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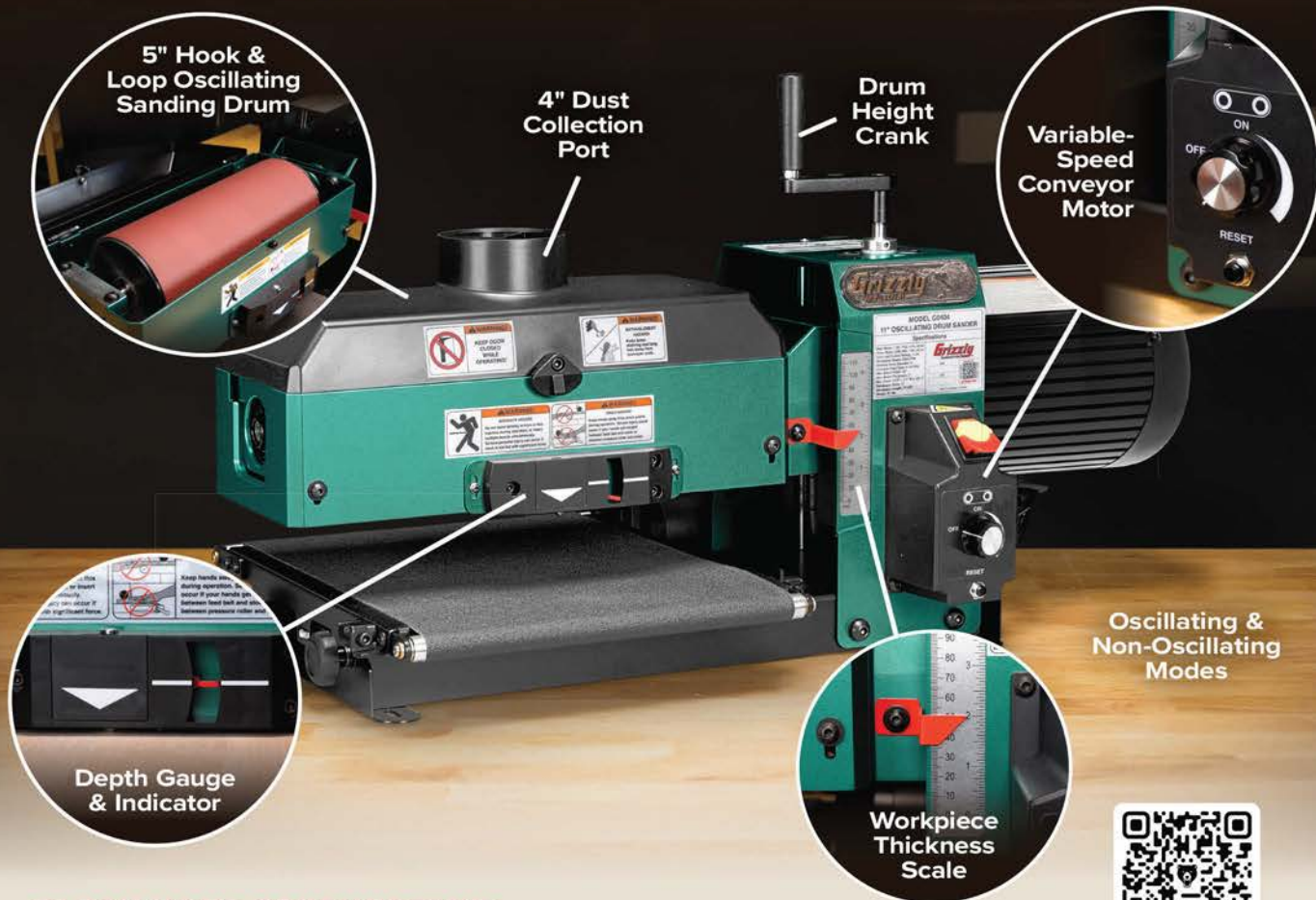


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EDITORIAL

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from the editor Sawdust

The weather has been nice enough that I've been able to keep the shop doors and windows open more and more. Though an unexpected rain storm did get some of my hand planes wet that were sitting on the sill. Which reminds me that it's time for my annual reminder to stop in for a visit if you're traveling through the Midwest. Des Moines is right along I-80 and our offices are easy to find. Woodsmith is unique in that our projects and articles are designed, written, built, and photographed in our offices. You can also see the set of the Woodsmith Shop TV show. Stop in to say "hi," check out past projects, talk with the staff, and see what's on deck. All I ask is that you send me an email to know when to expect you: phuber@aimmedia.com.

MARK YOUR CALENDARS. We've been planning the next Woodworking In America event for the fall. October 9 & 10, we'll be at the Iowa State Fairgrounds again with demonstrations, tool vendors, and classes to give your woodworking a boost. Get your tickets at WoodworkingInAmerica.com.

On page 62 is an article on cutting dovetails on the table saw. There wasn't room to cover the jig we used. So I'm offering the plans for the jig for free over at WoodsmithPlans.com. The plans will remain free for several months before going back to the regular price. That said, if you become a Woodsmith Unlimited member, you get free access to that plan, as well as all our others, and our videos, TV show episodes, and more. It's a great deal to invest in your woodworking journey.



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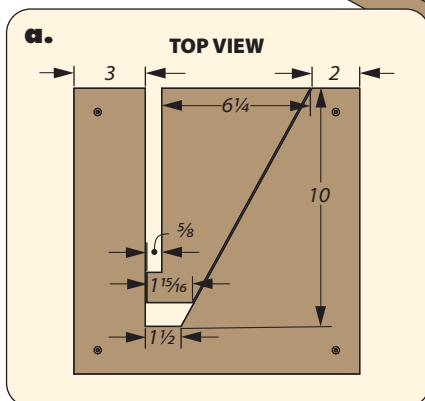
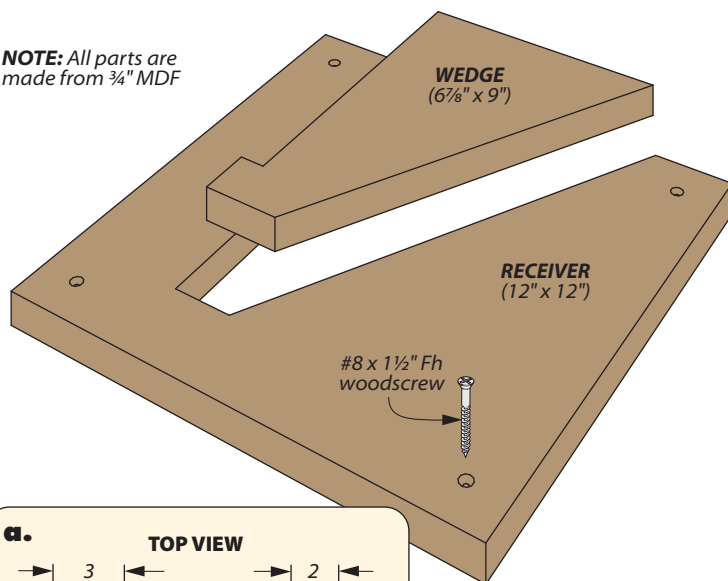


▲ Fit the workpiece against the heel on the wedge, then slide both forward into the receiver until the stop securely grips the piece.



▲ With thin parts, the wedge slides farther into the receiver. With this design, the bench stop can secure any workpiece larger than $\frac{5}{8}$ ".

NOTE: All parts are made from $\frac{3}{4}$ " MDF



NOTE: Screws secure receiver to base or workbench

Wedge Bench Stop

Folk worked with wood for generations without the use of screw-driven vises. I adapted one traditional work-holding device for my own shop.

This one takes advantage of one of the "simple machines" we learned about in elementary school: the inclined plane. This takes the form of a wedge. A heel on the wedge catches the end of a workpiece, as shown in the main photo. The wedge and workpiece combo slips into a matching receiver attached to the benchtop, locking both in place.

This design allows the bench stop to accept a wide range of workpiece sizes (photos above). I made mine from MDF, but plywood would work just as well. It's a great way to use up scraps. Since it's just screwed in place, I can take it off the bench if I need more flat space. Best of all, I have another option to keep a workpiece steady when my vise is in use.

*Harold Ebbeltrap
Potter, Wisconsin*

QUICK TIPS



(Sand)Paper Organizer. *Claire Doyle of Ankeny, IA* picked up a document organizer at a thrift store. Instead of papers, letters, and receipts, she uses it in the shop to organize sandpaper of all sorts: plain and adhesive-backed sheets, discs, and even belts fit inside. As a bonus, the top stores sanding drums.



Plans Clip. *Jerry Smith of Bagley, MI* cut a wood clothespin to hold plans and other documents on the pegboard wall in his shop. He drilled a hole in one side to accept a short length of a 1/4"-dia. joinery dowel. The dowel is a snug fit and allows him to place the pin anywhere on the pegboard.

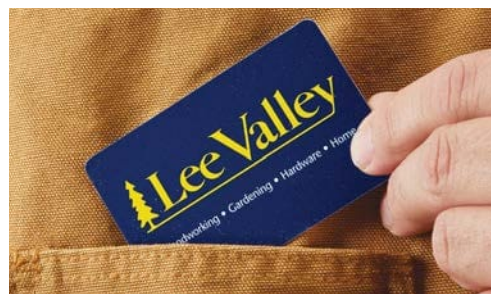
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V-Block Upgrades

Round and octagonal parts present challenges for workholding. One solution is a simple V-block. I don't do simple.

I made a thick V-block from two layers of plywood. A kerf down the middle protects fragile corners. I added a hardboard stop on one end. This keeps the

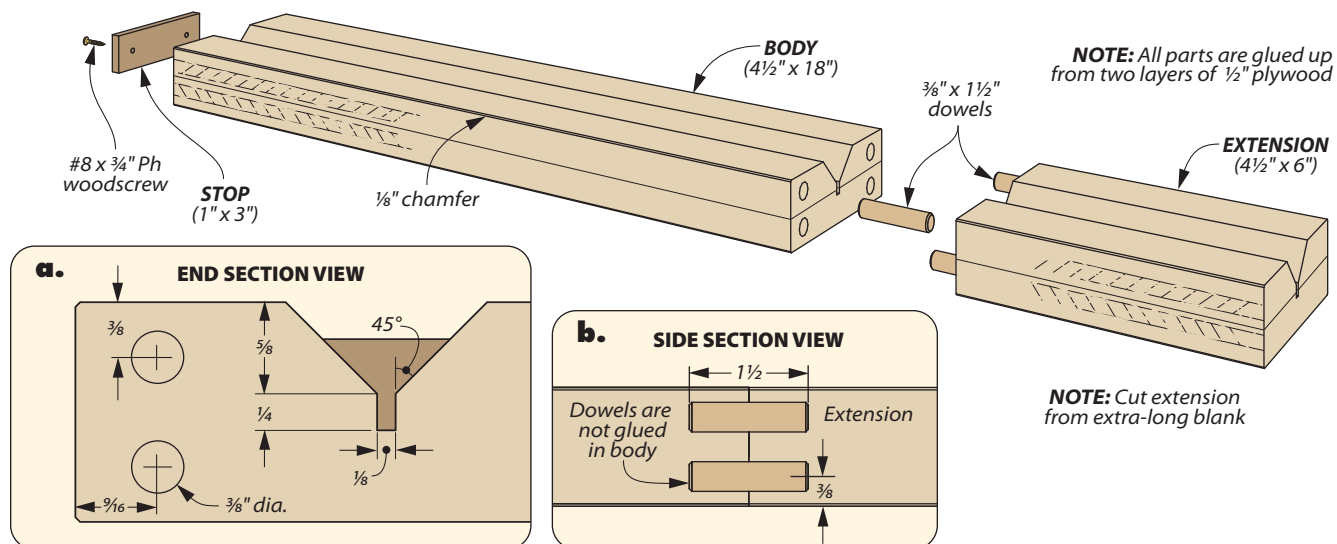
workpiece from sliding if I'm using a hand plane.

Then to support long parts, I cut off one end. I didn't want to lose it, so I can connect them back together with dowels. One side is unglued.

*Phil Huber
Urbandale, Iowa*



▲ In addition to a V-block's utility at the workbench, it also comes in handy to cradle a round workpiece (like the dowel above) at the drill press.



QUICK TIP



Better Gripper. Ben Strano of Southbury, CT uses a large grout float as a push pad on the jointer, router table, and table saw. Floats are larger than typical woodworking push pads. He prefers the floats with red rubber pads as they have a good balance of grip and softness.

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Sand Smoother Circles

It's easy to get unintended lumps and bumps when you sand circles. I came up with a jig that makes it just as easy to sand circles smooth.

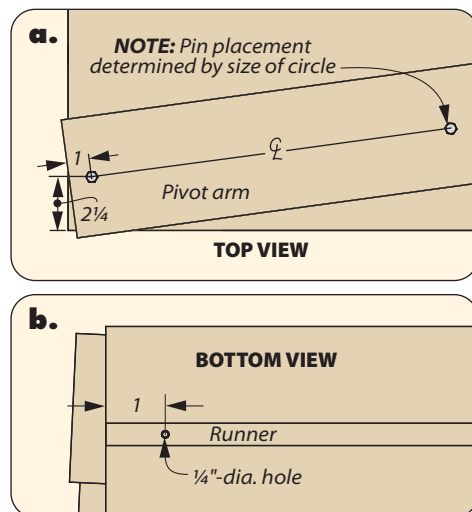
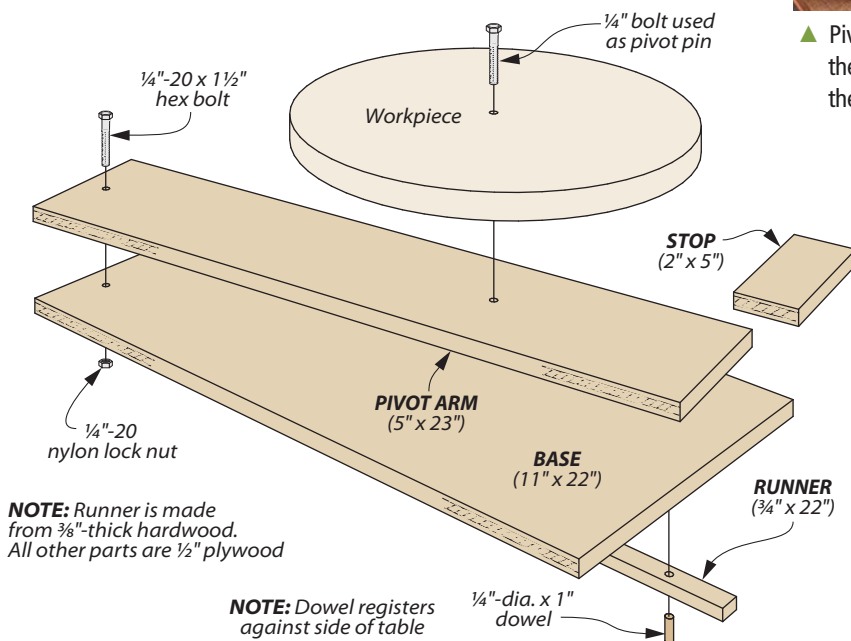
The jig is designed to work with an edge sander. The workpiece is held to the jig's arm with a cut-off bolt. The arm pivots on the base that registers

in the miter slot of the sander table. The key part is a stop. It's clamped to the table and constrains the pivot arm. Set the stop so that the distance from the pivot hole matches your desired radius. Then rotate the workpiece to smooth the edge.

*Bryan Nelson
Springfield, Missouri*



▲ Pivot the workpiece and arm into the sanding belt until the arm contacts the stop. Then rotate the piece against the sander's direction to round it evenly.





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Comments & Questions



TEMPERED HARDBOARD ?

I've purchased a number of your project plans. One commonly used material in the plans is $\frac{1}{4}$ " hardboard. The big box outlets sell tempered hardboard however, what they describe as $\frac{1}{4}$ " inch is really $\frac{3}{16}$ ". In some cases this small amount triggers dimensional changes throughout the plan. What sources do you use and can you recommend suppliers in Minnesota?

Jay Krafthefer

Hi Jay,

Many of our project plans were created back when $\frac{1}{4}$ " hardboard really was $\frac{1}{4}$ " and we have not changed with the times when specifying hardboard, which as you point out, is now mostly $\frac{3}{16}$ ". One of the reasons we specified tempered hardboard was that the color contrast made for an attractive project.

These days if we need a $\frac{1}{4}$ " panel we will sometimes use $\frac{1}{4}$ " MDF, which is a true $\frac{1}{4}$ " for projects. It has

a brighter color; a downside is that the skin is not as tough, but it still works well in many applications. Another option is to substitute MDF core plywood which is usually a full $\frac{1}{4}$ ". I have had good luck using $\frac{1}{4}$ " engineered underlayment plywood which is very strong. I get that from Menards.

We usually purchase our sheet goods for Woodsmith projects from Liberty Hardwood here in Des Moines. You might want to check with a plywood/hardwood dealer for $\frac{1}{4}$ " options that they might stock.

Dealing with materials that are not a standardized $\frac{1}{4}$ ", $\frac{1}{2}$ ", and $\frac{3}{4}$ " thickness is always a challenge when creating plans. Every sheet of plywood seems to be different, especially with different core types. But we need to make sure that with all plans moving forward, we acknowledge that tempered hardboard is $\frac{3}{16}$ " thick.

All the best,

Chris Fitch

Creative Director/Woodsmith

THE PERFECT MITER

Phil,

I enjoy your magazine. I am looking for guidance and input for perfect miter joints. I'm currently using a miter saw. I have been clamping down boards to the saw base to keep them from moving when I'm cutting a miter. It's close to perfect with this method with some sanding.

I have been looking at making a 45° shooting board to finish miter cuts. I tried this before without success.

I read Reader's Tips Chamfer Sander Vol. 47/No. 282 and wondered if using an oscillating edge/belt and spindle sander could work quickly. I would adjust folding table to 45° , then I'd install a straightedge on table.

I also have problems with the shelf life of wood fillers. Hopefully you can help me. I buy a product for my current projects but by the time I use it for another project it's dried out. I have started using FamoWood, which when put in smaller containers lasts longer. I live in Florida and keep product in my garage workshop. Should I be keeping filler in the refrigerator?

Thanks for any help with either of the above.

Denis O'Leary

Hi Denis,

Yes, we use an edge sander here at Woodsmith to fine tune miters, sometimes by hand, finessing the piece with gentle pressure on the heel or toe of the miter as needed. At other times, we use a miter gauge or a fixture to hold a piece at exactly the angle we need. So yes, similar to the chamfer sander that was shown in the issue.

Wait. Are you talking about miters used for a frame? Or miters used to assemble a small box? My



first thought was frame miters, but rereading your message has me wondering. I do think that a similar setup could work for box miters.

The shelf life of wood fillers drives me up a wall. It seems like I should just expect to buy a tub of filler, use it in the project at hand, then toss it straight to the trash. I have had some success with the stuff that comes in tubes lasting longer. But, still disappointing. I admit I haven't tried storing them in the fridge. I wonder about sealing them in a plastic bag before going in the fridge to prevent more moisture loss.

Frankly, I end up just making my own filler using sanding dust and liquid hide glue. It's always fresh and the correct consistency. I work this step into my prefinishing routines. Another option to consider is how serious the blemish is. Cosmetic gaps and dings can often be better disguised after finishing with a wax stick or tinted color putty.

Stay well,

Phil Huber
Executive Editor / Woodsmith

THE UPS & DOWNS OF SPIRAL BITS

Gentlemen,

In your article (No. 283) "Getting Clean Cuts in Plywood" you recommend spiral downcutting router bits. Would that be for using the router on top of the material? If my router is inverted in a router table would I want an upcutting bit?

Michael Brady
Longtime subscriber

Hi Michael,

Downcut and upcut router bit nomenclature makes sense when the bits are placed in a handheld router. In that position, the upcut bit lifts chips up (skyward) while a downcut bit pushes chips down (towards the floor). With so many of us using router tables where the router is inverted, it can be confusing. The way I like to think of it is that an upcut bit draws chips toward the router while a downcut bit pushes them away from the router.

The type of bit you choose depends upon the milling operation you are undertaking and not

if you are using a router table or a handheld router. An upcut bit is great for operations such as routing mortises because the geometry pulls the chips out of the mortise for efficient routing with a high feed rate and shears the wood fibers to leave smooth walls. It can, however, leave tearout at the entrance to the cut. This is not really a concern for mortises and similar cuts.

A downcut bit is used when the entrance of the cut needs to be razor sharp, such as cutting a groove for stringing in a table top. The geometry of a downcut bit presses the fibers into the cut as it shears them. This produces a very clean cut with no tear out but is much less efficient at expelling the chips. A lower feed rate is often required and can cause the bit to run hot, and heat destroys router bits, so use with care. I hope this helps.

All the best,

Chris Fitch
Creative Director/Woodsmith



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ALL
About

CLEAN JIG SAW CUTS



One tool that always remains close to my workbench is the humble jig saw. It's handy for quickly breaking down stock to a size that's manageable on more precise machines, or for removing waste on curves or angles that would be difficult otherwise. For fine woodworkers and DIYers alike, it's an easy and relatively inexpensive

way to fill the gaps between other tools. However, it's also an option that many shy away from for its undeniably rough results.

A VERTICAL RECIPROCATOR. A jig saw is a vertically oriented reciprocating saw, which excels at cutting precise shapes, like a handheld scroll saw. Of course, a scroll saw is limited by what you can maneuver on its table. When a workpiece is too large to be easily controlled on a stationary tool, or when the arm of a band saw would interfere with the cut, the jig saw is the answer.

And yet, a number of features about your typical jig saw don't lend themselves to fine woodworking. The orbital setting (see photo at left) helps remove a lot of material, but not nicely. Most wood-cutting jig saw blades also prioritize quick cuts over clean ones. Another issue jig saws face is deflection. Due to being fixed at only one end of its length, too much pressure on a blade can cause it to twist or curve during the cutting action.

Despite all this, there are ways to improve the quality of jig saw cuts. With the right blades and proper technique, it's possible to bring the performance of a jig saw up to par with our other fine woodworking tools, without sacrificing what makes it useful in the first place.

Jig Saw Anatomy



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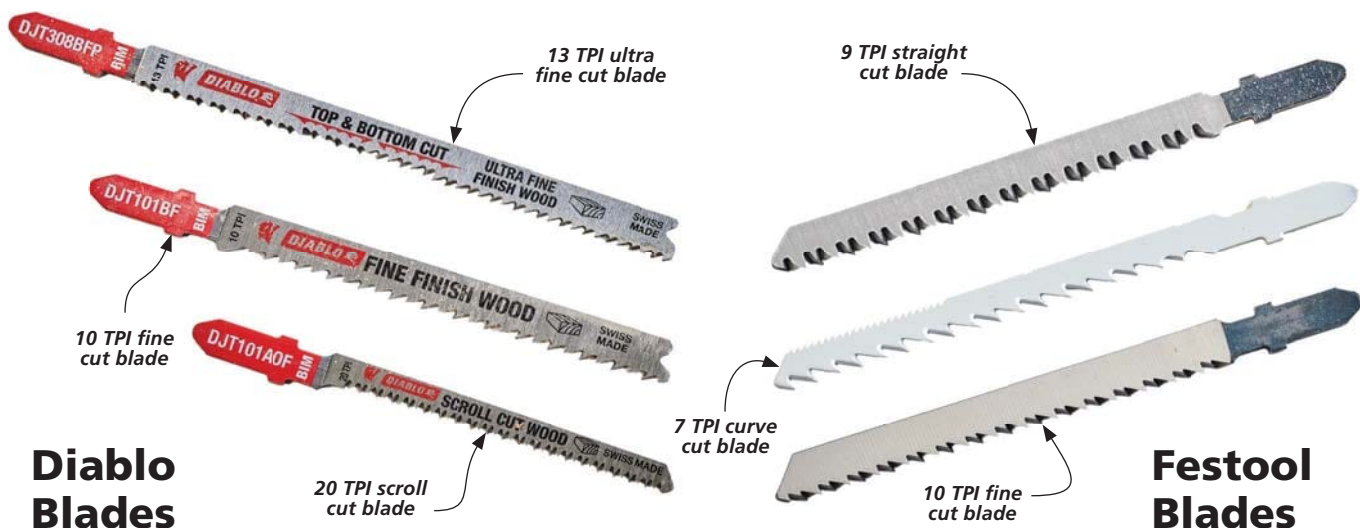
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Diablo Blades

Festool Blades

JIG SAW BLADES

Like all tools, the jig saw's usefulness is largely determined by its cutters. While there are a variety of blades for a variety of materials, I've limited the selection to a few useful for woodworking.

STRAIGHT & CURVE. The first blades are the two upper ones from *Festool*: a straight cut and a curved cut. These are inexpensive and break down stock easily, but they aren't very clean.

