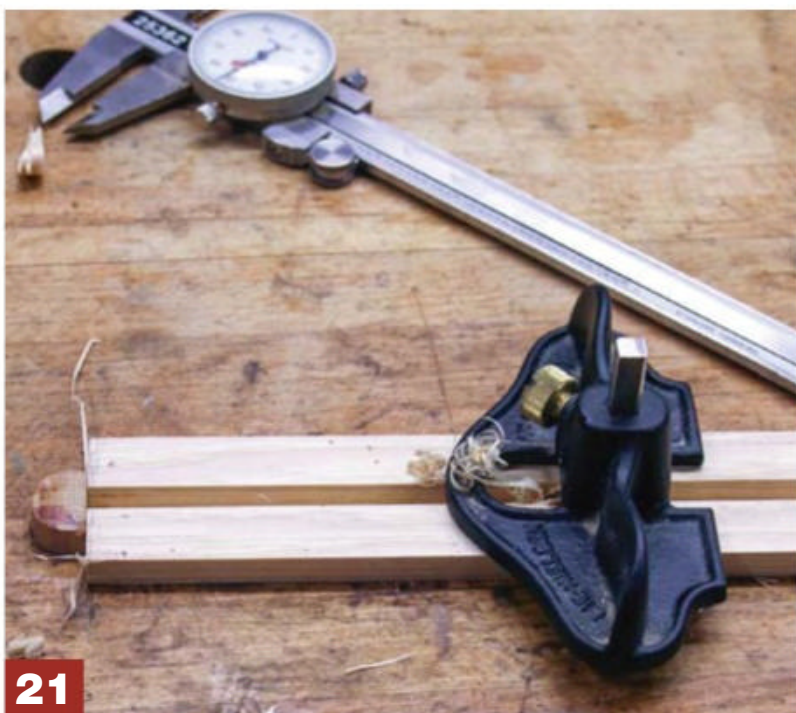
The Handle

Begin by preparing the handle stock. Accuracy is important to ensure the quick-release mechanism works smoothly without binding—using a pair of calipers to get thicknesses with ± 0.005 " saves you time fitting parts later. Start with a piece of hickory that is long enough to safely run through your machines. Re-saw and plane it to 0.315" thick setting the offcut aside for later. Next, cut a centered groove on the stock just wide enough for your $\frac{1}{4}$ " brass bar to slide through smoothly. I then use a small router plane to clean up the bottom of the groove. Plane the

offcut and glue it back on. Once the glue dries, I re-saw and plane the offcut side so the total thickness is 0.370."

Apply the templates, drill the hole in the top core, and cut and smooth the blanks. Glue the blanks together, ensuring the edges are flush, and drill the remaining holes after the glue has dried. Sand the two blanks until they nest together nicely with the top holes aligning (the handle won't swing until it is turned). Apply two generous beads of hot glue to the sides and temporarily assemble the top and bottom together; this glue holds the blanks together during turning.

Saw off the corners and mount the blank in a 4-jaw chuck. Next, insert the $\frac{1}{4}$ " bar stock into its channel, wedge it in place, and mount the free end in your live center. Many wraps of electrical tape support the weak hot glue joint and can be removed and reapplied to other areas. Carefully turn the tenon 0.005" smaller than the hole you drilled on your bow bracket. Follow the drawing to make sure the handle profile is not too thin. Once turned, give the tenon a light coat of epoxy to add durability, and apply finish (I find jojoba oil protects the wood while leaving a nice grip) to the handle assembly.



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21 True up the bottom of the groove with a router plane.

22 Glue the offcut onto the grooved workpiece.

23 Attach the templates with spray adhesive.

24 Glue up the handle blank parts.



25 The handle blank is held in the lathe chuck.

26 Carefully measure the tenon on the handle.



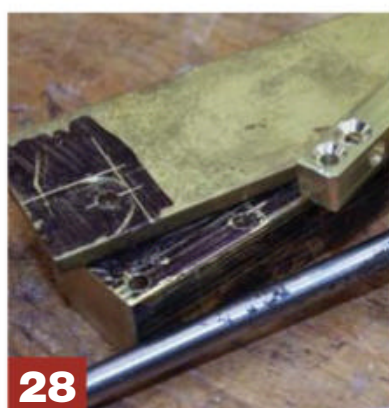
27

27 The finished handle should pivot freely.

More Metalworking

Mark the brass quick-release components, drill holes, and lightly countersink the holes on the drawbar. Rough out the profiles, file to your lines and sand the finished parts. A kerf from a hacksaw makes the perfect slot for a coping saw blade. The slot can be fine-tuned using a jeweler's file or sandpaper wrapped over the backside of a hacksaw blade until the blade freely slides in.

Insert the ear into the slot on the drawbar and transfer the first rivet hole to the ear using a $\frac{3}{32}$ " bit. Then insert a 13 ga finish nail into the hole and rivet. Repeat for the second rivet, then file rivets flush on both sides. Next insert a $\frac{3}{32}$ " dowel pin to connect the link to the ear and cut off the excess using a rotary tool. Some fine-tuning may be necessary so that the link rests against the drawbar as shown in photo 32. Round over the bottom corners as shown. Apply a little soft wax to the assembly, insert it into the handle, carefully insert dowel pins and use a rotary tool to cut