FINE CUT BLADES. The "fine cut" type of blades are the first step toward a cleaner cut. If you look above, you'll see they feature a slightly higher TPI than their straight and curved counterparts. Observe the tooth shape as well. Whereas the straight cut blade has long teeth with little

hook angle to remove material fast, the fine cut blade is closer in shape to the curved cut blade, with a positive hook angle that cuts slower yet cleaner.

Blade length is also a factor. The fine cut from *Diablo* is 4" long, while the *Festool* option is 3". At face value, the *Diablo* blade may seem like a better choice. However, a longer blade means it'll deflect easier during the cut — so, a shorter blade is often your best option until thicker stock requires a longer one.

SCROLL CUT BLADE. *Diablo's* scroll cut blade is an interesting choice. The first thing you may notice is the high TPI: twice that of the fine cut. Once again, I'd like to call attention to the teeth. Most jig saw blades are designed to

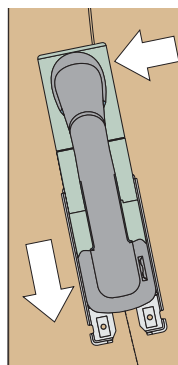
cut on the upstroke so the cutting action pulls the workpiece into the baseplate. In contrast, this scroll cut blade's teeth are triangular, with cutters along both edges so it cuts on both the up and down strokes.

As a result, this blade is excellent for cutting curves. It cuts slowly, but it offers a tighter turning radius and lower chance of chipout than other blades.

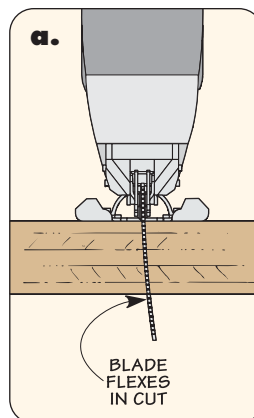
ULTRA FINE BLADE. The final blade to mention is *Diablo's* ultra fine blade. It has fewer teeth than the scroll cut (though more than the fine cut blades) and hook-shaped teeth like the curved and fine cut blades. Additionally, at the midpoint of the blade, the teeth switch direction. This means cutting occurs on both



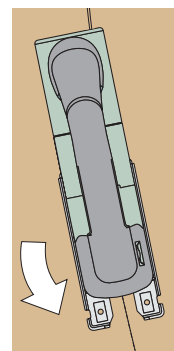
▲ When cutting tight curves, control the saw by gripping directly above the blade and just barely guiding the rear.



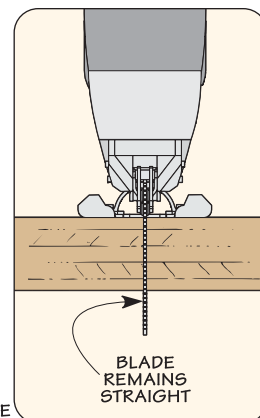
PUSHING TOO HARD ON SAW



BLADE FLEXES IN CUT



PIVOT SAW WITH LITTLE FORWARD PRESSURE



BLADE REMAINS STRAIGHT

▲ Deflection occurs when too much force is applied during a curving cut, resulting in a rough and unwanted bevel.

▲ To avoid deflection on curves, apply minimal pressure while cutting, allowing the teeth to do the work.

strokes, and that cuts are entering the face of the workpiece first, limiting chipout.

JIG SAW TECHNIQUES

Before jumping into a couple techniques I use, there's one thing to mention. Take a look at your jig saw. Does it have an orbital setting? This presses the blade into the cut on the upstroke and pulls it back on the downstroke. This action improves cutting speed — great for rough, construction work, not so great for fine woodworking.

HAND POSITIONING. One of the biggest annoyances on a jig saw is cutting a curve only to find you've somehow made a bevel. This is a result of deflection, and it's illustrated on the previous page. If you push the saw into the cut faster than the teeth can remove the material, or you attempt a tighter turn than the blade's width allows, you end up pushing the flat of the blade



▲ A zero-clearance baseplate can be created for a jig saw by cutting a piece of acrylic to match the size of the baseplate, creating a kerf for the blade, and attaching it with double-sided tape. Casted acrylic (like Plexiglass) is preferable over extruded acrylic as it's clearer, providing better visibility.



against the sidewall of the kerf. This causes the unsupported end of the blade to flex.

My fix is to adjust my hand placement. I control the saw with one hand directly over the blade, while my other simply rests on the back to help control the turns. This limits how much pressure I can apply and gives me greater control during the turn.

ZERO-CLEARANCE BASEPLATE. One final piece of advice I can offer is the zero-clearance baseplate you see above. Just like any other, it's meant to support the wood fibers directly beside the cut, preventing them from chipping or tearing. I use this when cutting something with a face veneer, as those can be particularly vulnerable to jig saws. [W](#)

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Making the Cut with Metal

▼ A high-tension hacksaw and a selection of high quality blades will get you started working with metal.

A little metalworking knowledge can be a very handy tool for a woodworker. With it you can create custom details or even furniture hardware that will separate your work from the rest and free you from using catalogs. Metalwork in a woodworking shop need not be complicated or expensive. All you need are a set of tools, a few techniques, and a little experience to apply them.

Let's look at one of the skills of working with metal — cutting it to shape.

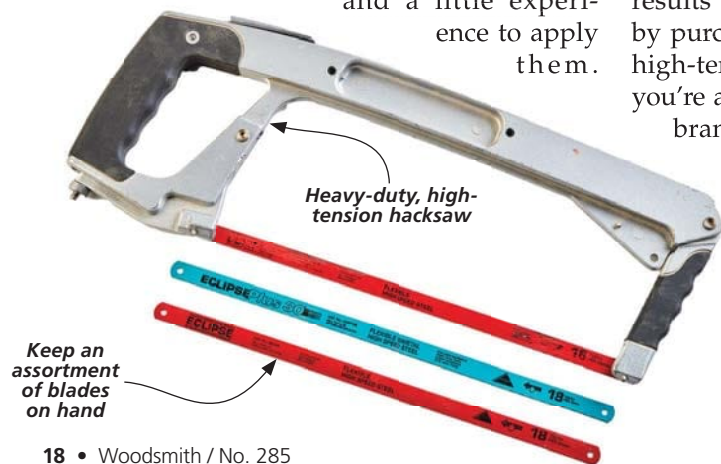
START WITH SAWS

The most efficient way to shape metal in the home shop is by sawing, using a hacksaw, a jewelers saw or a band saw.

Hacksaws are often viewed as a tool for rough work. That is not really the case. To get great results from a hacksaw start by purchasing a quality-made high-tension saw, and while you're at it get a variety of top brand blades. In practice, you need to act like you're using a fancy \$300 dovetail saw; use a careful grip, an assured stance, hold directly to the layout line, and saw with confident strokes

using the full length of the blade. If you treat it like a craftsman's tool, the hacksaw can deliver a craftsman's result.

Jewelers saws can go where hacksaws only dream of with their narrow blades. The blades come in a variety of tooth counts for different materials and will surprise you with their strength and longevity. When using a jewelers saw, it is important to support the workpiece fully. I like to use a machinist vise with the jaws slightly open, or use what jewelers use, a bench pin. Traditionally, a bench pin is a piece of wood with a V shaped cut to form a mouth and is clamped onto the edge of the workbench. With the work well supported, allow the saw to cut at its own pace, find a steady rhythm, and stick with it — the job will be done sooner than you think.



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USING YOUR BAND SAW

You probably already own an efficient saw for cutting thin nonferrous metals — your bandsaw. Cutting metal with a woodworking bandsaw requires the workpiece to be fully supported on a sacrificial board. This prevents the blade from being overly aggressive and keeps the lower edge of the cut metal from hanging on the bandsaw's insert — with support you get smooth feeding and cutting.

I usually use a piece of MDF with strategically placed screws, some double-sided tape, or my favorite method — glue. Metal can be held securely with any water-soluble glue such as white craft glue or hide glue. After the cutting is finished put it in water for 24 hours, the glue bond will loosen, and the workpiece will drop off.

SNIPS, SHEARS & SCISSORS

Thin sheet metal can be easily cut with metal-cutting snippers. Tinner's snips are the most common, you probably already own a pair, and they work great for most cuts. In addition to large tinner's snips, I like to have on hand medium-sized shears for precision straight cuts as well as small metal-cutting scissors for fine, delicate work. Jewelry supply houses such as www.RioGrandeJewelrySupply.com offer many sizes and types of scissors and shears suited for all manner of decorative work. Whether you

▼ Tinner's snips, shears, and scissors can handle sheet metal cutting large and small.

are using snips, shears, or scissors make sure they are rated for the thickness and hardness of the metal you are working with. And like any cutting tool, keep them sharp.

NIBBLE THE TIGHT SPOTS

If you find yourself cutting out complicated sheet metal shapes, here is a great tool to have — a nibbler. As the name implies, it nibbles its way through a cut. As the handles are squeezed, a blade retracts and clips a small amount of metal as the sheet is held against an anvil plate. What makes a nibbler such a handy little tool is that it can cut tricky interior shapes, gets into tight corners, and doesn't deform the material. It's an awesome tool for final fitting and cleanup work

when working with sheet metal.

THE HUMBLE COLD CHISEL

Don't overlook the humble cold chisel for cutting metal. I'm not splitting rusted nuts off bolts with these tools, so I treat them more like a woodworking tool, grinding a 30° angle at the cutting edge and further sharpening them on a stone. This sharp edge allows the chisel to make surprisingly clean and accurate cuts in sheet metal. Thin metal can

◀ The nibbler is handy tool that can "nibble" metal in small amounts at a time in tight locations.



▲ When using a jeweler's saw, support the work on the jaws of a vise and settle into a smooth, steady rhythm of saw strokes guiding the workpiece rather than the saw.



▲ A woodworker's band saw and blade can cut thin, non-ferrous metal that is secured to a sacrificial board.



be cut in one pass backed up by a piece of MDF or hardwood. For thicker metal I use a two stage process, first cutting most of the way through over the anvil plate of a machinist vise and then making a second through cut over an end-grain block of hardwood to protect the chisel's edge. Cold chisels, a simple tool and a simple process that can often be the solution for tough cuts.

FILES FOR THE FINISH

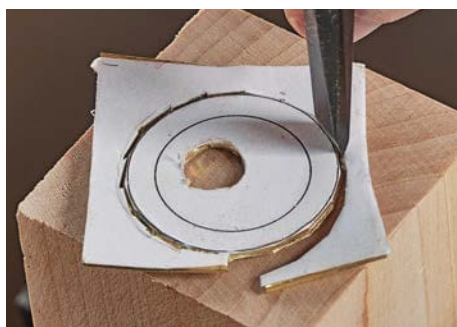
Versatility is what the cutting action of files offer — they are capable of rough shaping or fine finishing. The best place to file is on a big, heavy machinist vise.

It can grip the work tightly and has the mass to dampen vibration and cut down on file chatter. To protect your work from scarring from the serrated jaws buy a set of jaw protectors or attach some blocks of hardwood with double-sided tape. I recommend a set of files that includes: 10" straight coarse cut, 10" half round second cut, 10" knife file finish cut, a 10" round second cut, and a set of 6" files with a variety of shapes for detail work.

A few simple tools, some time spent learning, and a little practice is all that is required and you can be adding metal work to your projects. **W**



▲ Cutting thick metal with a cold chisel starts by cutting part way through on the vise anvil.



▲ Finish the cut on an endgrain block of hardwood to protect the chisel's edge.



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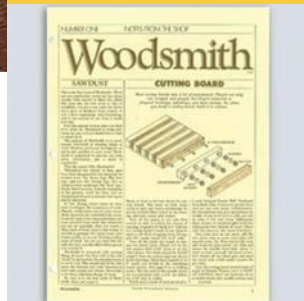
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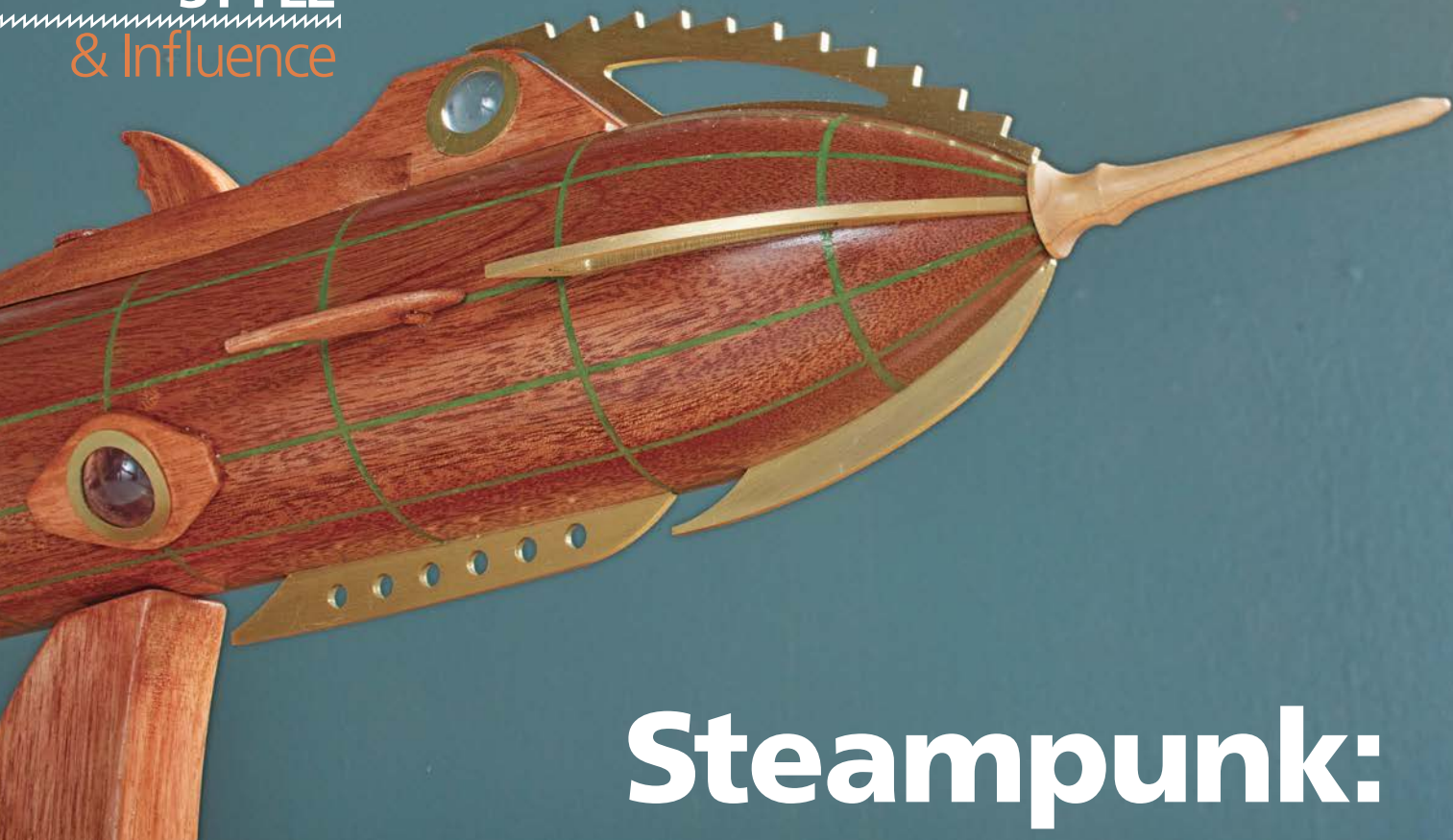


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Steampunk: Where Past & Future Collide

A world powered by steam and imagination; steampunk is a subgenre that feels both familiar and alien. It combines the elegance of the Victorian

era with the bold creativity of speculative technology, creating a society where steam powers impossible machines and brass gears tick beneath every surface.

It's a world that feels concurrently ancient and futuristic; one that never existed but, somehow creates the perception that it once could, or rather should have.

The term "steampunk" was coined in the 1980s by science fiction writer K.W. Jeter who was seeking a general term

that represented the subgenre of science fiction he and his peers were writing at the time. However, the aesthetic and storytelling ancestry that inspired these later works stretch back much further. 19th-century writers such as Mary Shelley, Jules Verne, and H.G. Wells laid the groundwork with visions of unorthodox science experiments, submarines, airships, time machines, and journeys to the moon long before these things were technically feasible. These fantastical narratives established the core tension that defines the aesthetic and genre as we know it today: advanced imagination constrained by steam-age materials.



The Walt Disney Company, 1954

◀ Captain Nemo's submarine, the Nautilus, from the 1954 Walt Disney version of *20,000 Leagues Under the Sea* is what inspired Chris Fitch's version you see above.

AESTHETIC & THEMES

Steampunk's visual identity is unmistakable. The aesthetics blend the style of the Victorian era with the grit of the Industrial Revolution, creating a look that is both nostalgic and imaginative. It's comprised of brass, riveted iron, hand-tooled leather, polished wood, steam valves, and intricate clockwork. And unlike the technology of today, the materials and mechanics are exposed and even celebrated in their composition. Many of the visualizations and aspects of steampunk design emphasize a balance between form and function. Garments combine period silhouettes, such as corsets and waistcoats, with functional accessories like goggles and tool belts, suggesting a world where invention was woven into the fabric of everyday life.

Narratives present within the steampunk genre often follow a hero's journey, which takes form as an adventure quest — think, Phileas Fogg in *Around the World in 80 Days*, or Captain Nemo in *20,000 Leagues Under the Sea*. Themes often explore the struggle between human agency and systems of control in a rapidly mechanizing world. The societies that are depicted are usually in flux

or at a crossroads. Steam-driven machines promise efficiency and power while simultaneously threatening autonomy, tradition, and moral responsibility.

Another common theme is struggle for power. Authority — regardless of its form — is frequently challenged by the benighted or “outsider” who values curiosity, freedom, and ethical restraint. Through this lens, steampunk uses imagined pasts to reflect on modern anxieties about surveillance, automation, and who ultimately controls and benefits from this progress.

INFLUENCE IN DESIGN

Beyond just a literary genre; steampunk is a visual and conceptual language that has influenced art and design across disciplines. It has offered designers a way to explore technology, nostalgia, and craftsmanship in an age dominated by digital distraction. Its influence can be seen in illustration, interior design, architecture, graphic design, fashion, industrial design, and interactive media.

The combination plane below, along with the setup gauge and square, above — although not direct descendants — are



▲ The setup gauge and 6" square are reminiscent of Victorian era decorative brackets.

suggestive of steampunk tenets. The plane's utility is on full display with its cast iron body and steel skate, contrasted by the rosewood handle. Prior to the creation of the No.45, planes were wooden and task-specific. This new, innovative modular design challenged this by introducing a single metal platform with interchangeable components.

The setup gauge and square were originally designed for a line of *Woodsmith* products. Although not of the era, both integrate decorative elements associated with steampunk into their construction to make something both visually interesting as well as highly functional.



▲ The Stanley No. 45 combination plane, both iconic and versatile, isn't shy about its material composition and functionality.

While often rare at full-scale, there are examples of steampunk principles employed in architecture. Renovated interior spaces adopt steampunk-adjacent aesthetics: exposed brick, steel beams, visible duct work, piping, and mechanical fixtures act as decorative elements. The photo below is a quintessential demonstration of these principals. Platform 11 at the Paris Métro Station looks as if it were a blueprint pulled straight from the pages of a Jules Verne fantasy.

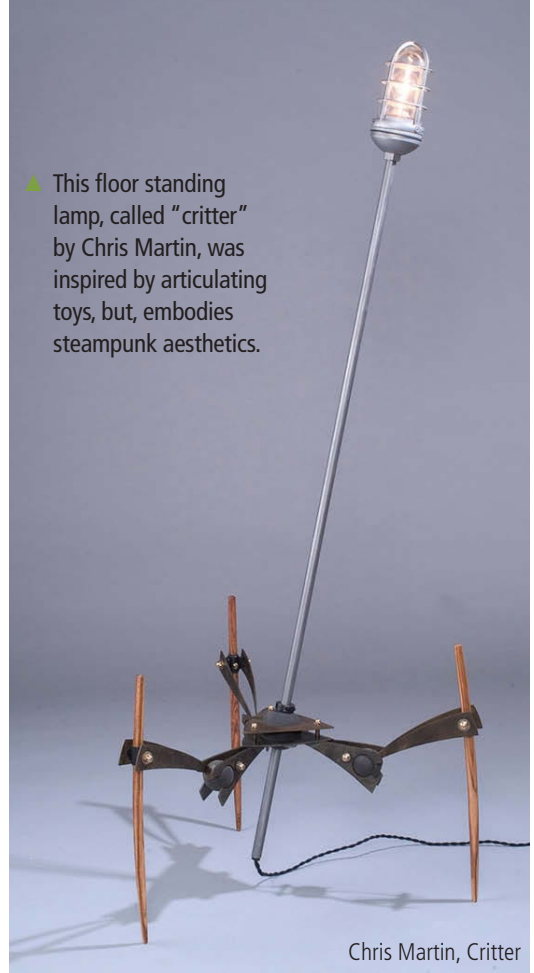
In addition to architecture and interior spaces, steampunk's influence can be translated into industrial objects that occupy these spaces as well. The image to the right is an example by furniture designer Chris Martin designed/built as part of a series called, *Articulation*. This breadth of work, though inspired by the industrial environment in which Chris grew up, combines and manipulates materials in a way that hints to the genre. Not only is this piece's functionality on full display, its construction implies a sense of motion. It reminds me of the *Tripod* (*Martian Fighting*

Machine) from *War of the Worlds*.

THE GENRE THAT ENDURES

The question remains: why does a subgenre that is so obstensibly niche and dated continue to be a relevant one? Especially considering we have entered a technological age that seems antithetical to its ethos. In an age dominated by sleek, minimalist technology, steampunk offers something refreshingly tangible. It reminds us of a bygone society where machines were objects of admiration that existed in tandem with their human counterparts, rather than against them. One where gears visibly turned and invention felt more

▲ This floor standing lamp, called "critter" by Chris Martin, was inspired by articulating toys, but, embodies steampunk aesthetics.



Chris Martin, Critter

like a personal craft rather than an opaque corporate endeavor. Furthermore, it speaks directly to modern anxieties about technology, identity, and the future — while offering an optimistic, more human-centered alternative to what progress can look like. Steampunk continues to be culturally relevant because it taps into a universal desire: the wish to explore worlds that never were, but easily could have. It's a genre that celebrates curiosity, creativity, and the fundamental belief that even the most fantastical ideas can be brought to life with enough imagination and the right amount of gears. **W**

◀ Métro Arts et Métiers in Paris was renovated to celebrate the bicentennial for the French National Conservatory. Inspired by the works of Jules Verne, Platform 11 is adorned with copper plated walls, rivets, massive cogs, and port holes.



Frédéric Beaumont, Paris Metro Station Arts et Métiers



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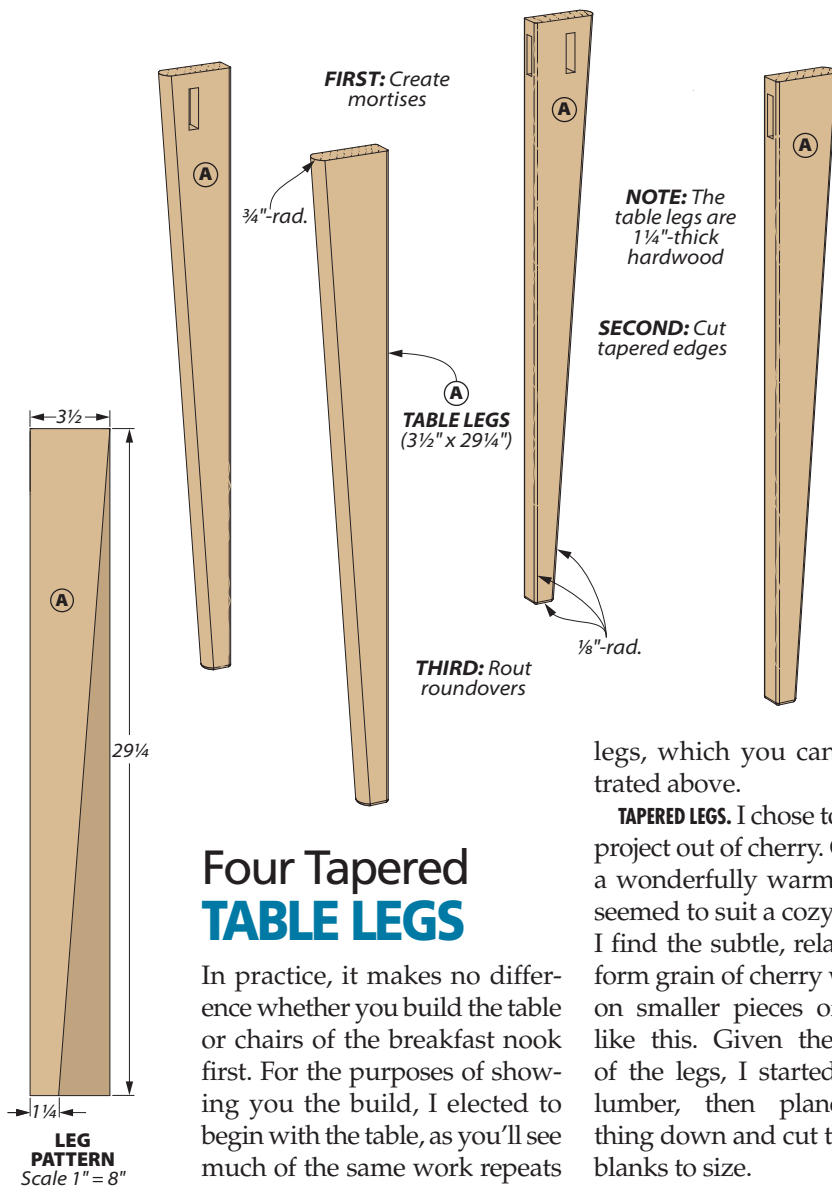
This elegant table-for-two brings warmth and a cozy environment wherever it lives, inviting you to take a seat and relax.

How you divide the space in your home can have wondrous effects on its feel. The addition of a rug concentrates the focus of a large room to a smaller space within it. Adding a bench or a cabinet to an entryway makes it feel less like a transitory limbo for coats and shoes to be tossed in and more like a room with its own purpose. And, to bring your attention to the topic of the next few pages, a table and chairs helps designate a function to an otherwise unsettled tract of the house.

The furniture set you see here is intended to create a breakfast nook, and that called for a few things in its design. As a place for the day's more casual meals, the set needed to be small, fitting easily into a corner of the kitchen or a windowed alcove. More so, it should feel light, not only in weight, but in aesthetic. To achieve this, the rails are arched, while the legs of the table and chairs are tapered and rounded.

However, these pieces don't lack on strength. Mortise and tenons put in the main structural work here. While we chose to build from cherry, you could use a softwood, such as poplar, for lighter finished pieces and a pleasantly cheerful look should you choose to paint them. All in all, this set will provide you with a satisfying build despite its small size.

▲ Long, tapered legs and arched rails on the table and chairs not only cut back on weight, but lend the set a light, graceful look.



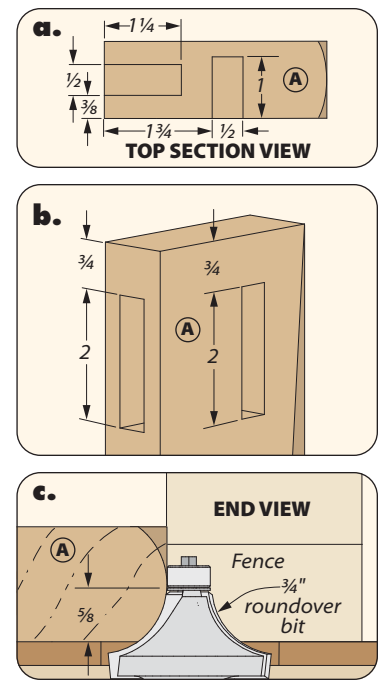
Four Tapered TABLE LEGS

In practice, it makes no difference whether you build the table or chairs of the breakfast nook first. For the purposes of showing you the build, I elected to begin with the table, as you'll see much of the same work repeats on the chairs. The first pieces to look at with the table are the four

legs, which you can see illustrated above.

TAPERED LEGS. I chose to build this project out of cherry. Cherry has a wonderfully warm color that seemed to suit a cozy nook, and I find the subtle, relatively uniform grain of cherry works well on smaller pieces of furniture like this. Given the thickness of the legs, I started with 6/4 lumber, then planed everything down and cut the four leg blanks to size.

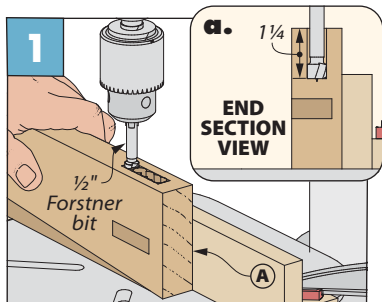
LEG MORTISES. Before any shaping was done, I chose to cut the



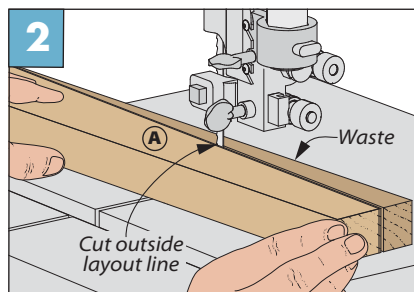
mortises that will accept the tenons on the rails. You can see the dimensions of these in details 'a' and 'b' above. I followed my typical method for creating mortises here, which begins at the drill press. You can see this in Figure 1 below, where a series of overlapping holes removes most of the waste. I then cleaned up the sides and squared the corners with a chisel.

CUTTING TAPERS. With the mortises in place, it was time to make the tapers next. To do this, I first rough-cut them at the band saw

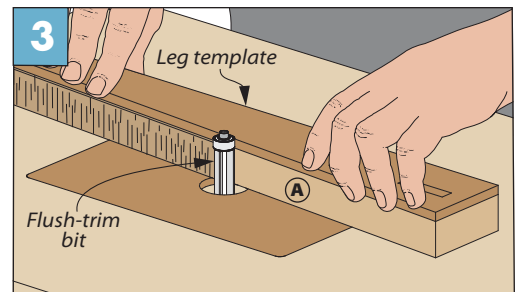
CREATING THE TABLE LEGS



Mortises. Begin the rail mortises by drilling out most of their waste. Finish them with a chisel.



Rough-Cut Taper. Once the mortises are done, lay out the tapers on the legs and cut them at the band saw.



Template Routing. To create a clean, finished edge on the legs, rout the remaining waste of the taper flush to the template.

(as in Figure 2). From there, I created a template from a piece of hardboard (MDF works just as well), shaping it at the band saw and the edge sander. This template then guided a flush-trim bit at the router table (Figure 3).

ROUND-OVERS. The last step on these legs is rounding over the corners. I did this at the router table, and you can see the sizes of the roundovers called out in the main illustration on the previous page. The one procedure of note here is making the bullnoses on the leg fronts. In order to avoid creating a ridge along the fronts, you'll need to ensure the workpiece is registering against the fence and not the bit's bearing, as in detail 'c' on the previous page.

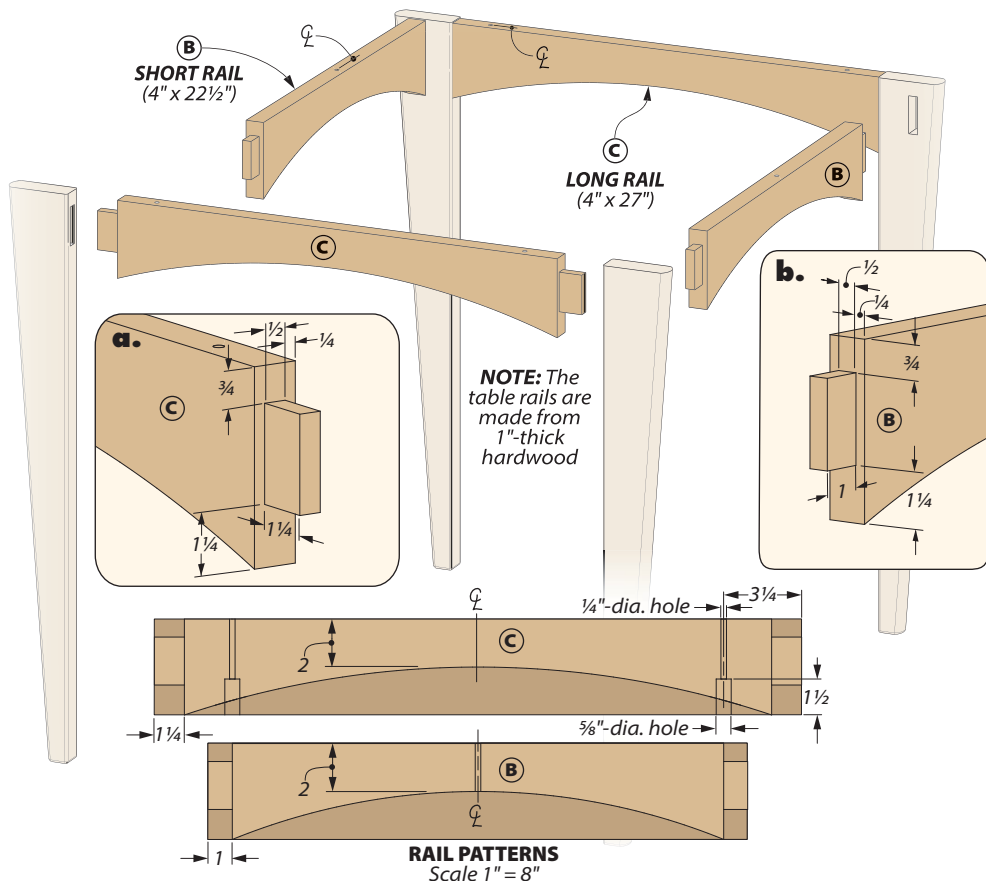
TABLE RAILS

The table legs are joined by rails. These rails come in two lengths and are tenoned on each end to fit the legs' mortises. Additionally, they feature arched bottoms that, like the tapers, provide them with a lighter look.

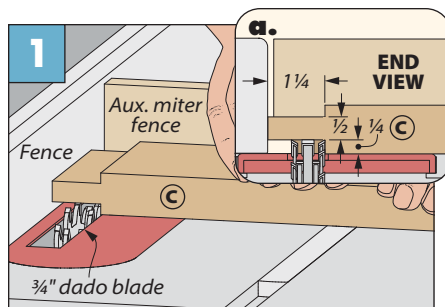
TENONS. As with the legs, the first thing to address on the rails is the joinery. I cut these tenons at the table saw, as shown in Figures 1 and 2 at right.

Next on the agenda were a few clearance holes. You can see these in the patterns below the main illustration. These will accept long screws to attach the tabletop. To allow for wood movement in the top, they're drilled a little larger than the screws, and, to hide them, counterbores are drilled in along the bottom for plugs (Figure 3).

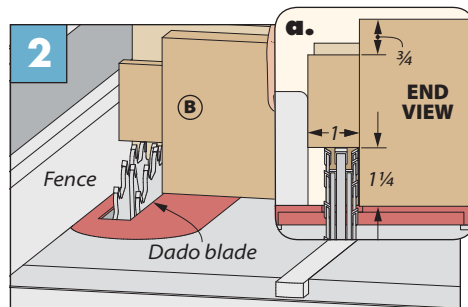
CURVED RAILS. With the joinery elements made, it's time to address the shape of the rails. I created these in the same manner as the leg tapers, first shaping them on the band saw, then using a hardboard template (Figure 4) to rout a finished curve using a flush-trim bit at the router table.



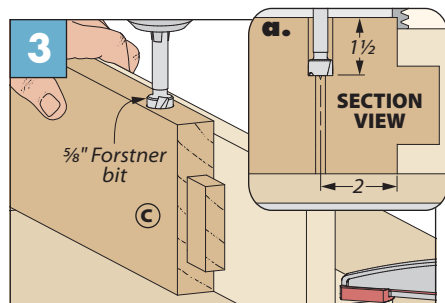
SHAPING THE RAILS



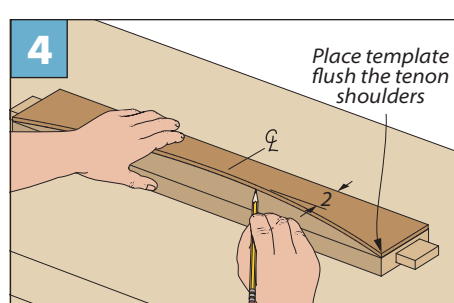
Face Cheeks. A dado blade at the table saw is used to cut the rail tenons.



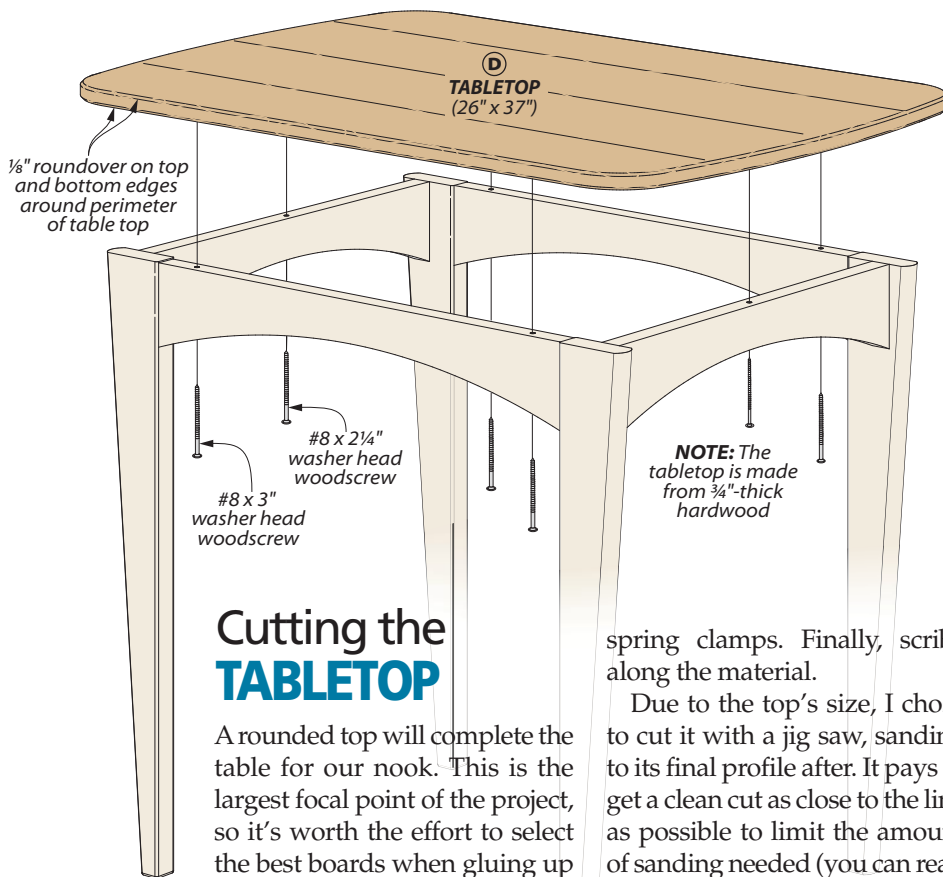
Edge Cheeks. After cutting the face cheeks, turn the rails to cut the edges.



Clearance Holes. Drill the holes for attaching the tabletop at the drill press.



Template Shaping. As with the legs, a template provides the rails' curves.



Cutting the TABLETOP

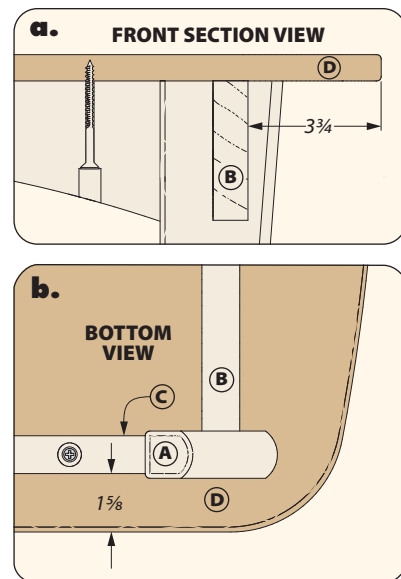
A rounded top will complete the table for our nook. This is the largest focal point of the project, so it's worth the effort to select the best boards when gluing up this top. Once the glue's dried and the top is cut to size, rounding it off is our next task.

END ARCS. You can see our first step in Figure 1: scribing an arc. To do this, I shot a pin nail in at the apex of the arc then bent a long piece of material down to the ends of the arc (hardboard or 1/4"-thick MDF or plywood will do), holding it in place with

spring clamps. Finally, scribe along the material.

Due to the top's size, I chose to cut it with a jig saw, sanding to its final profile after. It pays to get a clean cut as close to the line as possible to limit the amount of sanding needed (you can read more about that on page 14).

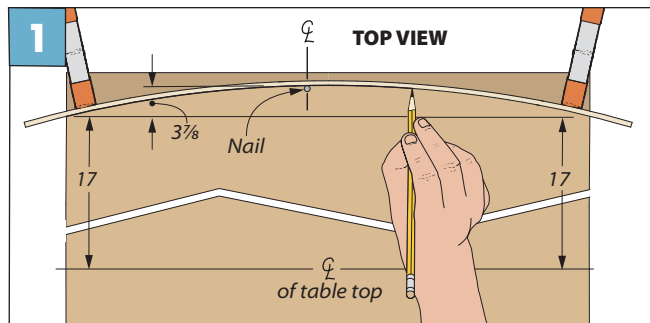
ROUND THE CORNERS. I used a corner template to round the corners of the tabletop. I like to keep a set nearby my workbench, but if you don't have one, they're easy to make from a piece of hardboard or MDF: scribe out the radius with a compass then shape it with a jig saw and sand on the final edge.



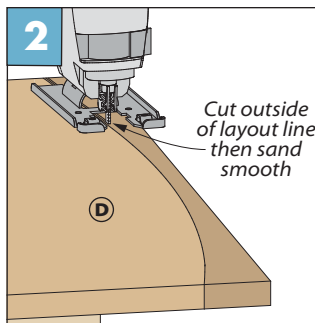
Using the circle template goes the same as the others we've used so far. I rough-cut the top using a jig saw once more and trimmed it to the template with a pattern bit in my router. Finally, I routed the roundovers shown in the main illustration.

ASSEMBLY. To put this table together, I glued up the legs via the short rails first, then connected the two assemblies with the long rails. The tabletop is attached with washer head screws. If you have dowel centers, those work great to mark the pilot hole locations. After drilling the pilot holes, drive the screws in to seat the tabletop.

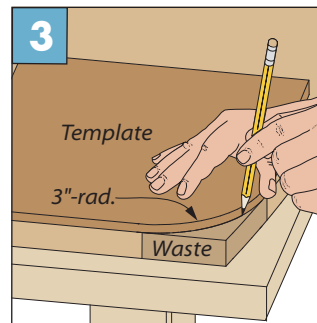
A ROUNDED TOP



Scribing Arcs. The easiest way to make an arc is to bend a long, flexible piece of material across the edge and scribe it.



Rough Cut. Cut the arcs with a jig saw, then sand.

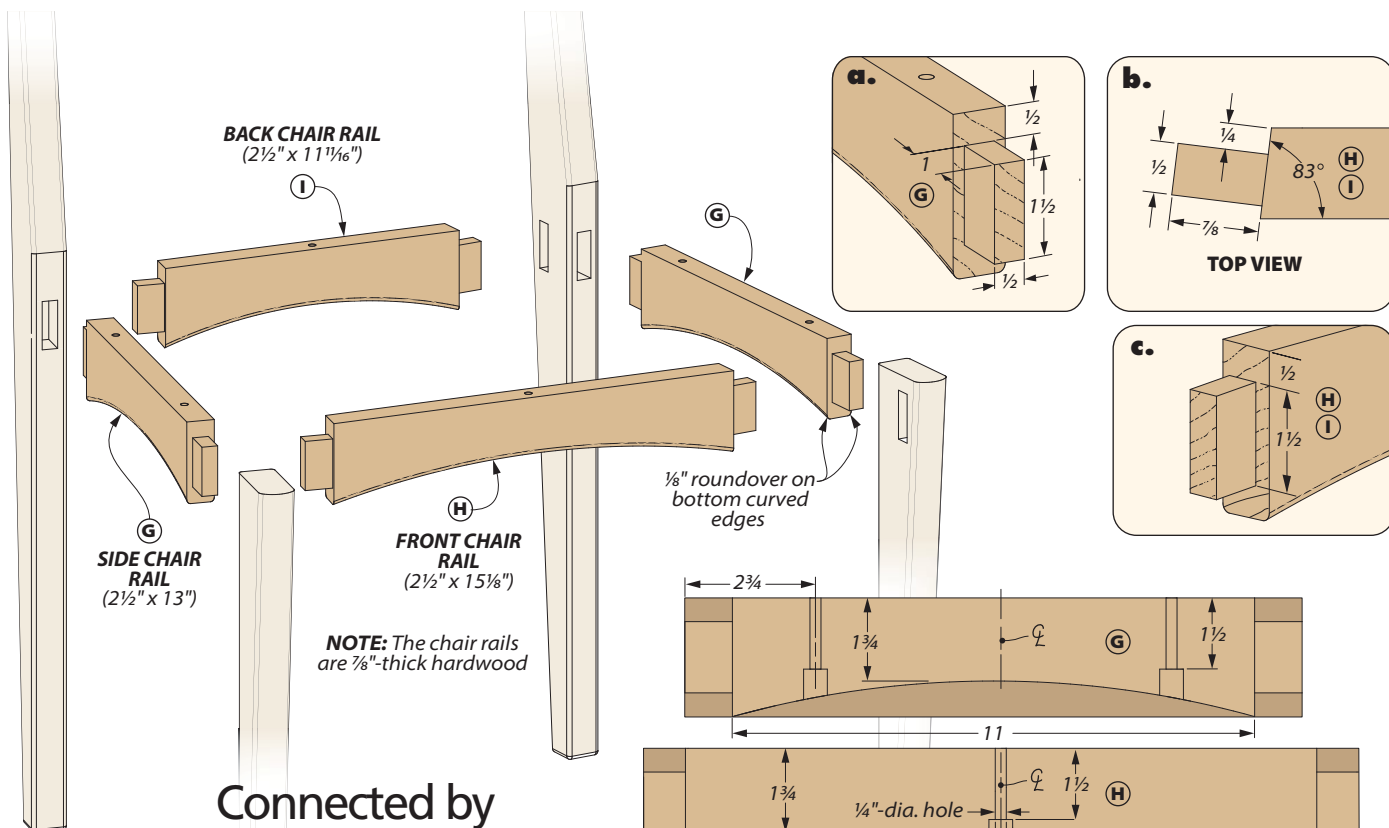


Corners. A corner template helps lay out the radii.

With the table complete, our attention falls to its two faithful companions: the duo of chairs. And, like the table before, we'll begin these chairs at their legs.

SHAPING THE LEGS. After the mortises come the tapers, and there's not much to expand on here, save to note that there is also a taper on the front side of the rear legs that gives the seat back a slight recline.

To do that, you'll need a wedge for support, which you can make from a thin cutoff of a scrap board with the table saw blade tilted to 76°. Use a miter gauge with an auxiliary fence to cut the notches. Attach the wedge to the back of a leg with double-sided tape, then position the wedge against the fence as you make the cut like a dado.



Connected by ANGLED RAILS

I said before that what you see on the chair will be a repeat of what was done on the table, and you'll see that here — but with a twist. Detail 'b' at right above best illustrates what I mean.

SIDE RAIL TENONS. After cutting the rails to size, I first tackled the tenons on the side rails. These are straight forward. They can be shaped with a dado blade at the

table saw, as in Figures 1 and 2 on page 29.

ANGLED TENONS. Now, things get interesting. As you may have noticed, these chairs are broader

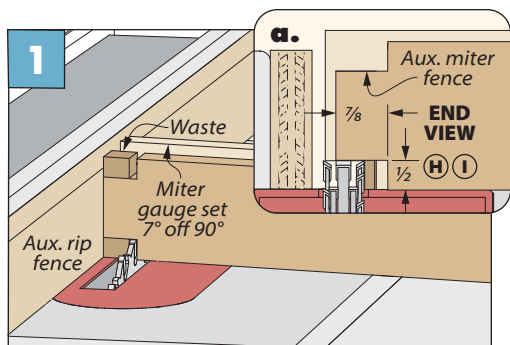
in the front than the back. As a result, the front and back rails require angled tenons.

I began these tenons at the table saw, as in Figure 1. I angled the miter gauge while establishing the shoulders. It's a good idea to label them and mark how each tenon needs to be cut, as you'll flip the angle for half the shoulders. Once those are cut, swap to a dado blade and waste out the rest of the edge cheeks.

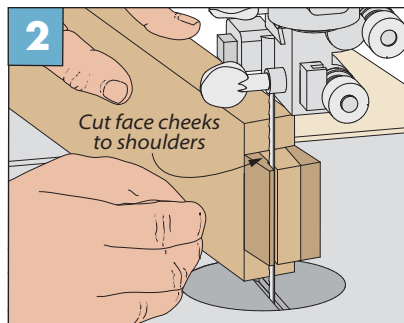
For the face cheeks, first cut along the tenons at the band saw (Figure 2). To remove the waste, I cut it free with a back-saw, using a block with a bevel at 83° to guide my saw on one side and another block at 97° for the opposite side.