28

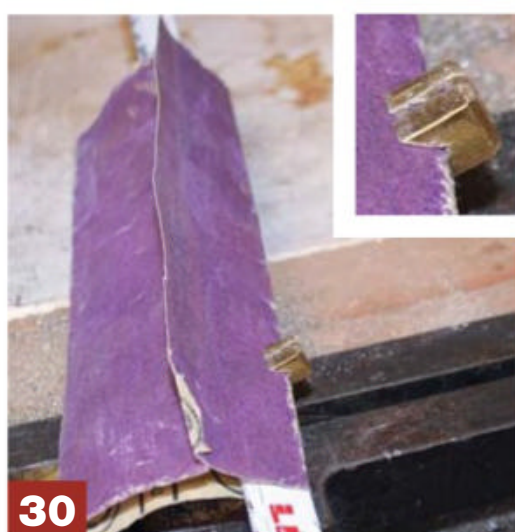


29

28 Mark out the linkage parts..

29 A before and after shot of the finished linkage components.

30 Smooth out the blade notch with sandpaper wrapped around a hacksaw blade.



30

off the excess. The assembled handle should move freely and when closed should not open when you pull on the drawbar.

Mount a #8-32 brass thumb screw in a drill and use a file and

sandpaper to slightly turn down the diameter. Now unplug the drill and use it as a vice while sawing the angled and vertical slot for the blade. File and sand the slots until the blade slides in freely.



31



32

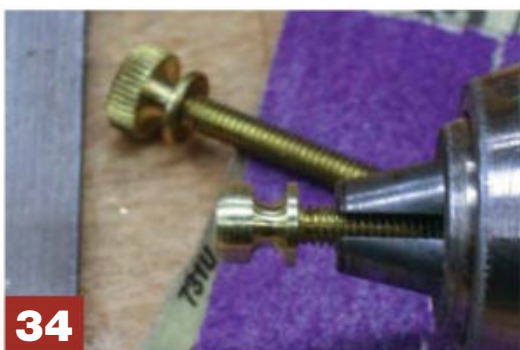
31 Rivet the ear to the end of the drawbar, peening over the ends.

32 Here, you can see the finished linkage and how the parts fold together once it's assembled.

33 The linkage and drawbar is inserted into the handle and riveted in place.



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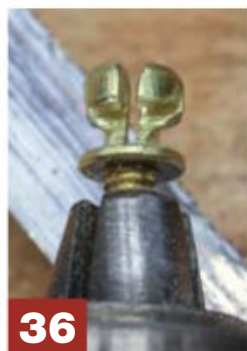


37

Insert the top blade holder into the top bracket and add the thrust bearing and knurled nut. Thrust bearing can be traded for a stack of washers if you don't want it to rotate freely. Next, apply soft wax to the handle tenon and insert it into the bottom bracket. Tap in a $\frac{3}{32}$ " dowel pin to keep the handle from falling out, and cut off the excess with a rotary cutter.



35



36



38

34-36 File down the knurling on the thumbscrew and cut a pair of slots in it — one for the blade body and another for the tabs to hook into.

37 Assemble the thrust bearing.

38 Add a keeper pin to the handle.

39 Open the handle to extend the drawbar and insert a blade. Then, close the handle to tension the blade.



39

Time to Try it Out!

Here are some tips on how to use your new coping saw.

1. Pivot the handle forward to unlock the blade tension mechanism while changing the blade or adjusting the tension.
2. Place your thumb on the bow while cutting to control the scroll angle.
3. Use a sharp blade and avoid heavy cutting pressure to prevent unintended blade twisting.
4. Remember to relieve tension when not in use so the bow maintains its shape.

At the end of this project, you not only have a saw that performs beautifully, but you also have a handcrafted saw that you can pass down for generations to come.

PW - Ryan Carpenter

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CRAFTING MAGIC: Making a Drawer Box



PROJECT #2317

Skill Level:
Intermediate
Time: 2 Days
Cost: \$40

One of magic's oldest box tricks.
By Lupe Nielsen



Magic boxes... Secret compartments... Items that do more than meets the eye... There is such a mystique surrounding these pieces. The world of magic and magicians is full of these. In fact, most of the magic box “secrets” we see today were invented between the mid-19th century to the early 20th century. By 1920, almost all of the secrets and methods of hiding objects and people in the compartments were explored by the magic builders of the day.

One of the classic magic boxes is the Drawer Box, which is a wooden box with a sliding drawer fitted with a secret compartment. It is used to vanish and produce small objects or animals.

One of the first recorded explanations of the Drawer Box in the magic literature can be found on page 343 of Professor Hoffmann’s “Modern Magic,” written in 1876. Such book contains three different construction methods for this box. Another version can be found in Chapter XV of Edwin Sach’s “Sleight of Hand” written in 1877. Since then, the trick can be found in other sources in magic literature and advertised in magic manufacturer catalogs. Currently, this effect is a popular addition to magic sets and can be purchased in magic stores worldwide.

I am going to describe a simple version of this effect, which is a nested set of three boxes. Two of the boxes make an “interior drawer with a secret compartment” that gets housed within an exterior wooden box. What follows is my procedure for the construction of the magic trick. Once you understand what the box does, you can make this item as elaborate as you like (with different and elaborate joinery), and even change the dimensions or proportions to fit your style.

The final dimensions of this box are 8" long x 5" wide x 4" tall. I chose these measurements ar-

bitrarily. The box proportions are attractive and, in part, follow the golden ratio.

INTERIOR ASSEMBLY

The easiest way to construct this box is from the inside out. We will make the two interior boxes first. For these, the following amount of material should suffice:

- 1/8" thick Baltic Birch: 8" x 6"
- 1/4" thick Baltic Birch: 16" x 12"

1 The precise sizes of this project require exact setup. I prefer to use setup blocks for dialing in these measurements.

2 Rip the interior box parts to width.

3 Set up a miter gauge to cut the parts to length.

4-5 Cut the interior box sides and ends.