SCREW HOLES & ARCS. There are two tasks left on these rails, both of which are repeats from our

CUTTING ANGLED TENONS



Angled Shoulders. Establish the edge shoulders with the miter gauge angled.



Free-Cut Faces. Cut the remaining waste on the cheeks at the band saw.

After the rails are made, they can be used to join the legs. I first glued up the front legs via the front rails and the back legs by the back rails, then, once dry, I glued the two assemblies together as well. A slow-set glue (or epoxy) is a wise choice here.

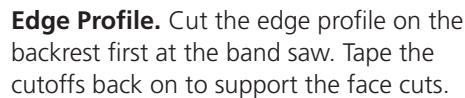
The final elements of our chairs are the seats and backrests. At a glance, they're just a couple shaped parts. In practice, there's a bit more to making these.

SEAT. I started with the seats, once more employing a template after gluing up the blanks and cutting them to size. Test the template's shape in your assembled chairs until they fit just right, then cut the seats to shape using it as a guide.

BACKREST. The backrests are shaped across two planes. Accomplishing this isn't too difficult. The shaping is primarily done at the band saw. The first step (shown in Figure 1) is to cut the workpieces on-edge.

Next, to support cutting the face profile, reattach the cutoffs using double-sided tape and cut the “sandwiches” to the pattern. Once the rough-cutting is done here, refine the shape to the layout lines at the edge sander. After peeling off the cutoff supports, I cleaned the faces of the backrests up with some sanding.

ROUNDOVERS & ASSEMBLY. There are only a couple steps left to complete the chair. Roundovers are next on the agenda. Once those are done, attach the seats and backrests to the assemblies. To disguise the screw holes, I used plugs made from cherry dowels (detail 'a'). With that, the set is complete, and all it needs now is its appropriate nook. [W](#)



Face Profile. With the cutoffs attached as supports, cut the perimeter of the face. Once finished, peel the supporting cutoffs free.

A	Table Legs (4)	1 ¹ / ₄ x 3 ¹ / ₂ - 29 ¹ / ₄	I	Back Rails (2)	7 ⁷ / ₈ x 2 ¹ / ₂ - 11 ¹ / ₁₆
B	Short Rails (2)	1 x 4 - 22 ¹ / ₂	J	Seats (2)	1 x 16 ¹ / ₁₆ - 17 ¹ / ₈
C	Long Rails (2)	1 x 4 - 27	K	Backrests (2)	1 ¹ / ₂ x 5 ⁵ / ₈ - 15 ³ / ₄
D	Tabletop (1)	3 ³ / ₄ x 26 - 37		(12) #8 x 2 ¹ / ₄ " Wh Woodscrews	
E	Front Chair Legs (4)	1 ¹ / ₈ x 2 ¹ / ₂ - 17		(4) #8 x 3" Wh Woodscrews	
F	Back Chair Legs (4)	1 ¹ / ₈ x 3 ⁵ / ₈ - 32		(4) #8 x 1 ¹ / ₈ " Wh Woodscrews	
G	Side Rails (4)	7 ⁷ / ₈ x 2 ¹ / ₂ - 13		(4) #8 x 1 ¹ / ₂ " Wh Woodscrews	
H	Front Rails (2)	7 ⁷ / ₈ x 2 ¹ / ₂ - 15 ¹ / ₈		(8) 3/ ₈ "-dia. x 3/ ₈ " Dowel Plugs	



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handy Tool Tote

Choosing the right tool storage for your workshop can be a daunting task. There's no shortage of cabinets, chests, and shelving options that can be built or bought, but your most-used tools just tend to disappear into them. So if you're looking for the perfect solution for your everyday tool set, a handy tool tote like this one is the way to go.

The goal was to design a tool tote that was large enough to carry the essentials,

light enough to move around, and laid out so everything you could need would be visible at a glance. A magnetically locking drawer was added to store smaller items that tend to vanish at the bottom of the deeper trays.

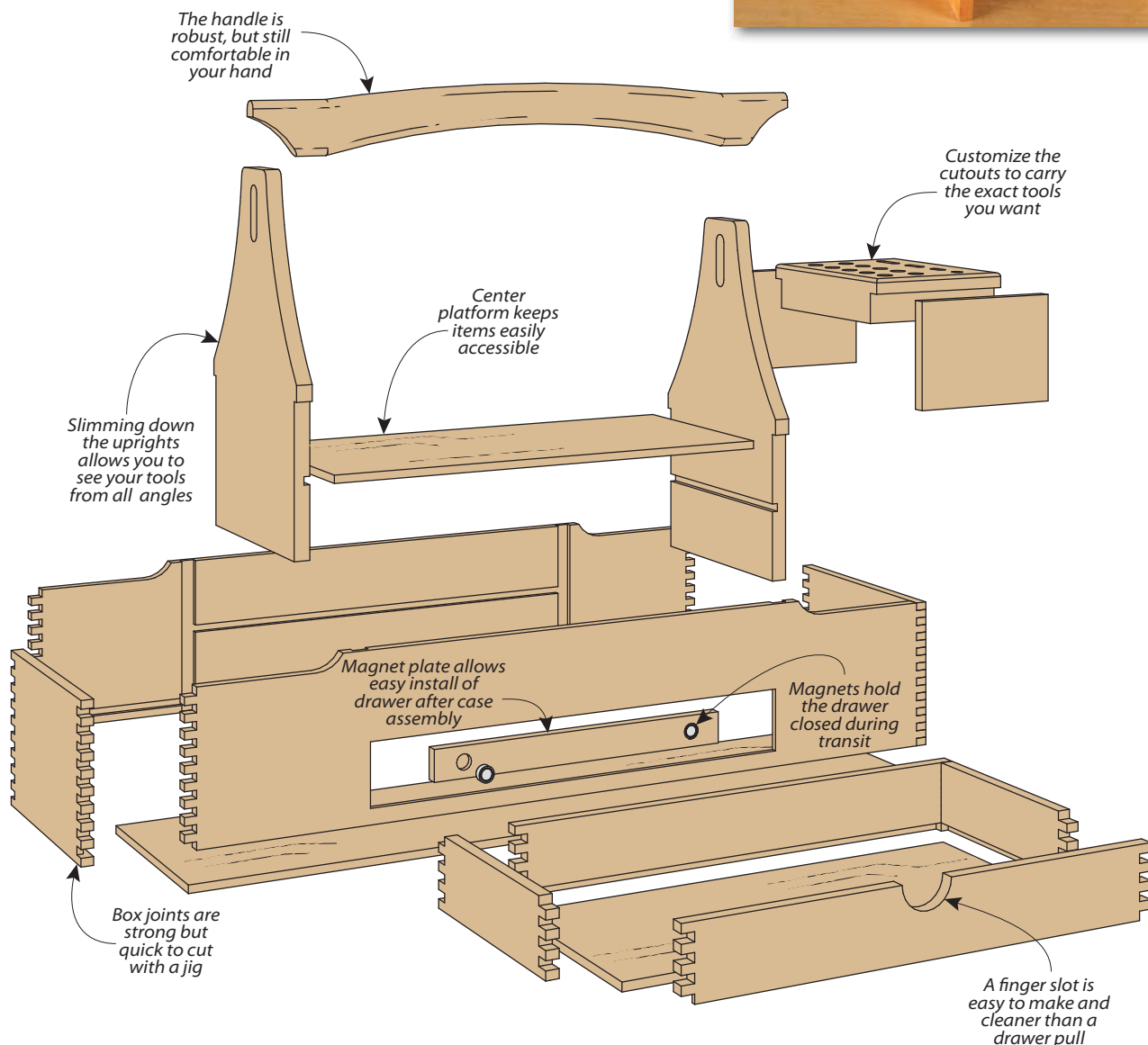
The thoughtfulness continues to the construction techniques and materials as well. Box joints add strength and visual interest, while solid walnut ensures the tote looks just as good as it functions.

Think of this tool box design as a starting template for you to create the custom solution for the tools you're actually using. Maybe you need two storage inserts to hold your carving tools. Or maybe you omit them altogether to store bulky items. It is definitely worthwhile to spend some time prior to building to make sure you can fit everything you want to carry. It's easier to add an extra inch at the start instead of the end.

Exploded View Details

OVERALL DIMENSIONS:
7"D x 26"W x 12"H

► **Extra Storage.** This custom insert keeps the tools you need right at hand without having to dig around.



materials & hardware

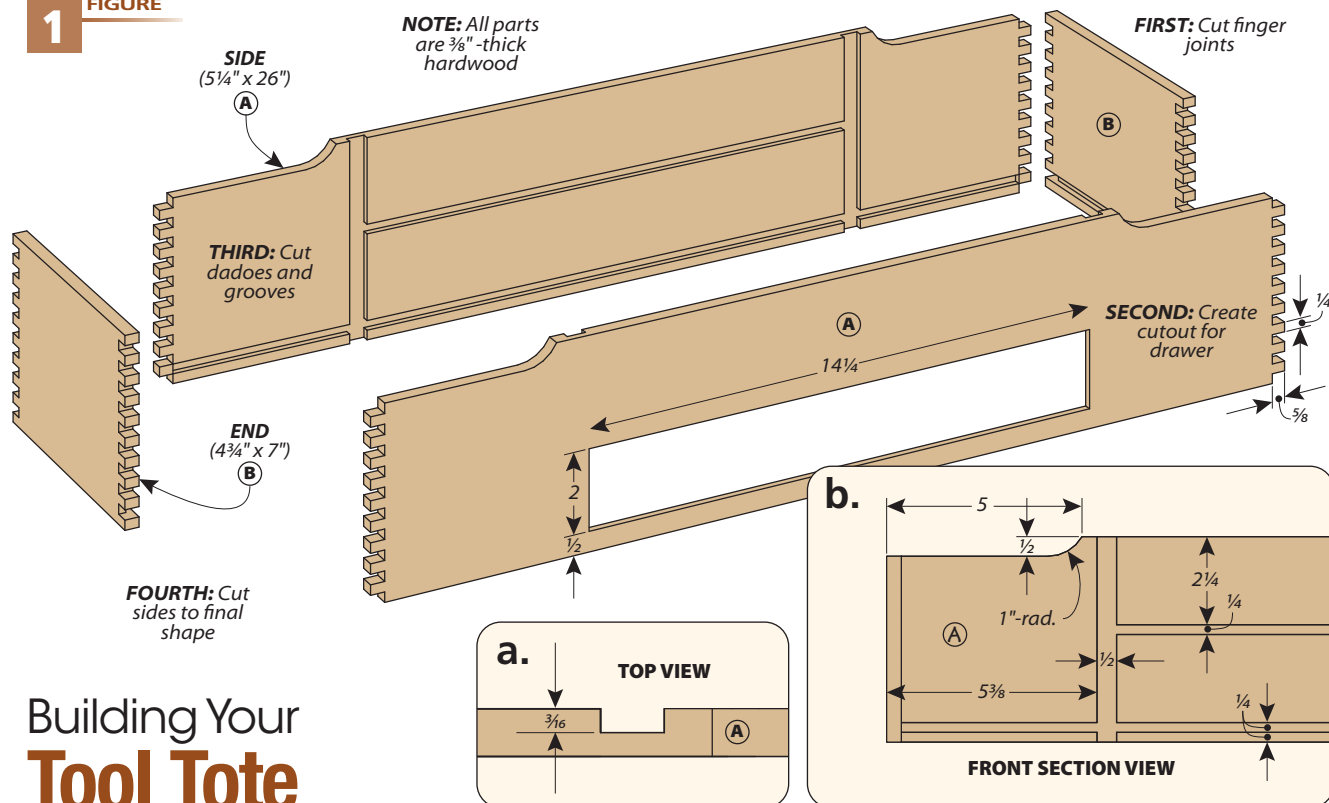
TOTE

A	Sides (2)	$\frac{3}{8} \times 5\frac{1}{4}$ - 26	F	Drawer Front/Back (2)
B	Ends (2)	$\frac{3}{8} \times 4\frac{3}{4}$ - 7	G	Drawer Ends (2)
C	Uprights (2)	$\frac{1}{2} \times 7$ - 11 $\frac{1}{2}$	H	Drawer Bottom (1)
D	Bottom (1)	$\frac{1}{4} \times 6\frac{5}{8}$ - 25 $\frac{5}{8}$	I	Magnet Bar (1)
E	Center Platform (1)	$\frac{1}{4} \times 6\frac{5}{8}$ - 14 $\frac{5}{8}$	J	Handle (1)

TOOL HOLDER

$\frac{3}{8} \times 2 - 14\frac{1}{4}$	K	Top (1)	$1\frac{1}{2} \times 5 - 6\frac{1}{4}$
$\frac{3}{8} \times 2 - 6\frac{1}{4}$	L	Sides (2)	$\frac{3}{8} \times 5 - 3\frac{1}{2}$
$\frac{1}{4} \times 6 - 14$	(2) $\frac{1}{2}$ " x $\frac{1}{8}$ " magnet		
$\frac{3}{8} \times 1 - 10$	(2) $\frac{1}{2}$ " x $\frac{1}{4}$ " x $\frac{5}{8}$ " O.D. magnet cup		
$\frac{1}{2} \times 2\frac{3}{16} - 19\frac{1}{4}$	(2) Washer for $\frac{1}{2}$ " magnet		

1 FIGURE



Building Your Tool Tote

Right off the bat, mill all of your stock to the desired thickness. I'm partial to walnut, but any hardwood will do. Rip all of the components to width on the table saw, then cut to length.

BOX JOINTS. There is a direct relationship between the height of the sides and the spacing of the finger joints. For most things, $\frac{1}{4}$ " joints are about perfect.

After cutting pieces to size, it's time to load up a dado blade to cut the finger joints. You'll want to use a jig to cut the fingers — it will ensure consistent results

and reduce chipout. We made a simple one with some scraps. It consists of an auxiliary miter fence and a key that sets the spacing for the cuts. The key needs to be the exact same width as your dado blade, and the space between the key and the blade needs to be the same as well.

Take the time to make a few practice cuts on a test piece of identical thickness — make sure that the depth of cut is correct, as well as the spacing. It should be tight enough not to fall apart, but you shouldn't have to force the sides

together.

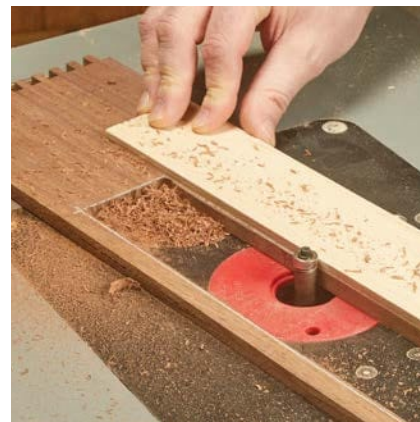
Once your practice cuts are out of the way, it's time for the real thing. Start by cutting the fingers on the two outside end pieces. Hold the workpiece flat against the miter fence and pressed firmly up the hardwood key. Take your first pass, making sure that you go far enough to cut cleanly through the workpiece and completely square the cut. Slide the workpiece over so the first slot is resting over the key and make your next cut. Repeat this process until all of



▲ **Finger Joint Jig.** Building a simple jig with an auxiliary miter fence will ensure accurate box joints.



▲ **Drawer Opening.** Drill out the corners, then use a jigsaw to rough out the opening for the drawer.



▲ **Flush Trimming.** A piece of thin stock can be used with a top-bearing flush-trim bit to clean up the edges.

the fingers for the end have been cut.

Without removing the end piece from the jig, position your side piece abutted to the edge of the end piece against the fence. This will set the correct spacing for the first finger cut without having to build an adjustable jig. Make the first cut on the side piece, remove the completed end piece, and finish your remaining cuts as before.

DRAWER OPENING. With the joinery all sorted out, it's time to cut the drawer opening. Measure and mark the location of the drawer on your preferred side. Drill out the four corners, then use a jigsaw to finish cutting the opening. A quick pass on the router table with a flush-trim bit riding against a taped-on straight edge will clean everything up nicely.

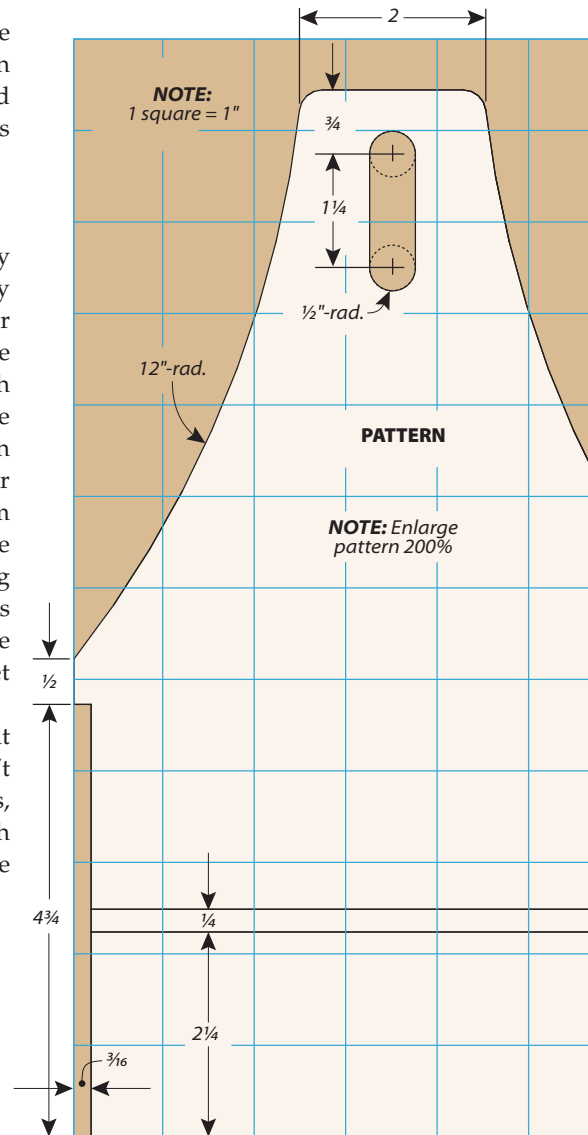
Don't go far from the router table after — the side pieces have a handful of slots to hold interior parts in place. There are two dadoes that hold the uprights in place that are cut with a straight bit. Next, swap in a $\frac{1}{4}$ " bit and cut a groove just above the lower edge to hold the bottom, and a stopped

groove near the center to hold the fixed shelf. These cuts are mirrored on both pieces. Finally, a jigsaw or band saw can be used for decorative edges at the top.

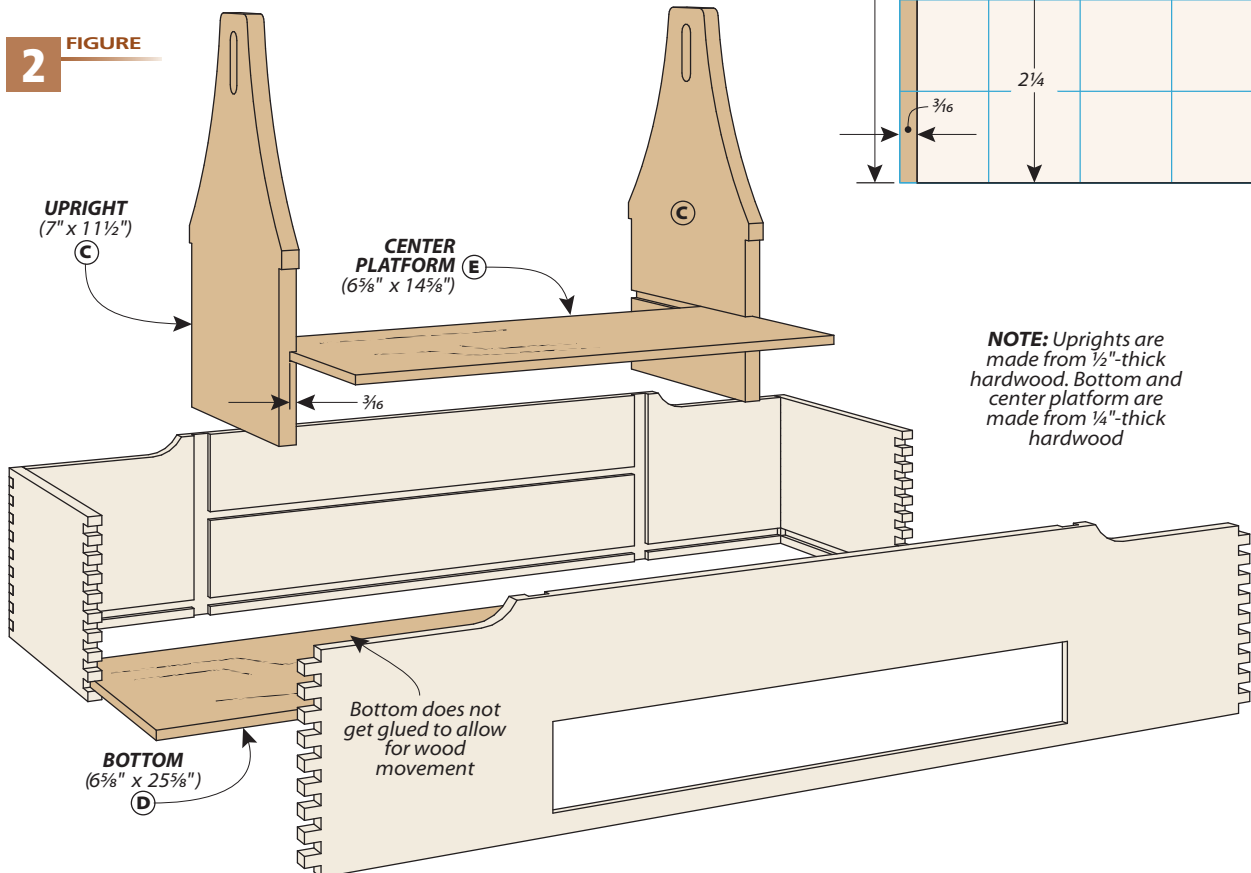
HANDLE UPRIGHTS

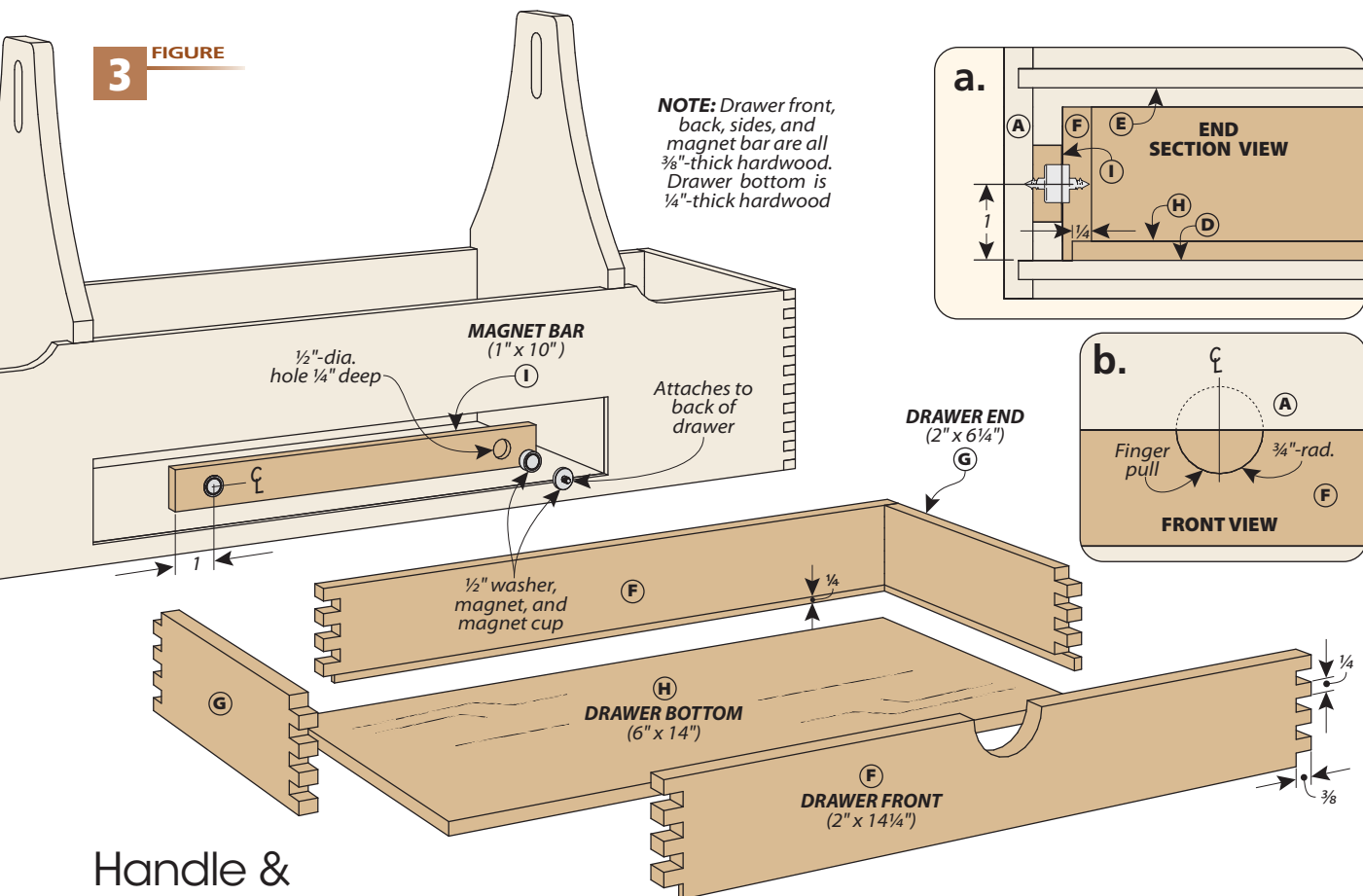
The last parts to build before assembly are the uprights for the handle. Start by cutting the two dadoes for the center platform. The pattern at right can be used to help lay out the shape, which you'll cut at the band saw. Since the two uprights are identical, you can adhere the two workpieces together with double-sided tape and cut them at the same time. Drill out and cut the slots for the handle before separating them. If your curved edges aren't as clean as you'd like, you can use the flush-trim bit and a template to get them nice and smooth.