I prefer plywood for this assembly because of the stability of the material and the piston fit of the boxes. This material will remain stable in spite of humidity and temperature. Also, all the components will be painted black, which hides the joinery and the edges of the material. Black is also pivotal in hiding the secret compartment using a magic principle called “Black Art” in which a black surface or object remains hidden when it is placed in front of the black background.

Inner Interior Box

The interior box fully enclosed with 2 sides, 1 bottom, and 2 ends.

The joinery for this piece is simple: glued and pinned butt joints. I pin the wood with 23-gauge $\frac{1}{2}$ " brad pins. Glue and pin the ends to the bottom sections, then glue and pin the sides in place. The result: a little open top box measuring 7" long x $3\frac{11}{16}$ " wide x $2\frac{3}{4}$ " high.

After the box is assembled, drill a $\frac{3}{4}$ " hole in the bottom. The center of the hole is located at a distance of $\frac{3}{4}$ " from one of the ends and centered from the sides (at $1\frac{27}{32}$ ").

To add neatness to the project, fill the pin holes with wood filler, sand the exterior—starting with 150 grit, up to 220 grit—and lightly sand the interior. Put the box aside.

Outer Interior Box

This box will be made out of a sturdy $\frac{1}{4}$ " (3mm) Baltic birch plywood. It consists of 2 sides, 1 bottom, and 1 end. Once again, the assembly will be simple, using the same butt joints fastened with glue and brad pins.

Attach the end to the bottom of the box, followed by the sides. The resulting box will be open on the top and an opening on the back.

Drill a $\frac{3}{4}$ " hole in the bottom of the box $\frac{3}{4}$ " from the opened end and centered from side to side at $2\frac{1}{8}$ " center. We want this section to become a slot. After drilling the hole, draw two tangential lines from the hole to the end of the



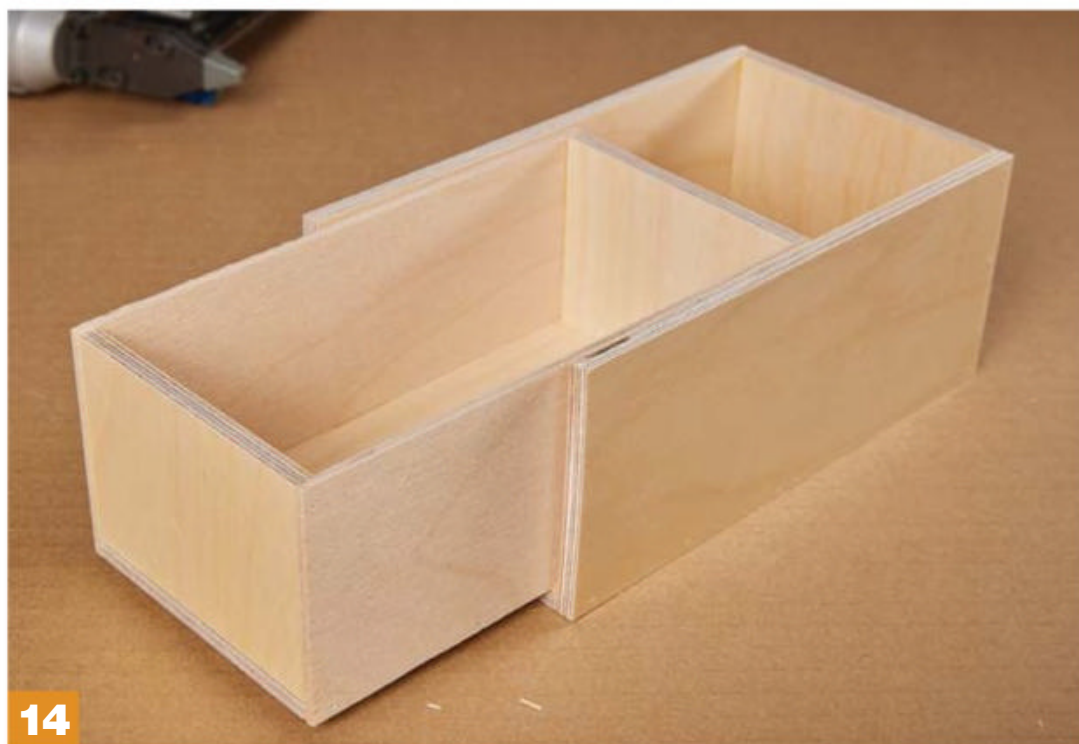
6-8 Carefully line up the interior box parts and glue and nail them together with a pin nailer.



9 Drill the finger hole on the interior box.

10 Because this will be painted, I fill all of the holes with putty, no matter how small.

11 Sand the entire inner box.



12-13 The outer box is slightly larger than the inner box, and is assembled the exact same way — glue and pin nails.

14 After assembly, make sure that both boxes slide together. You're looking for a fit that is just loose enough to allow room for flocking later.

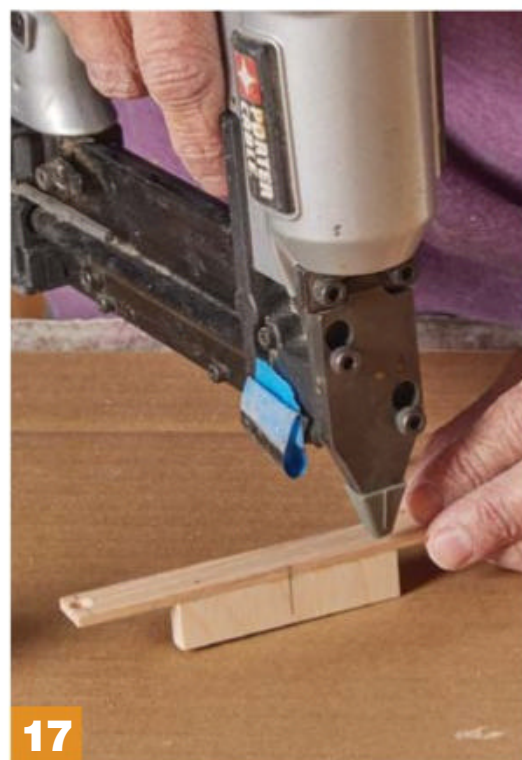
box. With a bandsaw, cut along these lines to form an elongated opening or slot.

Fill the pin hole with wood filler and sand the exterior. Lightly sand the interior as well.

Making the Trim for the Interior Box Assembly

We need trim to hide the plywood edges and the fact that 2 boxes (or drawers) are inside the box. Make $\frac{1}{8}$ " thick strips of wood. Using the table saw with a thin rip table saw jig. Refer to page 57 for the number and length of strips needed.

We will also need to cut a tiny block of $\frac{1}{4}$ " thick plywood (block dimensions can also be found on page 57). This little block will be glued and pinned to one of the short interior trim strips of wood. The block will be centered and flush with one of the long edges. Also, drill and countersink two $\frac{5}{64}$ " holes — each centered on the ends at $\frac{1}{8}$ " from the short edges on the little $4\frac{1}{4}$ " strip of wood containing this small block of plywood.



15 The outer box has a slot cut in it instead of a finger hole.

16-17 Make the trim for the top edges of the box. Drill and countersink two holes on one of the short trim pieces. A small stop gets nailed to this trim.

Hiding all the Sins:

Add Finish & Assemble Drawer

Mask the upper edges of the outer interior box with masking tape before painting, as that is the area that will be receiving glue for the trim. The drawers and trim edges get painted with two coats of an automotive primer, followed by a light sanding. The primer is followed with two or three coats of flat black lacquer finish. Remember that only one side of the trim gets finished, as the other side will be glued to the outer interior box.



18

18 I use automotive lacquer in both a primer and black top coat for most of my painted props. It lays down nicely and dries quickly.

19-20 The interior of both boxes is flocked. Paint on the flocking glue, then use a flocking cannon to apply the flocking.

Flocking a few surfaces comes next. The following are flocked:

- Entire inside of the inner interior box; also the outside end of this box (the end opposite to where the hole is drilled).
- Inside of outer interior box

For instructions on flocking, check out *Flocking: Take That Special Drawer or Box to the Next Level* in the August 2020 issue of *Popular Woodworking*.

Let the flock dry for 24 hours. In the meantime, move on to the exterior box.



19

THE EXTERIOR BOX

I like to make the exterior out of any domestic wood. My wood of choice is “wide” material of at least 8 1/2" provided by my local lumberyard. For the sake of this article, I found a beautiful piece of quartersawn red oak that met the “wide” criteria. I like it this way because I am going to use miter joints to put this box together. The box is 8" long, and I like the grain to wrap around the exterior. A 30" x 8 1/2" piece of 4/4 material will suffice for the entire project.

NOTE: You can save even more if you get thicker material that can be resawn on the band saw. Narrower pieces can also be used, but they have to be glued accordingly to make a panel that measures at least 8 1/2" wide. Once you have the material, cut a piece measuring 20" x 8 1/2" wide for the project. This will be the wood used for the box. Mill the wood to a thickness of exactly 3/8". I like that thickness for small boxes: It is not too heavy or flimsy, yet it is a delicate and pleasing thickness. Once we achieve the thickness, we cut the piece to the final width of 8".

Four Box Panels

To make the box, I need 2 exterior sides (with a measurement of 8" long x 4" wide), along with 2 exterior top and bottom pieces (measuring 8" long x 5" wide). I want the grain to wrap around the box, so they have to be laid out in an alternating fashion. I mark my layout with a pencil and number the pieces: 1-left side; 2-top side; 3-right side; 4-bottom side. I don't measure, but I know roughly what section of the wood I will use for each side. As you mark them, keep in mind that you are looking at the grain that will be the exterior of the box.

Cut the piece in half, knowing that one piece will be used for sides #1 and #2 and the other piece will be for sides #3 and #4.

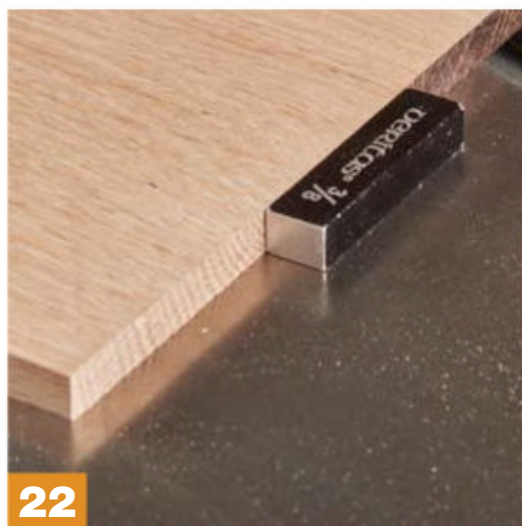
Set the blade of your table saw



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21-22 Plane the stock for the exterior box to thickness. With my diminishing eyesight, I check the thickness against a setup block.