Dry fit everything to make sure it all fits well, then glue it up. You don't need a ton of glue for the finger joints, just something with a long enough open time so it won't be dry before you finish spreading it around.



NOTE: Uprights are made from $\frac{1}{2}$ "-thick hardwood. Bottom and center platform are made from $\frac{1}{4}$ "-thick hardwood





Handle & Magnetic Drawer

The small drawer on the tote is perfect for holding bits and bobbles you don't want rolling around the bottom of the bins. Small magnets keep it from sliding open during transit.

DRAWER CONSTRUCTION. The build order for the drawer is similar to the rest of the tote. Cut your milled lumber down to size and set up your jig on the table saw again. Like before, place the stock flat against the jig's sacrificial fence and cut the fingers one by one. You will still need to use the end of your first piece to cut the matching joint — just place the open-ended joint against the key and butt the next piece against it to correctly locate your first cut.

While a small knob or handle might look nice on the drawer, it's just likely to get in the way, so I cut a finger notch instead. A short stop at the drill press made quick work of it.

A small rabbet is cut on the router table on each drawer piece for the bottom to fit into. Glue up your drawer and let it dry completely before moving on to the

next step.

MAGNETS. It might sound a little counterintuitive, but it is easier to install the magnets after the case and drawer are both assembled. Cut the magnet bar to size, and use your drill press to recess the holes for the cup magnet.

The next part is a bit like making a sandwich. Install the cups into the recesses without screwing them in for now. Then place the magnets, followed by the washers with screws in place. The correct order is demonstrated in Figure 3a. Now, you can use this entire assembly to transfer the location of the magnets to your drawer. Line up the magnet plate where you'd like on the drawer, and gently press down to embed the screw tips and mark the location for the washers.

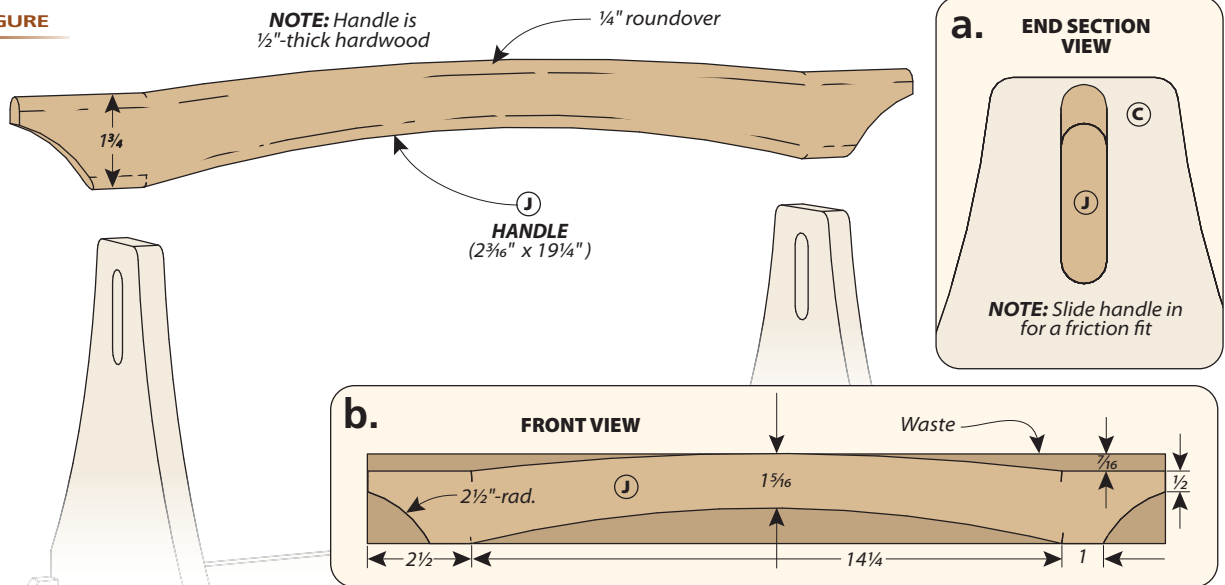
► **Cup Magnet.** The cup magnet has three main components. From left to right — the washer, magnet, and magnet cup.



Use these marks on the back of the drawer to recess the holes for the washer component. Install the washer and screw it firmly into place. Now you can reattach the magnet, cup, and magnet plate to the back of the drawer. Apply a thin layer of glue to the back of the plate, then slide the entire assembly into the drawer slot on the tote. Push the drawer all the way in and apply light pressure until the glue is dry.

Remove the drawer and the two magnets, then reinsert the magnet cups into their holes on the magnet plate inside the tote. Use a screwdriver to install the screws for the cups, which should be long enough to embed into the tote itself. Reattach the magnets to the washers on the back of the drawer and reinstall it in the tote to complete the drawer assembly.

4 FIGURE



HANDLE

The final part of the tote is the hardwood handle. Since this is where the rubber meets the road so to speak, this is a good area to make some personal adjustments so the handle feels comfortable in your hand. There are a few key dimensions you'll want to stick with, though — namely the shape and height of the handle where it connects to the uprights. The overall length of

the handle and distance of the connecting areas from the center should also remain the same.

The shape of the handle was cut on the band saw from a $\frac{1}{2}$ "-thick piece of stock. A rasp was used to finalize the shape of the handle and create the necessary roundover on the edges.

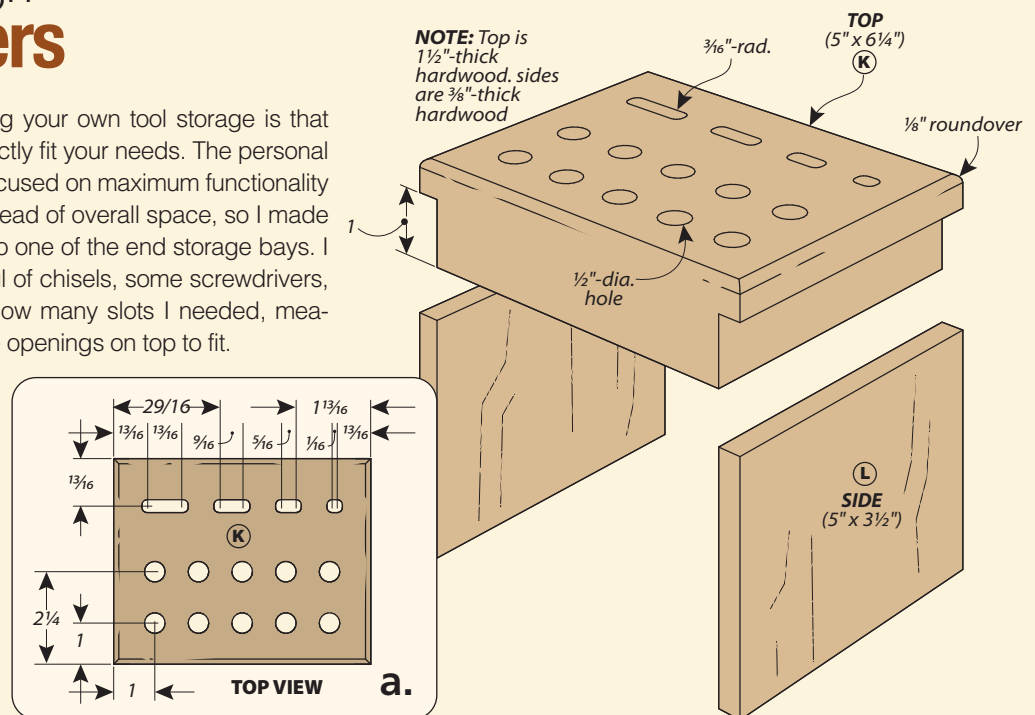
The handle and tote were both finished with lacquer before final assembly so the handle would be free to move

a bit in the slots. To install the handle, insert one end into the slot at a high angle and slide it far enough in to clear the other upright, then slide it through so the handle is centered. The curvature of the handle should prevent it from moving too much but you could pin it if you'd like. All that's left to do is fill it up with your everyday tools and you'll be ready to go with this stylish, functional tote. **W**

Optional Design Tool Holders

The best part about making your own tool storage is that you can customize it to exactly fit your needs. The personal goal for this tool tote was focused on maximum functionality and access of the tools instead of overall space, so I made a small tool holder to go into one of the end storage bays. I needed space for a handful of chisels, some screwdrivers, and an awl. I figured out how many slots I needed, measured my tools, then cut the openings on top to fit.

While the full dimensions are included here for you, feel free to think outside the box and make something that fits your requirements. Since the insert isn't permanent, you can always make another one (or three) down the road as your needs change.



Display Box

The glass lid on this compact case shows off your favorite collectibles while keeping them dust-free.

This little case is one of those projects that if done well, nobody will notice. They'll be too distracted by the special objects featured under the glass lid. While there are two compartments in this box, the display area is the main stage. A small drawer below provides backstage storage and the opportunity to rotate the exhibits.



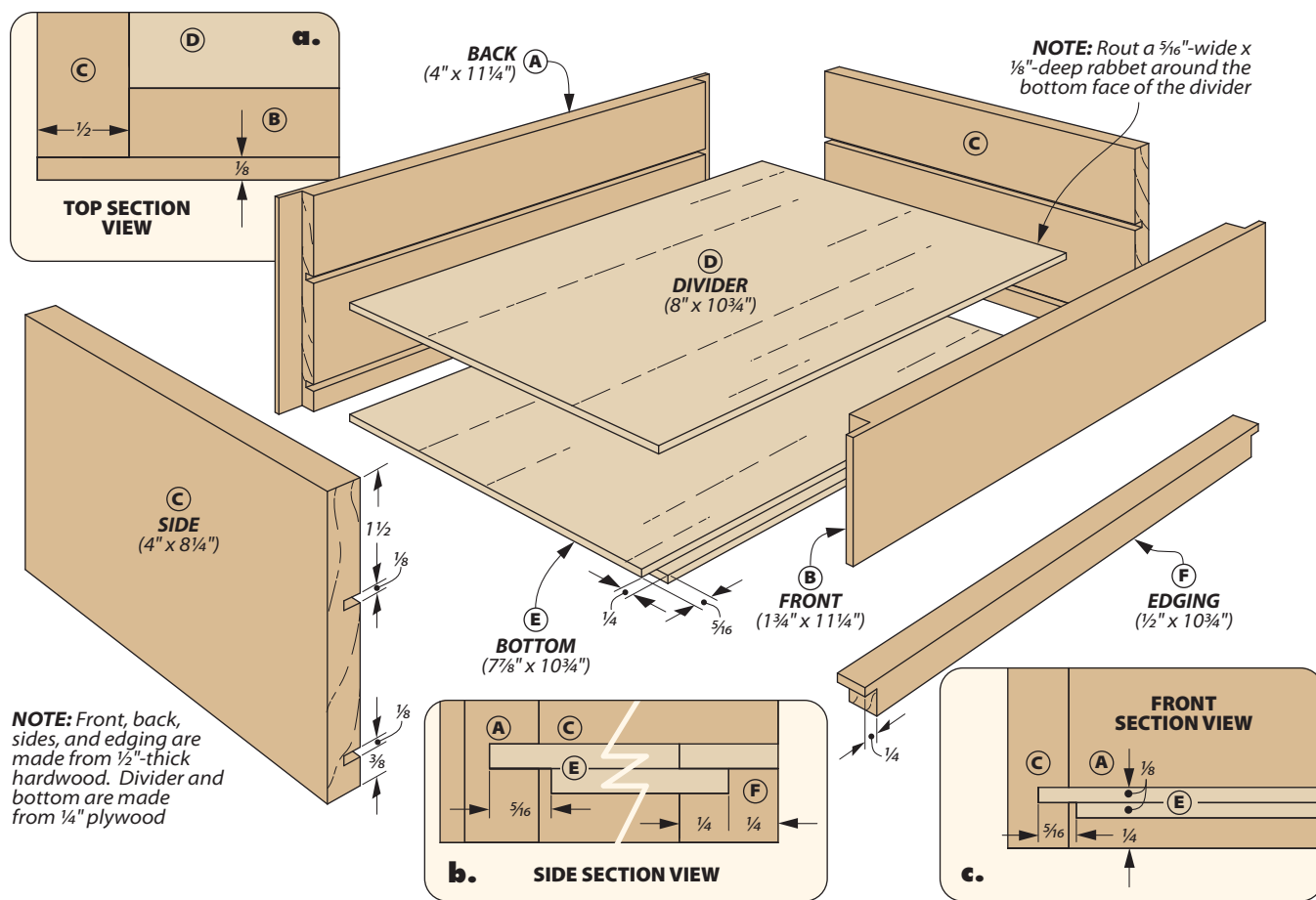
▲ Simple joinery like rabbets (case) and locking rabbets (drawer front) means you can get this project done in a weekend of enjoyable shop time.

Here's what the woodworkers in your life will notice, though. They'll see the spare lines of the joinery. The quiet grain of the cherry combined with subtle walnut accents draw appreciative nods. The unique hinges require some explanation and offer the chance to tell a story. Turns out that maybe this box is part of the display after all.

With a drawer below the display area, you have enclosed storage for more items or accessories.







Case construction **MADE EASY**

Since one of the goals of this project is to show off the contents, I didn't want the case to distract from what's on display. That calls for clean lines and simple details. You're probably thinking this means miters. To quote Bartleby, "I would prefer not to." Rabbets offer the benefits of clean lines with an easier cutting and assembly process.

The choice of joinery provides a starting point for the project. The back and front feature a rabbet at each end to house the sides. The rabbets are shown in the main drawing above and dimensioned in detail 'a.'

JOINERY. While we're on the topic of joinery, I cut the rabbets and all the other joints at the router table. I find that work on small parts like these is more comfortable at the router table.

In addition, straight bits offer clean, flat-bottom cuts, which is ideal for a project that's viewed up close.

For the rabbets, I used a push pad to keep the workpiece against the table surface. A support block behind the workpiece prevents tearout. In the case of the front, the support block also keeps it square to the bit.

A pair of narrow grooves follow the rabbets. One groove holds a divider that forms the floor of the display compartment. The other groove accepts the case bottom. Cut grooves in the front, back, and the two sides.

Since you're working with the grain, a support piece is unnecessary. A push pad alone suffices.

DIVIDER & BOTTOM. I used a couple small clamps to put the case parts together, without glue.

This determines the overall sizes of the divider and bottom. The divider has a rabbet cut around the bottom face to fit into the grooves. I cut the rabbets slightly wider than the groove depth. This allows the divider to seat and the rabbet joints to close tightly. This is shown in details 'b' and 'c.'

The bottom requires a modification to that approach. First off, notice that the bottom is narrower than the divider. Cut the same rabbet along the sides and back edge.

At the front, a rabbet is cut into the top face, leaving a tongue along the bottom. This tongue fits into a groove cut into a hardwood edging strip (detail 'b'). This strip gives the front of the case a clean look behind the drawer front. I recommend an

extra-wide blank for the edging. This makes it easier to control and safer, too. Cut the groove along one edge of the blank. Then you need to form a tongue on each end to fit into the grooves in the case sides, as shown in the main drawing. Once the joinery details are complete, rip the edging to final width.

ASSEMBLY. All the case pieces are complete. It's time to glue the parts together. The divider and bottom work to keep the box square, but it's good practice to double check before you walk away.

DRAWER

The lower compartment of the case houses a small drawer. Take a look at the drawing below to survey its construction.

The drawer front joins to the sides with a lipped locking rabbet. The drawer back uses a simpler tongue and dado joint.

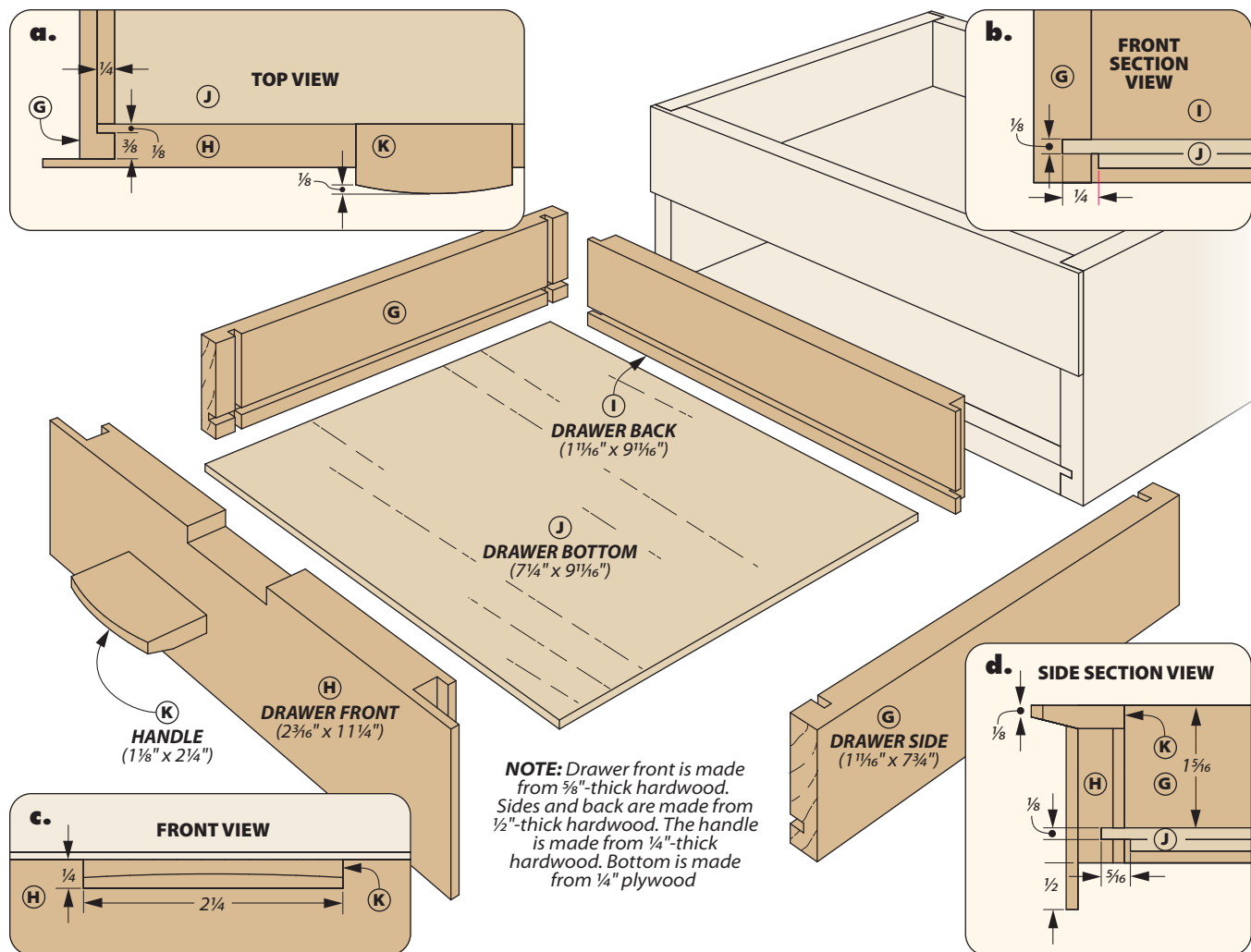
SIDES FIRST. The drawer joinery begins with the sides. These two recesses are registration points for the cuts to follow.

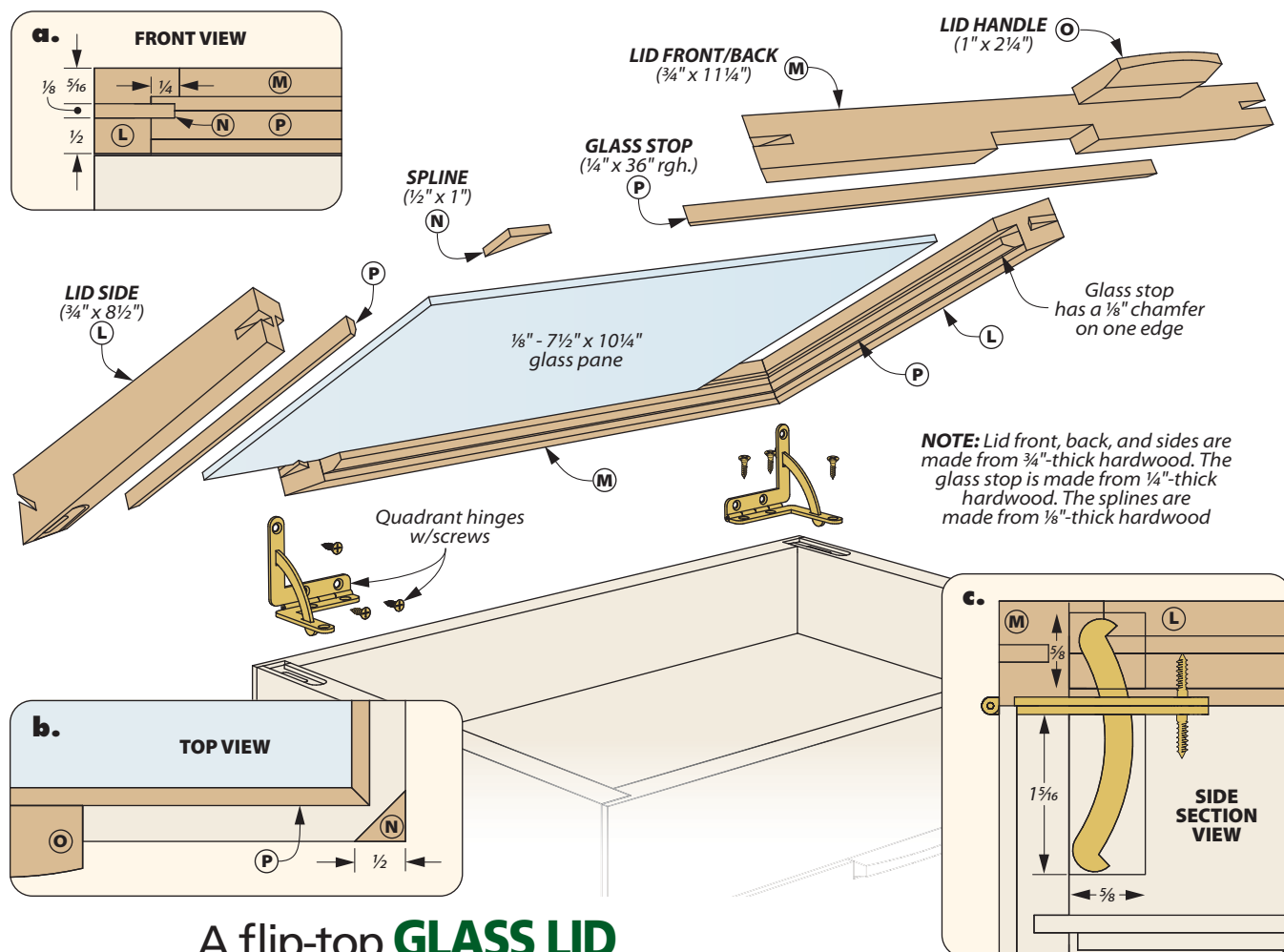
I then moved to the locking rabbet at the front. The drawer front is rabbeted to overlap the sides. On the inside face, a small tongue engages with the dado in the drawer side, as shown in detail 'a.' In order to do this, I diverged from the router table. Instead, I stood the drawer front vertically with a tenoning jig at the table saw to cut a deep slot in each end. Trim the inner flange of this slot back to form the short tongue of the joint. The drawer back has a tongue on each end

to fit the dados. This step works well at the router table with a backer board.