23 I layout the part locations for a grain match around the box.

24 Miter the edges of the parts at the table saw. Make sure to pay attention to the part locations and measurements between the top/bottom and sides.

to 45°. Rip the first edges of the pieces of wood to this angle. You will now have a 45° cut along the #1 and #3 sections, which are the narrower piece that have a final measurement of 4". Set your table saw fence to 3 3/8" (calculated by subtracting the thickness of the material (3/8") from the desired measurement of 4"). Flip the boards sideways 180° and make the miter cuts. You now have 2 identically sized pieces (#1 and #3, the left- and right-side pieces).

Do the same with the remaining components, only that when cutting them to size, you set your table saw fence to 4 5/8" so that the resulting size will be 5".

The next step is to cut a groove to fit a floating bottom in the box. For this step, I like to change the blade of my table saw to a *Forrest #1 Grind Box Blade*. With it, I cut a 3/16" deep and 3/16" wide groove 3/16" from away from the bottom. The box blade has flat carbide cutters that leave a very clean finish on the bottom of the groove.

If you follow the instructions above, you will have 4 box panels with a continuous grain along the sides.

Components for the Ends

Rip 3 9/16" of the remaining 10" x 8 1/2" material and plane it down to 3/8". Cut what will become the door of the box out of this piece. The remaining piece, measuring roughly over 6 1/2" has to be dimen-



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24



25

25 Laying out the parts, you can double-check the grain orientation.

26 Drill a finger hole in the bottom of the exterior box.

sioned down to 3/16" thick to make the bottom of the box. Because the piece is too short to run through the planer, I use a small drum sander for this final operation.

Once the "floating bottom"



26

section is cut to size, insert it into the groove of what the bottom panel of the box would be—panel #4. You are going to drill a $\frac{3}{4}$ " hole with a Forstner bit in the center, located $\frac{3}{4}$ " above the bottom of the box and centered on the panel. This hole will eventually be aligned with the holes on the black drawer assembly that we made before.

Interior Finish of the Exterior Box

After the above components are cut, we are going to finish the interior of the exterior box before gluing it together. I like to do this because it is very difficult to finish the interior neatly after the box is assembled. I use lacquer for the finish but try to avoid overspray and inconsistencies in the interior.

Admittedly, finishing a box like this is optional, as no one is going to examine the box after it is finished. From a craftsmanship standpoint, it is just nice to know that someone took the time and attention to properly finish the prop on the inside as well as the outside.

To finish it, I sand all the surfaces using a rotary sander with 150 grit followed by 220 grit sandpaper. I then mask all the miters with blue masking tape—as these will be glued together later. The color of the interior will be black. I spray two coats on the interior surfaces with an automotive primer. This is followed by a light sanding with 600 grit sandpaper, followed by two to three coats of flat black lacquer. The paint I use is 10% sheen black Mohawk brand.

Assemble the Exterior

Once the interior is completed, it is time to unmask the miters and glue the entire box together. To do so, I spread the components in order on the bench, making sure that the grain flows continuously, and hold them from the back with a few strips of masking tape. I apply the glue to the miters, put



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28



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27-28 After painting the interior, you're ready to assemble. Use tape as a hinge as you're gluing up the box. Apply glue to the miters and roll the box up. Don't forget to add the back panel in the groove.

29 Clamping a mitered box can be tricky. Band clamps work well, and if there's any small gaps along the miter, you can apply extra clamps in those areas.

the bottom in place, and bring all the components together.

The clamps of choice for this operation are 3 Pony-Jorgensen band clamps. Two go onto the ends, while one applies pressure in the middle. Make sure the pressure is even, and the miters are as straight as possible. If the box was cut correctly and the wood was perfectly straight, there should be almost no lifting or unevenness in the miters. If there is, use another clamp to bring all the sides together. Let dry for a day before removing the clamps.

MAGIC BOX ASSEMBLY

Add the Door to the Outer Inner Box

Insert the drawer assembly in the exterior box and make sure that everything fits properly. You will notice that there is enough space in the front for the front face of the box to be installed. Take the door (or drawer front) and place it in this space. If it is tight, trim it slightly with a block plane until it fits. I like to leave about $\frac{1}{32}$ " gap around this drawer front. You might also notice that the $\frac{3}{8}$ "

measurement might be too thick. You can either plane it or sand it slightly with a drum sander until it is flush with the front of the box.

Once the drawer front fits, locate the center of it and stick it to the drawer assembly with a few pieces of double-sided tape. We are going to attach a small drawer knob to the drawer assembly and drawer front. I purchased a small knob on Amazon and calculated the diameter of the hole needed to fit the screw that came with the knob. The screw was too long for the narrow wood, so with a hack-saw, I cut it to the right length: approximately 1" long.

Take the above assembly to the drill press and drill a $\frac{5}{32}$ " hole in the center, through both the drawer front and the outer interior box. After the hole is drilled, because we need the screw to be flush with the interior surface of the drawer (as not to interfere with the inner compartment), we have to expand the hole from the inside with a counter sink attached to a hand-held drill.

Assemble Interior Box

Unmask the edges of the outer interior box. Glue and pin the short interior box trim (part G) without the tiny block on the front of the box, along with the two long interior box trims (part H) on the long sides. These are meant to hide the edges of the double drawer.