BOTTOM GROOVE. Swap out the bit to cut a groove for the drawer bottom. Take note that since the drawer front is wider than the sides and back, I referenced off the top edge of the parts to locate the grooves (detail 'd').

Like the divider and case bottom, the drawer bottom is rabbeted to fit the grooves, as shown in detail 'b.' There's one last detail before glueup. Cut a notch in the drawer front for a handle. The handle is cut to fit the notch. The front edge is curved. A bevel on the underside lightens its appearance. I used walnut for a complementary look. At last, you can glue up the drawer.





A flip-top **GLASS LID**

The lid shown in the drawing above takes care of the “display” part of this project. I like to think of it more like a picture frame. The construction of the lid backs that up. In this instance, miters are appropriate and separate the construction of the lid from that of the case.

Unlike a frame, the lid needs to open easily to examine the items on display or to change them out. L-shaped quadrant hinges incorporate a stop that holds the lid open a little past vertical.

MITER MUSCLE. As I said, the lid parts are joined with miters. Size the pieces to match the outer dimensions of the case. The front of the lid features a notch to accept a handle identical to the one on the drawer.

I like to assemble frames like this with masking tape serving

as the clamps. The frame rolls up with the tape. Once again, make sure it’s square before you set it aside to dry.

The joints are reinforced with walnut splines, as you can see in the drawing and detail ‘b.’ I cut slots for the splines at the router table with a slot cutter. A backer block with a mitered front edge holds the lid at the correct angle, and prevents tearout.

The splines are cut from a long-grain, over-size blank. Plane the blank for a snug, press fit in the slot. I use a hand saw and a miter box to cut triangles from the blank. Make the splines slightly larger than the openings, then glue them into place. Sand the splines flush when the glue is dry.

RABBET FOR GLASS. Change the slot cutter for a rabbeting bit. Rout a

rabbit on the lower face face to accept a glass pane. I made this in several light passes.

The glass is held in place with thin strips called “stops.” One edge of the stop is chamfered for a refined look. The stop is held with small dots of sealant. This allows you to pry the stop off in case the glass breaks and you need to replace it.

FANCY HARDWARE. Make a second handle and glue it into the notch. The final step is to add the hinges. These require stepped mortises. A shallow mortise accepts the hinge leaves. Then a deeper mortise is cut in the lid and the case for a loose, curved stay. You can see this all in detail ‘c’ above. The best way to install these hinges is with a dedicated router jig. The steps are shown on the next page. **W**

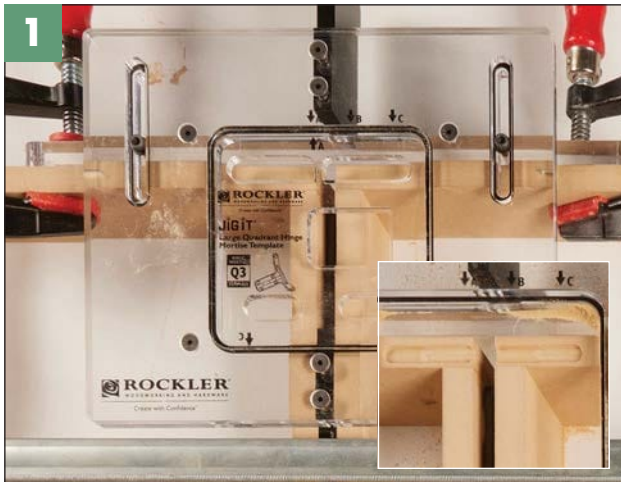


▲ The L-shaped hinges work well with thin box sides. A built-in stop keeps the lid from tipping back.

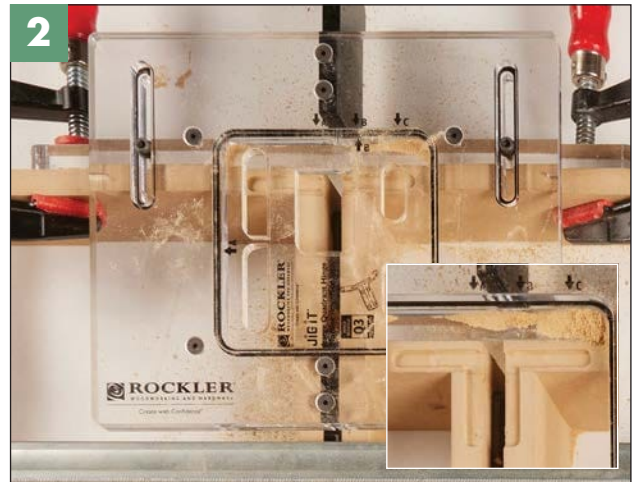
Materials & Supplies

A Back (1)	$\frac{1}{2} \times 4 - 11\frac{1}{4}$	K Drawer Handle (1)	$\frac{1}{4} \times 1\frac{1}{8} - 2\frac{1}{4}$
B Front (1)	$\frac{1}{2} \times 1\frac{3}{4} - 11\frac{1}{4}$	L Lid Sides (2)	$\frac{3}{4} \times \frac{3}{4} - 8\frac{1}{2}$
C Sides (2)	$\frac{1}{2} \times 4 - 8\frac{1}{4}$	M Lid Front/Back (2)	$\frac{3}{4} \times \frac{3}{4} - 11\frac{1}{4}$
D Divider (1)	$\frac{1}{4}$ ply. - $8 \times 10\frac{3}{4}$	N Splines (4)	$\frac{1}{8} \times \frac{1}{2} - 1$
E Bottom (1)	$\frac{1}{4}$ ply. - $7\frac{7}{8} \times 10\frac{3}{4}$	O Lid Handle (1)	$\frac{1}{4} \times 1 - 2\frac{1}{4}$
F Edging (1)	$\frac{1}{2} \times \frac{1}{2} - 10\frac{3}{4}$	P Glass Stop (1)	$\frac{1}{4} \times \frac{1}{4} - 36$ rgh.
G Drawer Sides (2)	$\frac{1}{2} \times 1\frac{11}{16} - 7\frac{3}{4}$	• (1) $\frac{1}{8}$" Glass - $7\frac{1}{2}$" x $10\frac{1}{4}$" • (1 pr.) $1\frac{1}{4}$" Quadrant Hinges w/Screws	
H Drawer Front (1)	$\frac{5}{8} \times 2\frac{3}{16} - 11\frac{1}{4}$		
I Drawer Back (1)	$\frac{1}{2} \times 1\frac{11}{16} - 9\frac{1}{16}$		
J Drawer Bottom (1)	$\frac{1}{4}$ ply. - $7\frac{1}{4} \times 9\frac{1}{16}$		

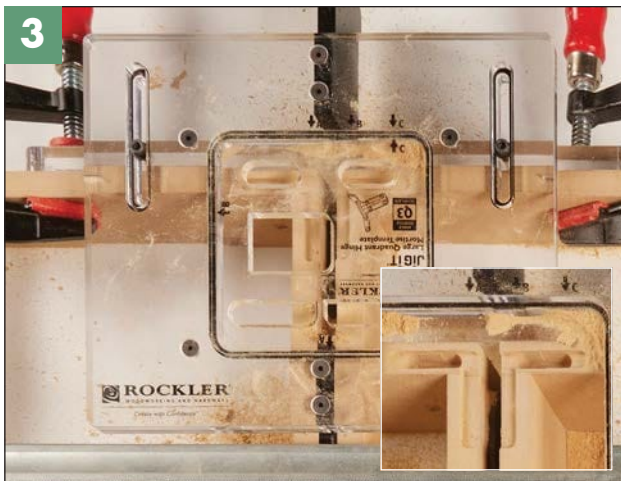
INSTALLING QUADRANT HINGES



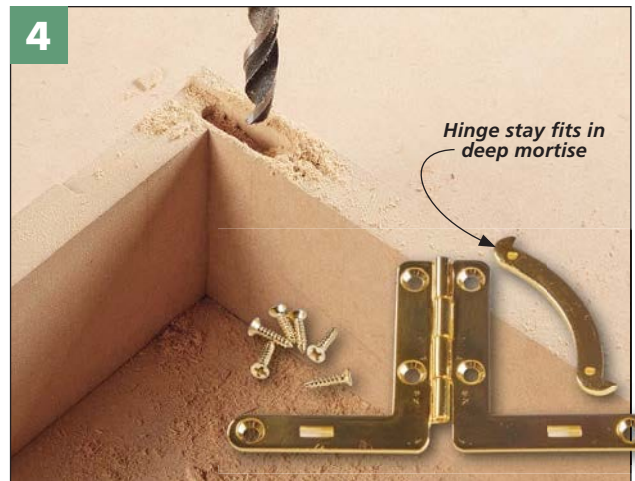
First Position. The jig registers the case and lid. In the 'A' position, rout a shallow mortise in the sides of the case and lid with a $\frac{3}{16}$ " straight bit and a plunge router.



The Other Leg. Adjust the insert to the 'B' position to rout the leg of the hinge mortise along the back edge of the lid and case using the square opening.



Stay Mortise. One final turn of the insert allows you to cut the shorter, but deeper mortise for the hinge's stay. Take care not to rout through the lid.



Deeper Mortise. Since the lid is thin, the stay mortise in the box needs to be deeper than the router bit can cut. Extend the mortise at the drill press.

Nordic Chest of Drawers

Crisp lines plus subtle curves and satin hardware show off the Art Deco roots of this storage piece.

Some styles of furniture play well with other styles ... some don't. Scandinavian modern furniture is one of those friendly forms. The clean lines are at home with Shaker as well as Arts and Crafts pieces. When paired with more ornate, traditional furniture, the modern project is happy to stand aside and be the sidekick.

Design editor Dillon Baker was doing some research and came across a lesser-known variation. It's an older form known as Nordic Deco. While Art Deco styling transformed everything from home appliances to locomotives, designers in northern Europe took a more restrained view. This dresser is Dillon's interpretation.

SQUARE PLUS CURVES. The case is made from riftsawn oak plywood. Straight grain suits the clean lines and mitered joints. To break up the blocky look, the turned feet feature bold lobes and coves. The drawer boxes are in mahogany. This material and color change offers a counterpoint when the drawers are opened.

Another feature of Nordic Deco is the use of metal accents. But this isn't bright, shiny brass. Instead the look is satin steel. With some digging, Dillon found knobs that work. He dressed those up with custom plates that are easy to make.

- Even though the feet are made from oak, a coat of oil finish gives them a deeper color than the rest of the case.



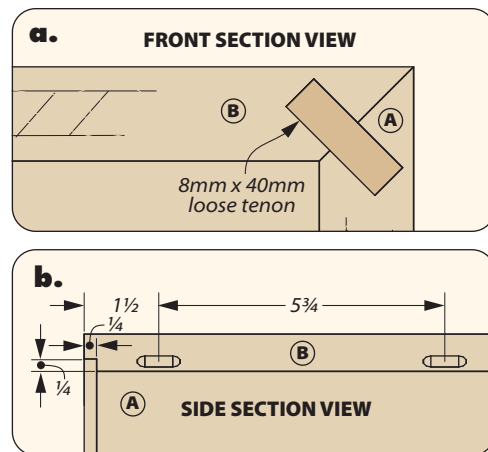
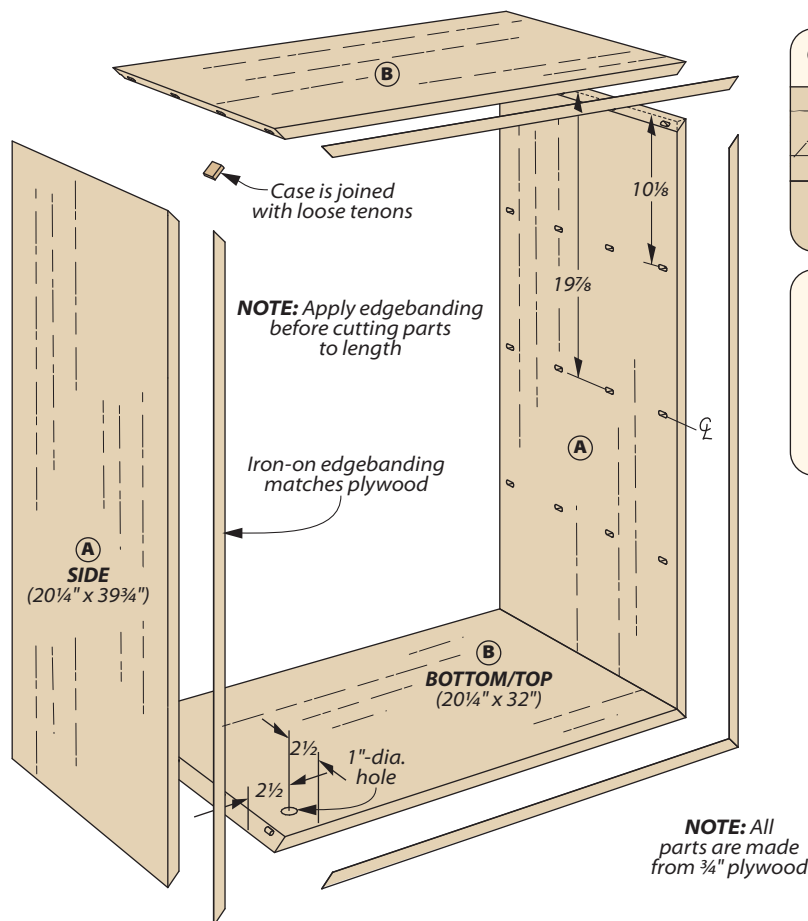
▲ Mitered case construction creates a seamless flow of wood grain across the top and down the sides.



▲ Complementary materials (mahogany here) in the drawer box surprise with a change of color and texture.







The advantage of the edgework is that the seam between the plywood and banding is nearly invisible. The two sides, top, and bottom are joined with miters. I prefer to apply the edgework before I cut the miters. This approach results in a tighter seam on the angled cut. The edgework is slightly wider than the thickness of the plywood. You need to trim the banding flush before cutting the panels to size. I recommend getting the dedicated trimmer tool for this. You can make it work with a utility knife or a block plane, but run the risk of tearout.

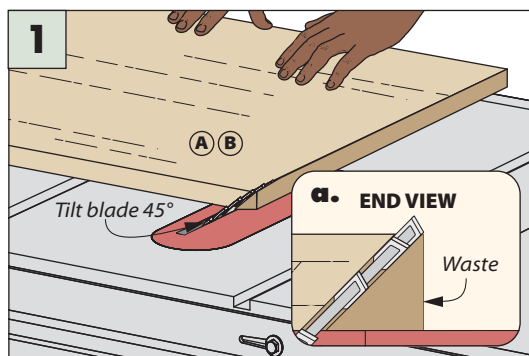
I cut the miters at the table saw, as shown in Figure 1 below. I ran one edge against the rip fence.

A Reinforced PLYWOOD CASE

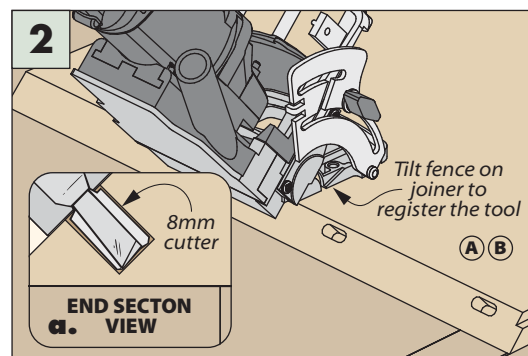
Like most Scandinavian furniture of the modern era, this case emphasizes a minimal look. It's the perfect place to use plywood panels. In the drawing above,

you see the start line: the outer case. That leaves the issue of what to do about the exposed edges. For this project, we used iron-on veneer edgework.

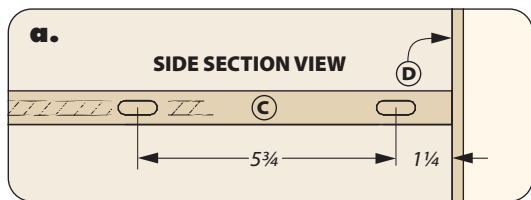
MITERS & MORTISES



Panel Miters. Set the rip fence to cut the sides, top, and bottom to length. You could use a panel-cutting sled as well.



Angled Mortises. The miter joints are reinforced with loose tenons cut into the miter face. The fence angles to support the tool.



A few test cuts to verify the blade angle is time well spent.

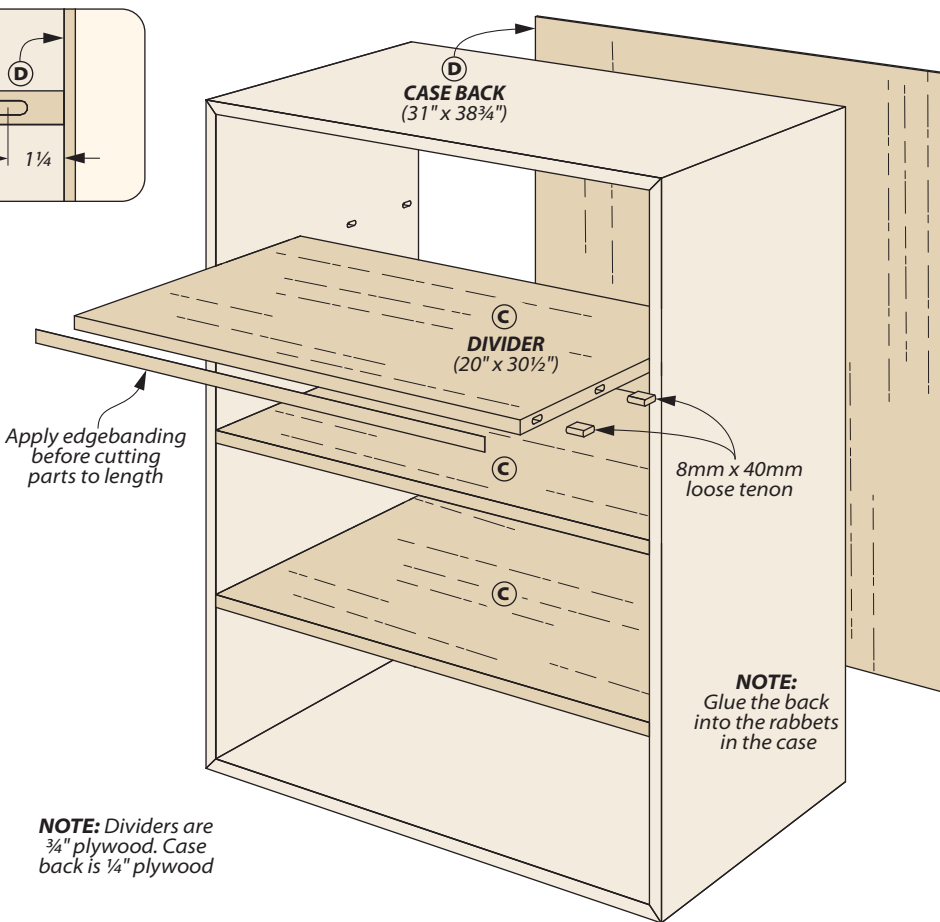
Return the blade to vertical and install a dado blade. This is used for a rabbet to house the back panel, as you can see in detail 'b' on the previous page. The bottom has holes to accept the tenons on the feet.

LOOSE TENONS. Miter joints have an appealing, seamless look. However, the strength of the joint lacks, especially on a large case piece. For this one, Dillon used loose tenons made with a dedicated joinery tool called the *Domino* joiner. This is an admittedly pricey tool. Don't worry, these same mortises can be made with a router and a jig. You could use biscuits as well.

Figure 2 on the previous page shows how the joiner works with mitered joints. I align the joiner to centerlines on the workpieces.

DIVIDERS

One benefit of the loose tenons is that they allow you to



NOTE: Dividers are 3/4" plywood. Case back is 1/4" plywood

assemble the case, without glue, to check the fit of parts. It also allows me to nail down the sizes of the three dividers that form the drawer compartments as well as the case back.

Cut the dividers to size and apply edgebanding. With square ended parts, you can apply the banding before sizing or after. Whatever suits your work style.

Loose tenons connect the dividers to the sides. Figure 1 at left shows the setup for cutting the mortises in the sides. The locations are shown in the drawing on the previous page.

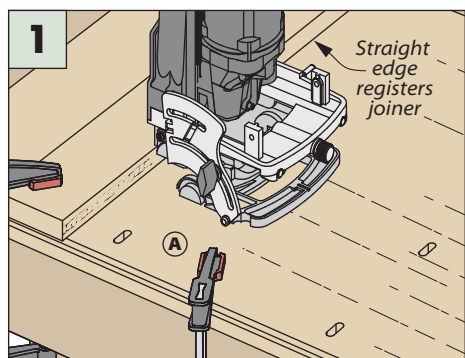
CASE ASSEMBLY. With this many parts (and all the loose tenons), you need to have a plan to glue this case up. With the exception of the back, all the parts have to come together at once.

The first step is to manage the loose tenons. When I use loose tenons, I like to glue them into one of the workpieces. When you take this step, the workpieces act like ones with traditional tenons on the ends. For this dresser, I glued tenons into the ends of the top and bottom and into the dividers. Allow the glue to dry for 30 minutes or so.

I glued the dividers into one of the sides. Here I applied glue only to the tenons to avoid squeezeout. Glue on the bottom next. I do apply glue to the mitered faces to maximize strength. The other side comes next.

Tip the case upright and clamp across the dividers. At last, install the top and glue in the back.

DIVIDER MORTISES



Straight Lines. Clamp a straightedge to the sides in order to align the mortises with the centerlines of the divider panels.

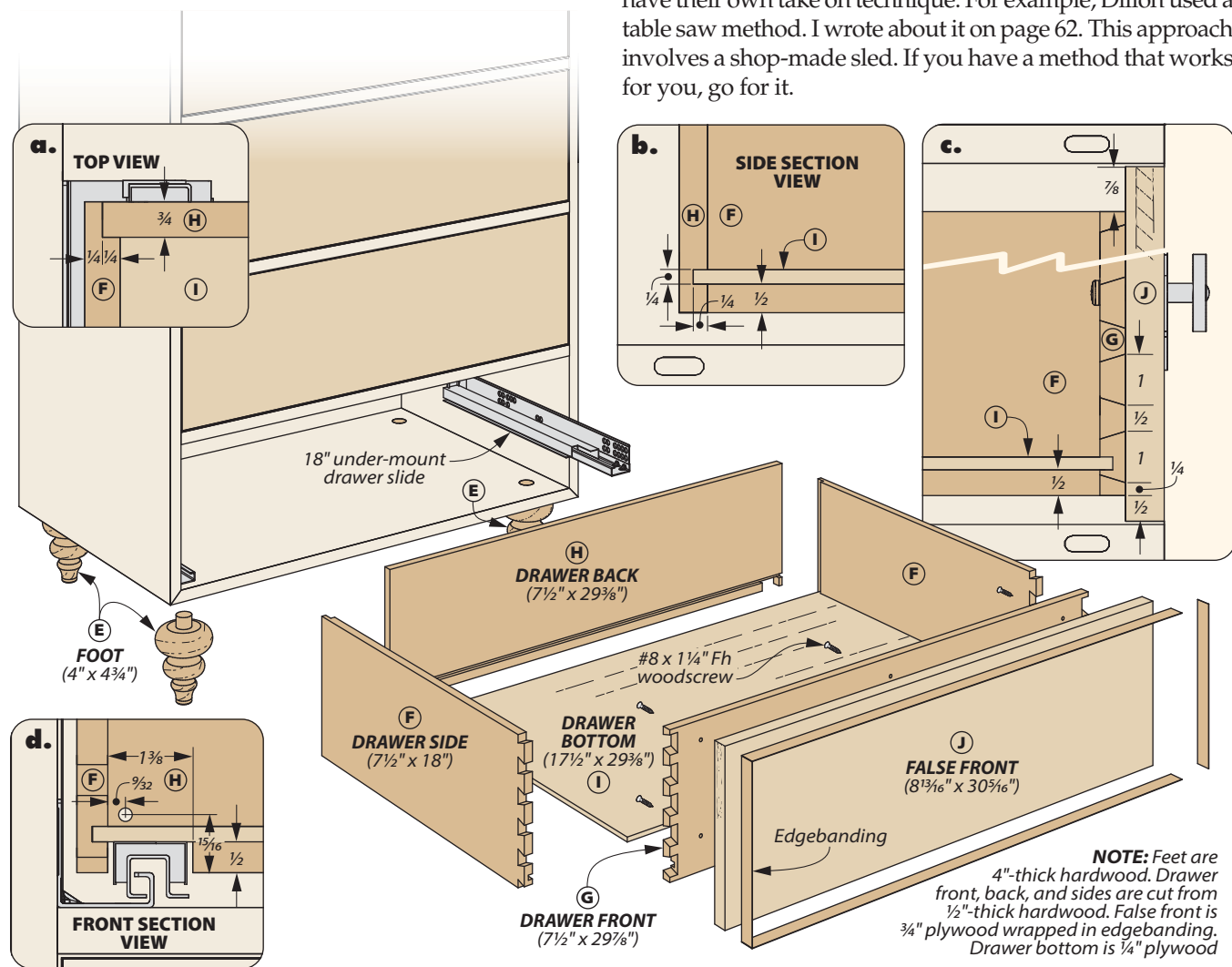
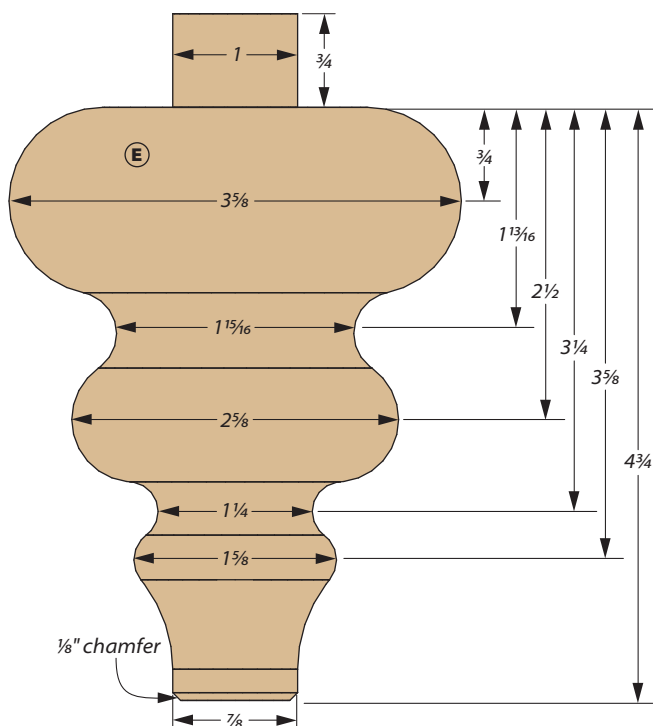
Shapely, turned FEET

We have a plain box with shelves at this point. To turn it into something more like furniture, I added a set of turned feet. The first step is to glue up blanks in order to get the size you need. I used oak to match the case.

The profile of the feet is shown in the drawing at left. I don't turn much, but I found that I could shape this profile without much trouble. I used carbide turning tools. One thing to note is that the feet don't need to be identical. They just have to look similar. The only portion of the turning that's critical is the size of the tenon. I used calipers so that it was a snug fit with the hole in the case bottom. Glue them in place.

DRAWERS. Next on the list is to make the drawers. These always seem like a project within a project. If you take a look at the drawing below, you'll see what I mean. Each drawer is essentially a small box. A false front dresses up the drawer and ties it to the case.

Most of your attention focuses on the through dovetails that connect the sides to the front, as shown in detail 'b.' I've learned that cutting dovetails is personal. Everyone seems to have their own take on technique. For example, Dillon used a table saw method. I wrote about it on page 62. This approach involves a shop-made sled. If you have a method that works for you, go for it.



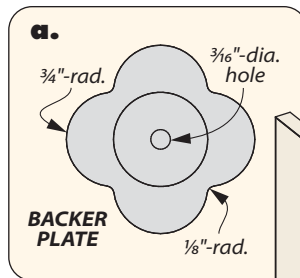
The sides-to-back connection doesn't face the same stress (and isn't visible), so a rabbet joint serves well here. The drawer back has a notch and a small hole to create clearance for under-mount drawer slides (detail 'd').

Cut a groove in all the parts to house the drawer bottom. Glue up the drawer. Before making the false fronts, install the drawer slides on the drawer and in the case. Without the false front, you have better visibility to make adjustments. The instructions that come with the slides do a good job of covering the process.

FALSE FRONT. The false front is made from the same plywood used on the case. Once again, edgebanding conceals the exposed plies. Size the fronts for a consistent gap all around.

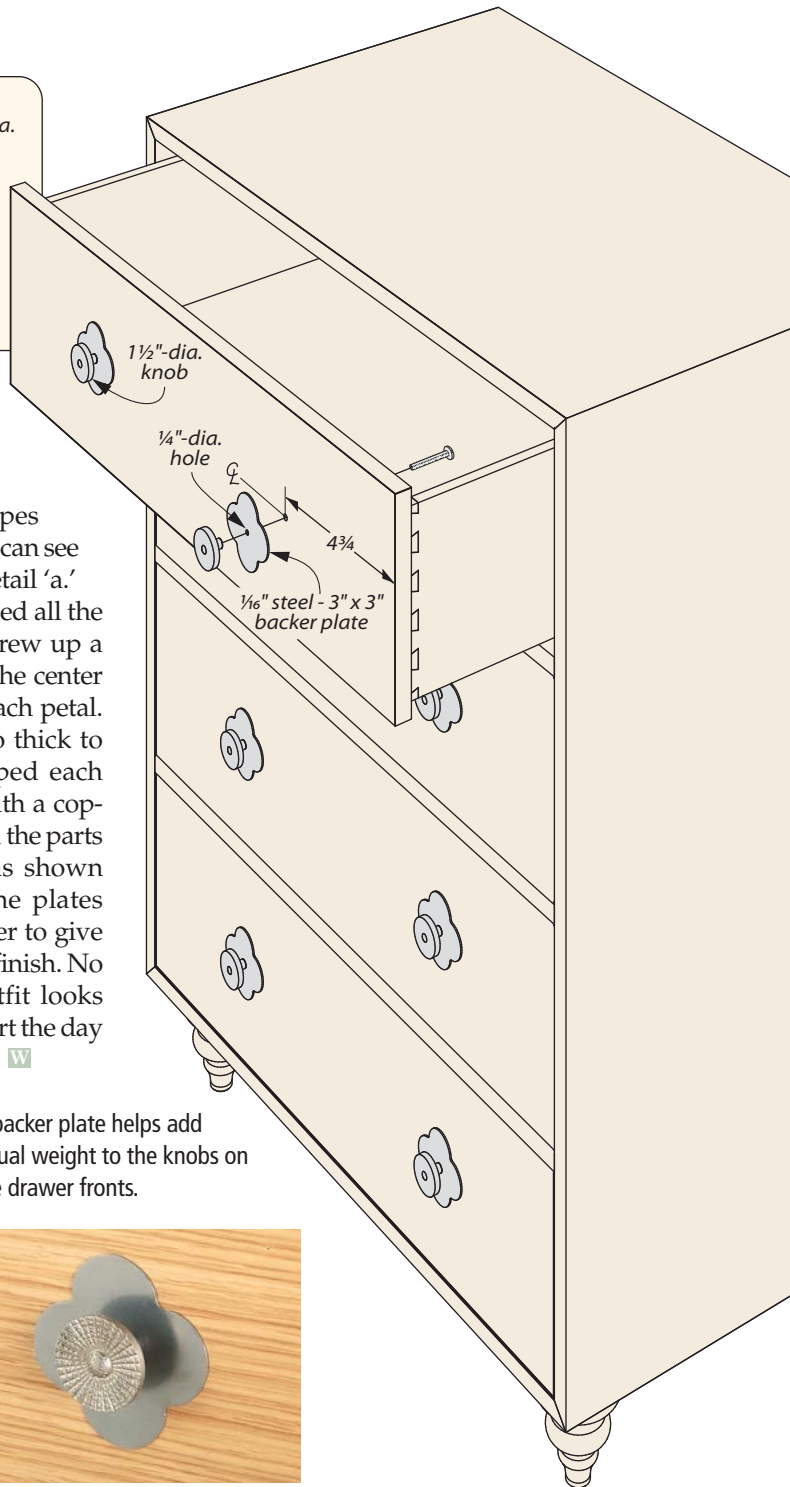
HARDWARE

Dillon found pulls that suited the look of getting the Nordic Deco style. But by themselves, they looked lost on the large drawers. Time to accessorize. He picked up some thin steel and made a

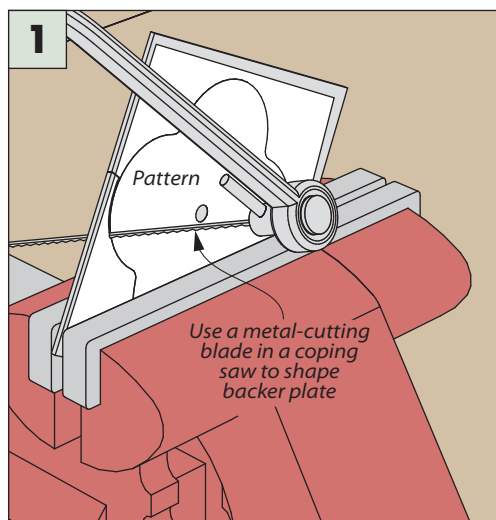


quatrefoil backer plate for each knob. The lobes and curves are similar to the shapes found in this style. You can see these at right and in detail 'a.'

To shape them, I taped all the blanks together and drew up a paper pattern to drill the center hole and the base of each petal. That much steel is too thick to cut at once. So I shaped each backer individually with a coping saw and files. I held the parts in a machinist vise, as shown below. I sanded to the plates with 400-grit sandpaper to give them a uniform matte finish. No matter what your outfit looks like, at least you can start the day with a little bit of style. **W**



BACKER PLATES



Careful Cuts. With a metal-cutting blade, shape the lobes with a coping or jewelers saw. File and sand the edges smooth.

▼ A backer plate helps add visual weight to the knobs on the drawer fronts.



Materials & Supplies

- | | | | |
|--------------------------|---|-------------------------|---|
| A Sides (2) | $\frac{3}{4}$ ply. - $20\frac{1}{4} \times 39\frac{3}{4}$ | I Dwr. Btms. (4) | $\frac{1}{4}$ ply. - $17\frac{1}{2} \times 29\frac{3}{8}$ |
| B Top/Btm. (2) | $\frac{3}{4}$ ply. - $20\frac{1}{4} \times 32$ | J F. Fronts (4) | $\frac{3}{4}$ ply. - $8\frac{13}{16} \times 30\frac{5}{16}$ |
| C Dividers (3) | $\frac{3}{4}$ ply. - $20 \times 30\frac{1}{2}$ | | |
| D Back (1) | $\frac{1}{4}$ ply. - $31 \times 38\frac{3}{4}$ | | (40) 8mm x 40mm Loose Tenons |
| E Feet (4) | 4 rgh. x 4 rgh. - $5\frac{1}{2}$ | | (4 pr.) 18" Drawer Slides |
| F Dwr. Sides (8) | $\frac{1}{2} \times 7\frac{1}{2} \times 18$ | | (24) #8 x 1" Fh Woodscrews |
| G Dwr. Fronts (4) | $\frac{1}{2} \times 7\frac{1}{2} - 29\frac{7}{8}$ | | (8) $1\frac{1}{2}$ "-Dia. Knobs |
| H Dwr. Backs (4) | $\frac{1}{2} \times 7\frac{1}{2} - 29\frac{3}{8}$ | | (2) $\frac{1}{16}$ " Steel - $12" \times 12"$ |

Nautilus Submarine

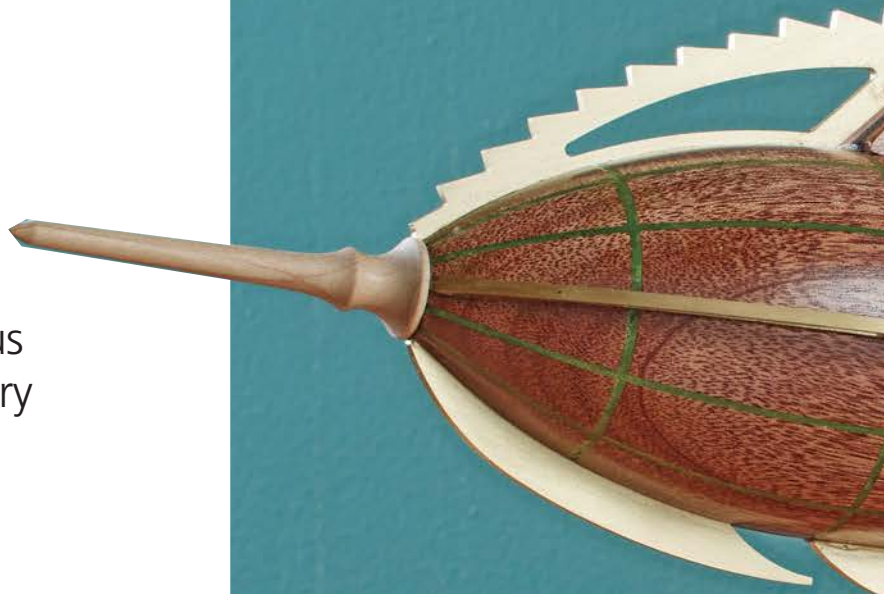
This recreation of the infamous vessel from Nineteenth Century science fiction evokes both a wondrous sense of adventure and a wistful nostalgia.

Originally serialized from 1869 to 1870, *Twenty Thousand Leagues Under the Sea* by French author Jules Verne has since stood as a landmark of science fiction literature. The book captures the imaginative and optimistic zeitgeist of the late Nineteenth Century as the period we now call the Second Industrial Revolution began. Verne envisions a world in which, as we descend to the final unexplored frontier, humanity's discoveries are no longer about the world around us, but about the world we create. In Verne's words: "This monster, this natural phenomenon that had puzzled the learned world, and overthrown and misled the imagination of seamen of both hemispheres, it must be owned, a still more astonishing phenomenon, inasmuch as it was a simply human construction."

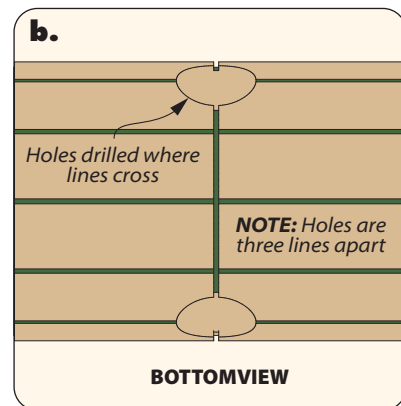
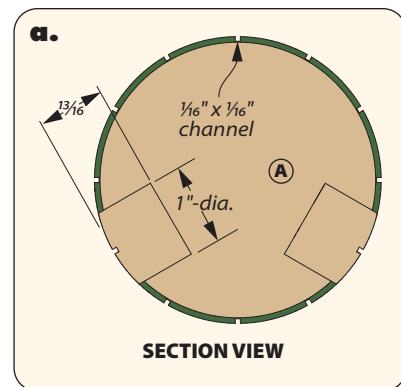
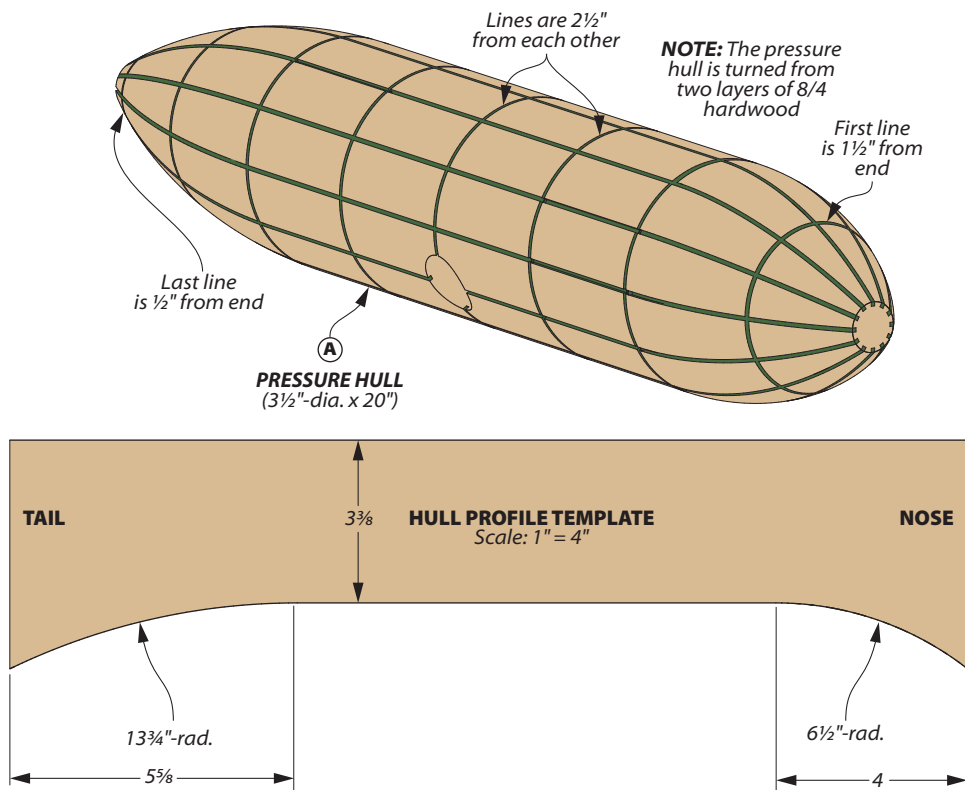
Within the novel, there stand two iconic figures: the intrepid Captain Nemo and his faithful submarine, the Nautilus. As you can see, the latter has been our focus. Our Creative Director, Chris Fitch, designed and built this project. His inspiration came not just from the text, but from famous interpretations, such as the 1954 movie of the same name.

Chris chose mahogany as the primary wood for this project. Its dense, straight grain grants a uniform look. Brass complements the wood, highlighting the vessel's mechanisms, viewports, and offensive prows. This project offers a variety of techniques in terms of procedure: turning, routing with a jig, plenty of template shaping, and even a bit of metalwork. Variety is the spice of life, after all, and you'll find building this project as entertaining and unique as the model itself.

- ▶ The prows, rudder, propeller, and keel provide pleasant brass accents; Chris shows how to make these in his article on page 18.







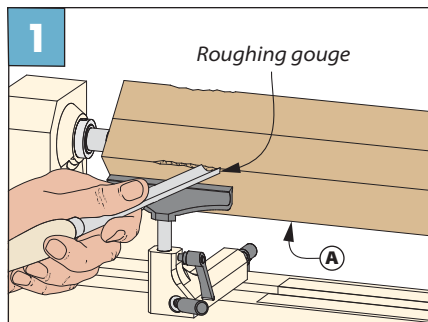
Turning the PRESSURE HULL

The logical place to begin this model is with its main body: the pressure hull. Everything else will be built around this part, and it began as a blank glued up from two pieces of 8/4 mahogany. Once dry, it's time to head over to the lathe to turn it round.

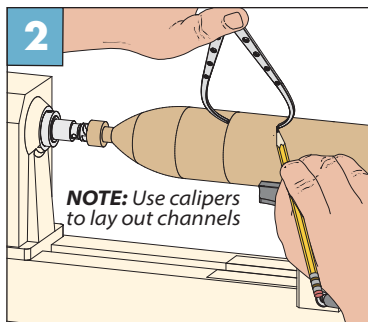
TEMPLATE TURNING. The template above provides the shape of the hull. After roughing the hull down to the appropriate diameter, this is your target. Take your time. Get as close to the template's shape as you can. Many other parts will register against the rounded ends, so precision here pays off in the long run.

FAUX PANELS. In reality, a submarine's pressure hull is encased in a steel shell, with ballasts in between to allow for submersion. Of course, we've no need to create these innards, but we can hint at steel exterior. In the steampunk fashion, a grid of channels evokes the image of riveted steel plates.

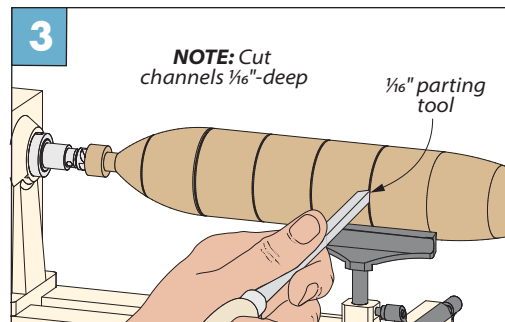
TURNING THE HULL



Round the Hull. Begin by mounting the blank in your lathe and turning it round with a roughing gouge.



Lateral Channels. Lay out the channels across the circumference of the hull with a pencil.



Cutting Channels. Cut the channels with a parting tool. If you lack one small enough, a ground-down screwdriver can do the job.

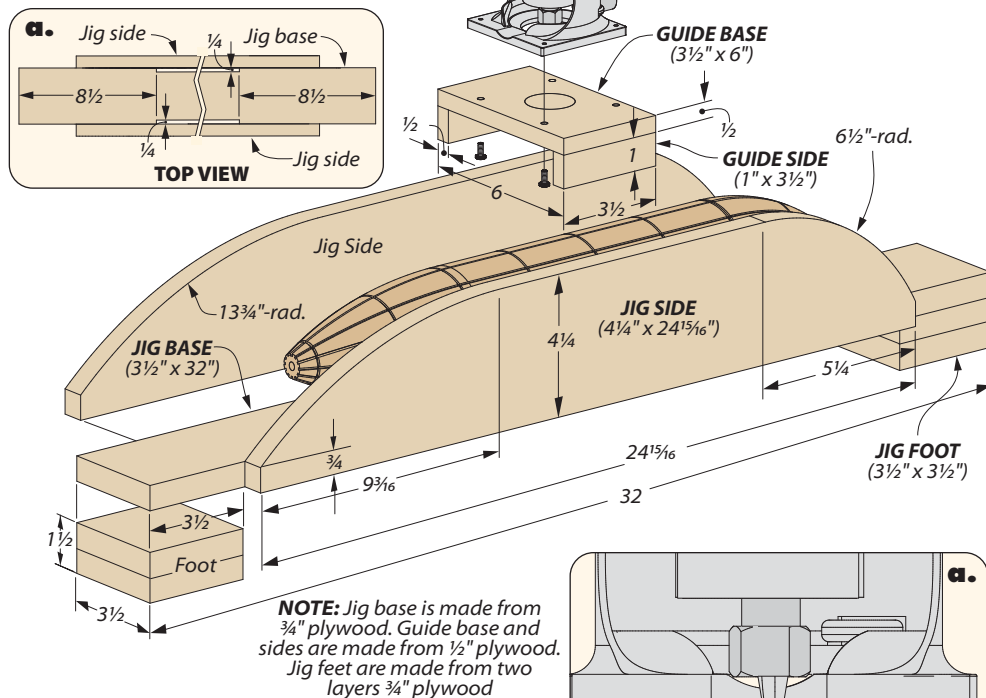
The channels that circle the hull can be made while on the lathe. You can see how we did this in Figures 2 and Figure 3 on the previous page. The main illustration shows the spacing of these channels. I used my calipers to lay these out since I had them nearby to gauge the thickness of the hull anyway.

JIG & ROUTING

The lateral channels complete the lathe work. The next steps are focused on joinery, along with cutting the channels that run the length of the hull. To do these steps, you'll want to make the jig you see at right.

HULL JIG. The jig consists of a base matching the width of the hull, two sides that follow its profile, and a pair of feet that allow clamps to slide beneath and tighten the sides onto the workpiece. The edges of the base are slightly recessed at its midpoint, allowing the sides to flex in as the clamps are applied. The router is kept parallel to the sides by a guide, riding along the top of the hull as it cuts.

ROUTING CHANNELS. The box below shows how to cut the longitudinal channels. First, cut a piece of masking tape to the length of hull's circumference (Figure 1).



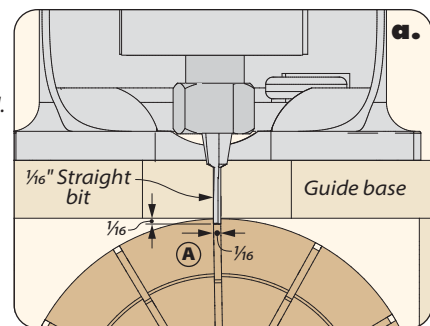
To ensure it's square, keep it aligned to one of the lateral channels. Then remove the tape and divide the strip into twelfths (detail 'a'). These will mark where the bit needs to cut the channels.

Now, wrap the tape back around the hull, as in Figure 2. Set the hull in the jig, align one tape mark with the router bit, clamp the sides, then cut the channel, then turn and repeat.

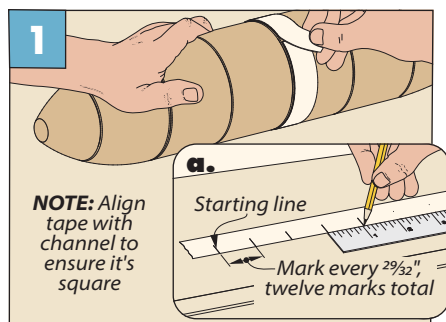
WINDOW HOLES. With all the channels cut, we can drill a pair of

holes (details 'a' and 'b' on the previous page). These will hold acrylic balls to create the lower observation windows and can be made at the drill press using a Forstner bit.