Insert the small drawer into the large drawer, which should fit snugly into it. You are now going to lock the small drawer inside the large drawer by attaching the short interior trim (part G) with the tiny block on the other end of the large box. As you see, the block of wood prevents the inner drawer from coming out of the assembly. Put this trim in position and drill two $\frac{1}{16}$ " pilot holes into the edges of the outer box, that correspond to the $\frac{5}{64}$ " holes that you drilled earlier. Attach the trim with two #2, $\frac{3}{8}$ " flat head screws



30-31 Position the front of the box with double sided tape, aiming for an even reveal.

32 Drill a hole through the box for the knob.

33-34 Peel the tape off of the top edge of the outer box to install the trim. The front and side trim is glued and nailed.





35



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35-36 The back trim is installed after inserting the interior box. This trim is held on with screws in the countersunk holes. This is in case you need to disassemble the box at a later date.

37-38 Sand and roundover the edges of the exterior box.

39 Apply your finish of choice. Mine is a clear spray lacquer.



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to keep it in place.

After everything is assembled, there might be a visible edge of the trim on the sides, along with the couple of pin holes left from attaching the trim and the screw heads. We want this entire assembly to be black. At this point, I mask the interior of the assembly with a piece of cardboard, along with the rear end of the assembly. I then add another coat of flat black to the exterior of this assembly.

The result: You now have a black drawer within another black drawer that can open and close in a telescoping manner.

The Final Touches

What remains is quite simple, as all that is left is to finish the box and the drawer front.

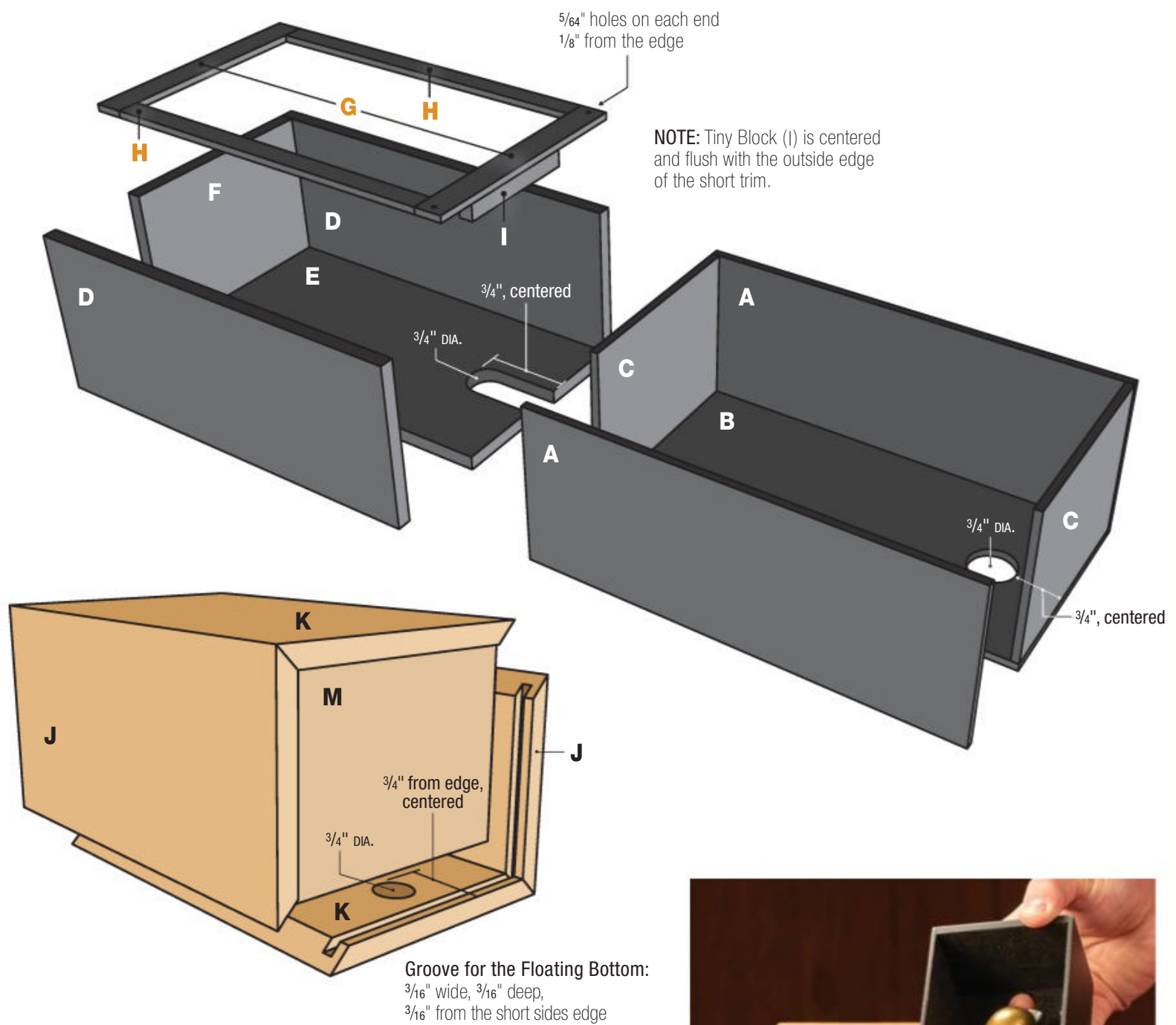
Make sure you sand off any glue residue from the glue up and round the sharp corners of the box with a $\frac{1}{8}$ " radius router bit. Sand the exterior of the box with 150 grit followed by 220 sandpaper, and sand and round the sharp corners of the drawer front with the sandpaper as well.

Spray sanding sealer on both the exterior of the box and both sides of the front. Sand lightly. Spray 2-3 light coats of clear 10% sheen lacquer on the box.

Wait for it to dry, install the knob, add felt pads on the bottom of the box, and there you have it: A Magic Drawer Box!

To operate the trick, hold the box in your hand and open the drawer. When you place an item in the box, you can make it “disappear” by inserting your finger in the hole after you’ve closed the drawer. When you open the box, only the outer box slides out, giving the illusion of an empty box. Make your item reappear by closing the box and removing your finger before you open the box. **PW**—*Lupe Nielsen*

Magic Box



Cutlist

No.	Items	Dimensions (inches)		
		T	W	L
Interior Box				
2	A Inner box sides	1/8	7	2 3/4
1	B Inner box bottom	1/4	7	3 7/16
2	C Inner box ends	1/4	3 7/16	2 1/2
2	D Outer box sides	1/4	7 1/4	3 1/16
1	E Outer box bottom	1/4	7 1/4	3 3/4
1	F Outer box end	1/4	3 3/4	2 13/16
2	G Short box trims	1/8	1/2	4 1/4
2	H Long box trims	1/8	3/8	6 1/4
1	I Tiny block	1/4	1/2	2 1/4
Exterior Box				
2	J Left/right sides	3/8	4	8
2	K Top/bottom sides	3/8	5	8
1	L Door (drawer front)	3/8	4 1/4	3 1/4
1	M Floating bottom	3/16	4 5/8	3 9/16

Rough Cut List

Interior Box

- 1/8" thick Baltic birch: 8" x 6"
- 1/4" thick Baltic birch: 16" x 12"

Exterior Box

- 4/4 domestic wood: 30" x 8 1/2"
(I used quartersawn red oak.)



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Restoring an Antique Rocking Chair

By Willie Sandry

Bring new life to a tired antique. Here are my steps to restoring an old rocking chair.



PHOTOS BY THE AUTHOR

Beauty is in the eye of the beholder, I suppose. Some people see a forlorn rocker and put it out on the curb with a “Free” sign on it. That’s how we came upon this antique *Kingcraft* rocking chair, although I could instantly see past a few surface blemishes. Underneath the tattered original leather upholstery c. 1910, was a surprisingly sturdy chair frame. Sure, the

corbels popped loose as they often do, but a quick inspection revealed good bones and a nice original finish. You’d be amazed by how many barn finds are out there if you just keep your eyes open.

Kingcraft was produced by the *Oregon Chair Company* and was a Northwest competitor of *Gustav Stickley* and *Charles Limbert*. Many of their chairs in particular were

heavily influenced by the *L&LG Stickley* designs (if not a direct copy). The Portland, OR based company imported quartersawn white oak largely from Japan to build a full line of Arts & Crafts style furniture. I’ve restored three *Kingcraft* rockers identical to this one, and each had the original spring deck in excellent condition. Here’s my restoration process:

1 Repair & Wax

It makes sense to do any glue repairs before the wax treatment, so the glue will have maximum strength. Once the clamps are removed, go ahead and wax the chair with fine-grade steel wool and immediately wipe down with a clean rag. Let the residue dry to a haze before giving it a second buffing with a fresh rag. Restoration waxes are a great way to rejuvenate an antique finish and restore the luster without removing the original finish.

3 Off your rocker? Not for long. Identify any loose joints and re-glue them. Use leather-lined, curved clamping cauls to attach rockers.

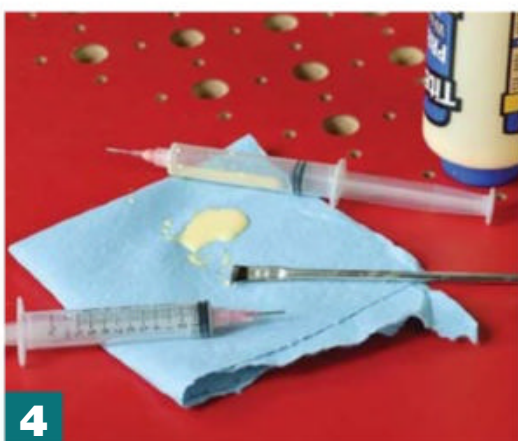
4 Glue syringes are helpful to apply glue deep into the joints.

5 Clean and wax. Wipe the chair down with a damp sponge to thoroughly clean the frame and apply colored wax with #0000 steel wool.



1 Don't be surprised to find straw, horse hair, and natural cotton batting as you strip the old upholstery. A barn find indeed!

2 Glue loose corbels in position. Clean any old hide glue or residue that might prevent a good bond as you clamp the parts in place.



6 Select a wax that matches the color of your furniture. Mid brown *Briwax* was used to conceal nicks and scratches, without changing the overall color of the chair. Light brown and mid brown are my most used restoration waxes.

2 Foam & Batting

When building up the foam layers of a rocking chair or armchair, make sure the seat doesn't get too tall. There have been many well-intentioned upholsterers (even PROs) that made the seat a couple of inches too thick, which renders the armrests virtually useless. Avoid these problems with frequent mock-ups on the chair itself. Use combinations of foam sizes and densities until it feels comfortable. Remember that the addition of a leather cover will firm-up the feel of a cushion, so make sure it doesn't feel too firm during the mock-up stage.

9 Wrap a 1" layer of very soft 1818 foam around another piece of 2" thick 1818 foam to build the back-rest cushion. Measure for the leather cushion covers. Take detailed measurements directly from the cushions, compressing the batting slightly with a cloth tape measure.



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7 Attach deck pad with hog rings. Deck padding is like dense batting and is about 1/2" thick.



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8 Add foam, then batting, attached with spray contact adhesive. High-loft polyester batting or "Dacron" works best for household upholstery.



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3 Leather Work

The real art of upholstery is measuring and patterning the cushion cover. The sewing itself isn't that difficult, but learning to accurately measure the covers takes some practice.

You'll need to keep in mind two items: leather stretch, which is inevitable when the cover is installed, and seam allowance. For leather stretch, my rule is to *subtract* a 1/4" for every 10" of panel size. So, a 40" x 19" measurement becomes 39" x 18 1/2" panel. If you're working with upholstery fabric, you can disregard stretch. Then factor in your seam allowance which is usually 1/2" along each sewn edge.



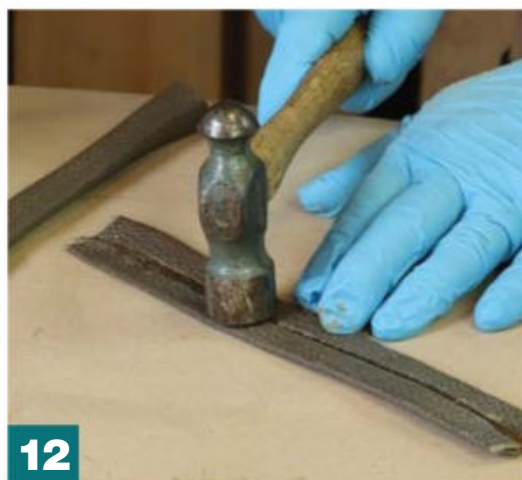
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10 Layout the shapes of the panels required with a leather marking pen and cut them out with leather shears. Next, make a template for the side panels of the seat cushion. Mark the front and back of the template and panels to avoid confusion. Flip the template over after tracing the first side panels, so you'll have a left and a right.



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11 Make optional backrest strips. Cut a piece of leather 2 1/4" wide by 9" long and thin it to half its normal thickness with a oscillating sander and coarse belt.



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12 Roll contact cement on the suede side of the strips and fold the edges inward. Hammer the strap flat and fold it on itself a second time. The strap will be top-stitched prior to installation.



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13 Cut 2 1/4" square notches from the backrest panels. These will be sewn closed for a "faux box cushion" affect.

4 Sew, Staple, & Stuff the Cushions

The best upholstery trick I ever learned was to use a stapler to hold layers of leather together before you sew. The tool for the job is a

plier stapler, which is similar to an office stapler, but has a longer nose. It helps to have 1/4" long staples for the thin seams, and 3/8" staples for bulky seams with piping and multiple layers of leather. This single technique will prevent misaligned panels as you sew your project together. Remove the staples before turning the cushion right-side-out.

Check out and enjoy Willie's *YouTube Channel, The Thoughtful Woodworker*, for full step-by-step instructions on how to upholster a Morris Chair or large rocking chair. Of particular interest will be the video series on a red leather *Kingcraft* rocker and a series featuring a *Stickley #319* rocker. **PW** - Willie Sandry



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14 Sew the seat panel to the sides with a blind stitch and a decorative top-stitch for additional seam strength.

15 Center the cover and pull it to the reference marks 1" from the seat frame. Staple in place. Add the dust cover.

16 Use a plier stapler to staple the straps and cover together. Sew the perimeter seam with a 1/4" cording foot.

17 Slide the backrest cushion into a trash bag and vacuum out the air with a shop vac. The shrink-wrapped cushion slides easily into the zippered opening. Remove the bag once the cushion is inserted.

18 Enjoy your newly restored rocking chair!



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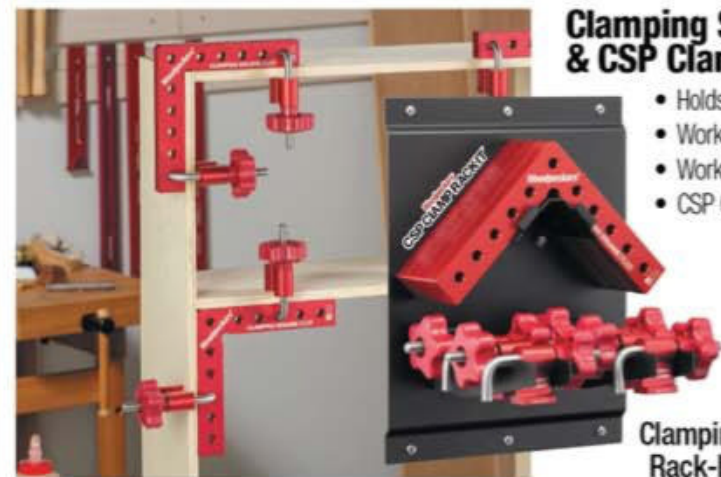
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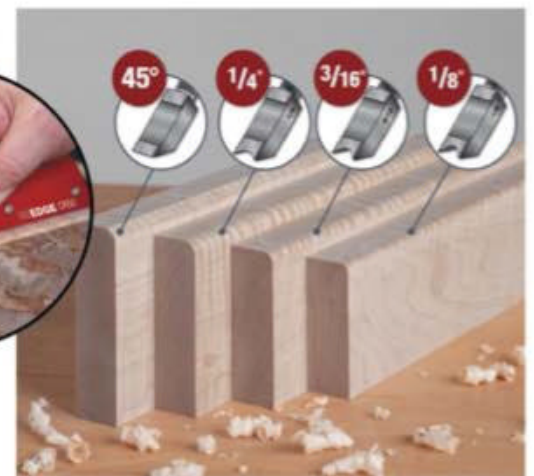
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