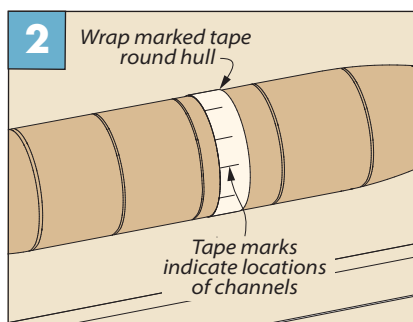
That completes our immediate work with the jig, but don't discard it just yet. As you'll see, we'll need it to cut some mortises down the road.



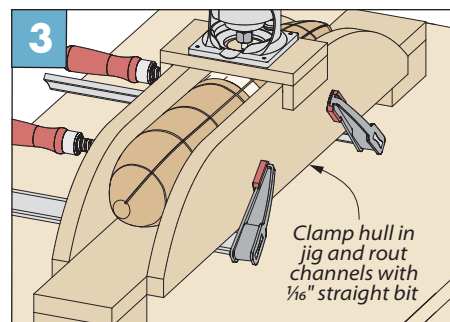
LONGITUDINAL LINES



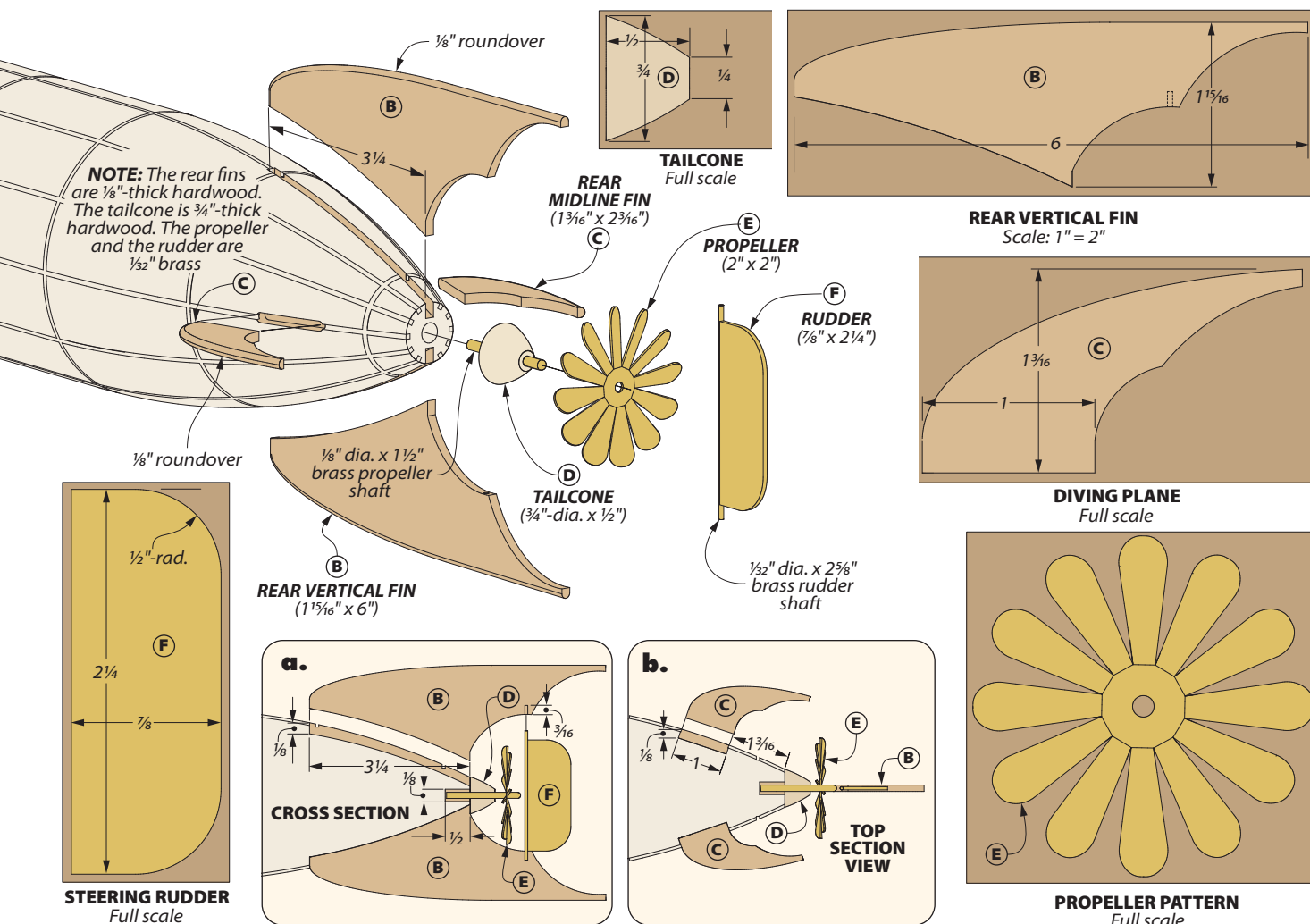
Mark the Tape. Divide a strip of tape as long as the circumference of the hull into twelfths as a guide.



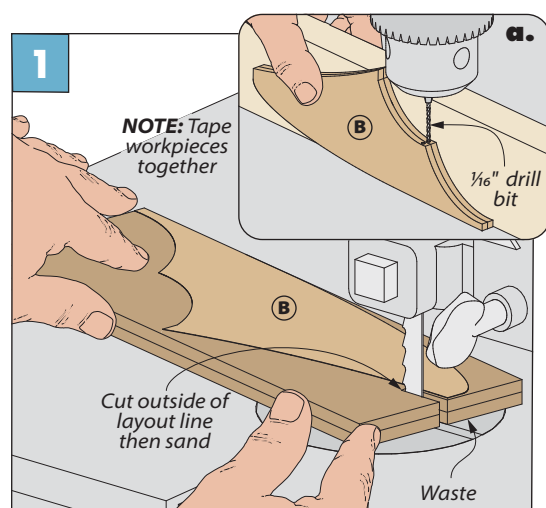
Reapply. Wrap the tape back around the hull. The lines now indicate where you will need to rout.



Routing Channels. Align the marks on the tape to the bit, clamp the hull in the jig, then rout along the workpiece.



MAKING THE REAR FINS



Cut & Drill. Gang cut the rear fins at the band saw, then sand them to shape. The vertical fins also need holes to accept the rudder shaft.

Adding the **TAIL ASSEMBLY**

Following the hull, the tail assembly was next. As you can see above, this includes rear fins and a tailcone, along with a brass propeller and rudder.

REAR FINS. The rear fins are made of thin mahogany to match the hull. You can see the patterns above. The key is making the pairs identical, which can be done by sticking the blanks together with double-sided tape, as in Figure 1 at left. The vertical fins also have minuscule holes for the rudder shaft (detail 'a'). Next, peel the fins apart and sand roundovers onto their front edges for a hydrodynamic look (main illustration).

TAILCONE. The tailcone is the next addition. For a contrasting

accent, we used maple. Rather than just sizing this small part, I recommend mounting a larger blank in your lathe, shaping the tailcone on its end, then cutting it free. The curve here is a continuation of the hull's tail end, so use that radius of the template to guide you. Lastly, drill a hole through the length of the tailcone to accept the propeller shaft (details 'a' and 'b').

PROPELLER & RUDDER. The last two pieces of the tail assembly are brass. Template cutting is the main work here. Chris discusses cutting metals on page 18, so you'll find more on cutting these there. One thing to note is the propeller fins: you'll need to twist them slightly after cutting.

These parts also need shafts. We used brass rod and soldered them on during assembly. Due to their small size though, CA glue will also suffice here — but we'll get there in a moment.

NOSE ASSEMBLY

Looking forward, the nose assembly was next to address. After the tail assembly, much of the work here should be familiar.

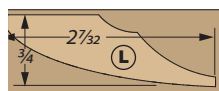
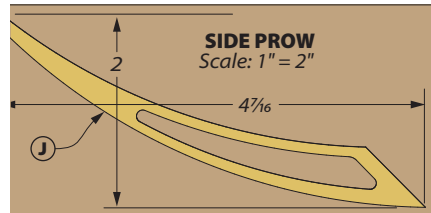
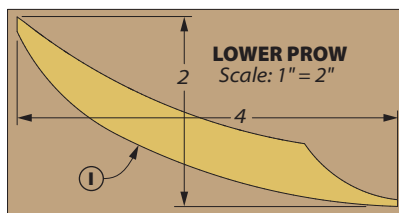
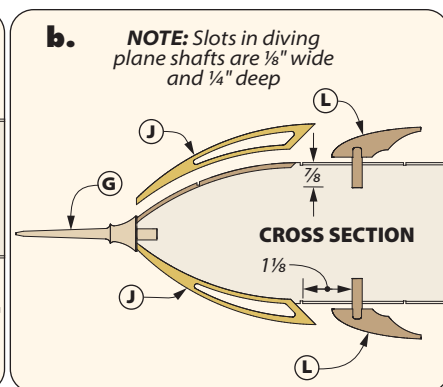
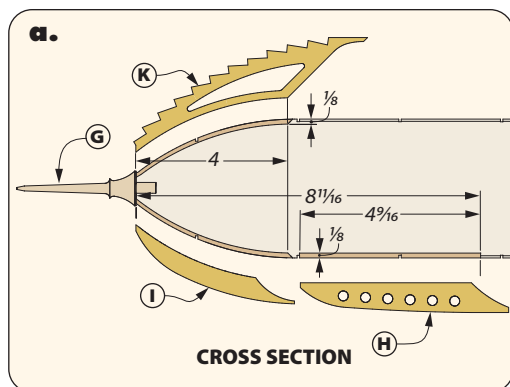
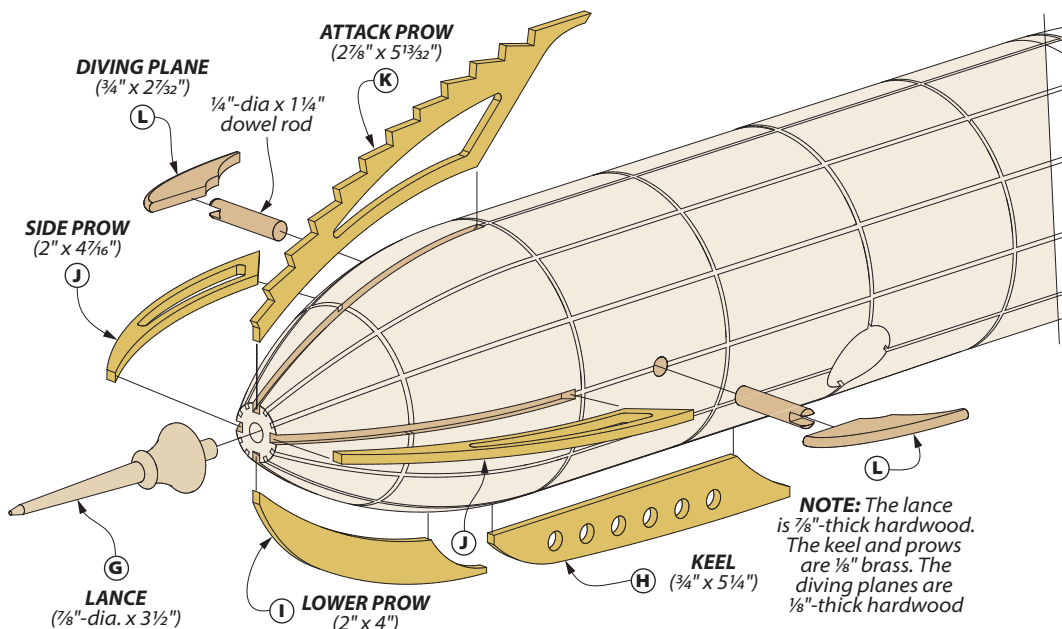
LANCE. The lance is a small, turned piece of maple. After rounding the blank, lay out the crests and troughs, then cut those points to their diameters (pattern below). Smooth the crests and troughs together (except for the tenon and shoulder) and cut the lance free.

KEEL & PROWS. There are four prows at the front of the model and a keel below. Chris shows shaping these on page 18.

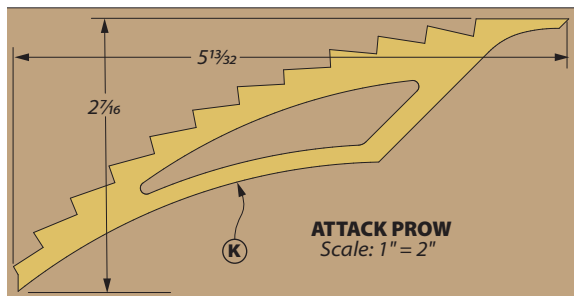
DIVING PLANES. Diving planes are rotating fins that control the pitch of a vessel. For our purposes, we made them as we did the tail fins. Where the contrast comes in is the dowels that secure them. These insert into the hull's sides, and have a slot to accept the planes (detail 'b' above). I cut these slots at the band saw, then sanded a round-over on the cut ends.

GROOVES & ASSEMBLY. Finally, cut the grooves for the fins, keel, and prows. These are routed using a straight bit and the jig from page 57. Drill the holes for the diving plane shafts, too. Additionally, flip ahead to page 61 and take a look at detail 'd.' There's a hole to accept the dowel for the stand you'll want to drill now as well.

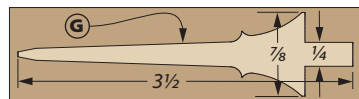
Now, parts can be glued up. The tailcone is first, followed by the propeller and its shaft. The fins come next, with the rudder shaft pinned between the vertical fins. On the front, each part simply needs to be glued into its respective hole or groove.



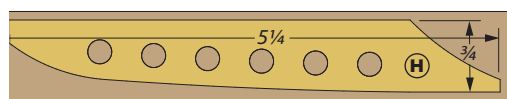
DIVING PLANE
Scale: 1" = 2"



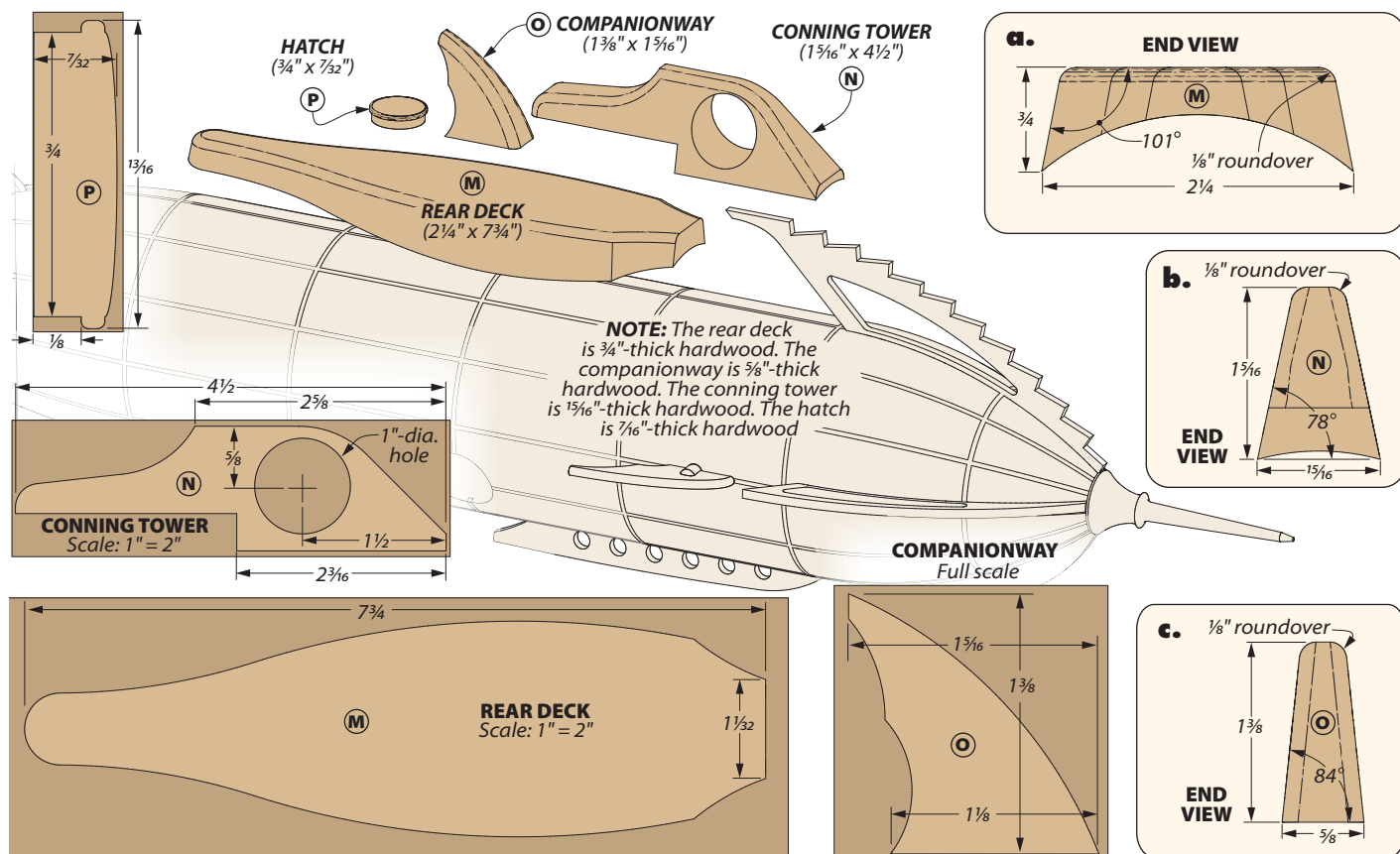
ATTACK PROW
Scale: 1" = 2"



LANCE
Scale: 1" = 2"



KEEL
Scale: 1" = 2"



Building the BRIDGE

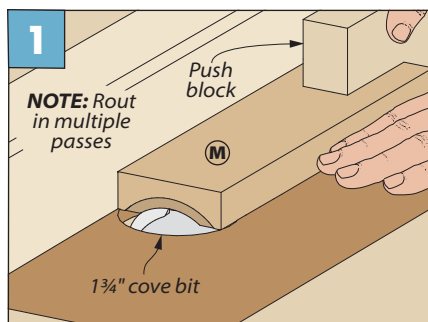
The midship is our last area of focus. You can see the layout of the bridge above: the rear deck provides a platform for the back end of the conning tower, the companionway, and the hatch.

COVERED BOTTOMS. Because the rear deck and conning tower both sit directly on the rounded top of the hull, they'll need covered bottoms to match. Figure 1 below shows how this was done.

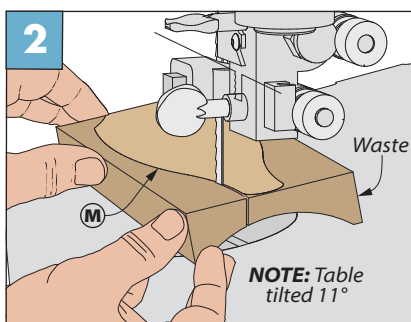
SHAPING THE BRIDGE. The deck, conning tower, and companionway were cut to the patterns shown at the band saw.

The bevelled sides are made by tilting the band saw table (Figure 2). For the conning tower, drill the observation window before shaping (Figure 3). The conning tower and companionway taper upward (details 'b' and 'c'). This is done easiest by scribing the taper on the ends and shaping with a block plane.

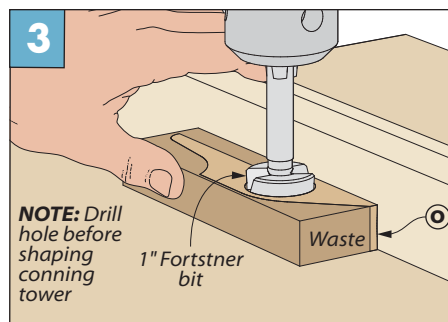
CREATING COVERED PARTS



Cove Routing. Cut the coves at the router table using a cove bit. This curve matches the radius of the hull.



Deck Profile. Shape the rear deck at the band saw. Tilt the table to create the beveled sides.



Upper Observation. The conning tower also contains viewports. Drill the hole for these using a Forstner bit.

HATCH. The hatch was made in a similar manner as the tailcone on page 58, save that it's mahogany. It begins as a part of larger blank, being rounded and shaped on the end, then cut free.

ASSEMBLY. The four bridge parts are glued in place: the rear deck first, then the conning tower, companionway, and hatch on top. A quick-set glue works well, as you can simply hold the parts in place until it sets.

VIEWPORTS & STAND

We're on the home stretch now. The finale will be adding the observation windows and mounting it on the stand.

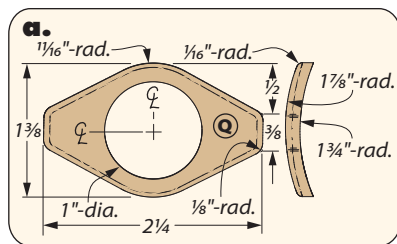
LOWER VIEWPORTS. The viewports begin like the deck. Size a blank that both ports can be cut from, then use a cove bit to rout a channel on the blank's bottom.

While still one blank, drill a hole in each viewport, as in detail 'a' above. Use detail 'a' to help you cut the viewports at the band saw as well, then sand them to their final shapes.

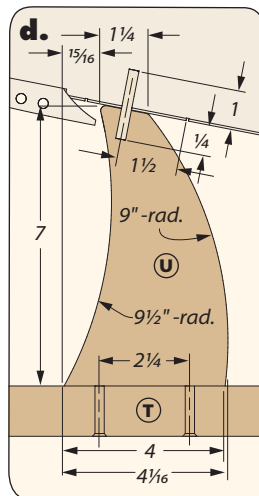
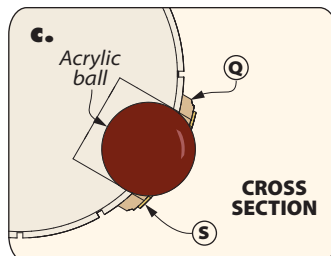
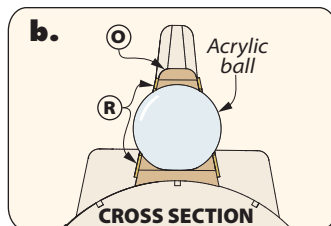
Last on these, you'll need to curve their tops. Due to their size, this is best done by hitting them with a block plane.

WINDOW BEZELS. Round pieces of brass form the window bezels, which accent the viewports and retain the windows within. As with the other brass parts, you'll find more on these on page 18.

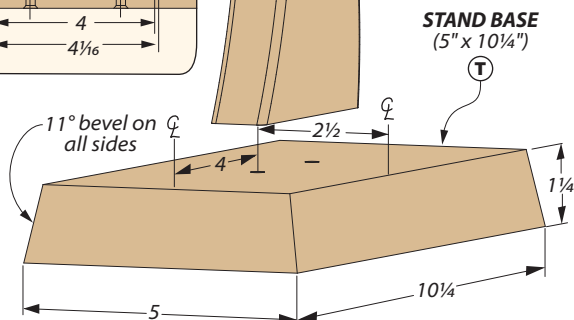
The "windows" themselves are acrylic balls. Insert them into the holes and secure them by gluing the viewports and bezels.



LOWER WINDOW BEZEL
(1 3/16" x 1 3/16")



STAND ARM
(4 1/16" x 7")



STAND BASE
(5" x 10 1/4")

NOTE: The lower viewports are 1/4"-thick hardwood. The bezels are 1/32" brass. The stand base is 1 1/4"-thick hardwood while the arm is 1"-thick hardwood

STAND. The model's majesty is somewhat undermined when it's lying on a table. A stand is a more worthy home. This consists of a base and arm. The base's sides are beveled, drawing the eye upward. The arm is arced (detail 'd'), slimming at the top and implying forward motion. The base joins to the arm with woodscrews, and the arm to the model with a dowel.

Materials & Supplies

A Pressure Hull (1)	3 1/2 x 3 1/2 - 20	J Side Prows (2)	1/8 brass - 2 x 4 7/16	S Lower Bezels (2)	1/32 brass - 1 3/16 x 1 3/16
B Rear Vertical Fins (2)	1/8 x 1 15/16 - 6	K Attack Prow (1)	1/8 brass - 2 7/8 x 5 13/32	T Stand Base (1)	1 x 5 - 10 1/4
C Rear Midline Fins (2)	1/8 x 1 3/16 - 2 3/16	L Diving Planes (2)	1/8 x 3/4 - 2 7/32	U Stand Arm (2)	1 1/4 x 4 1/16 - 7
D Tailcone (1)	3/4 x 3/4 - 1/2	M Rear Deck (1)	3/4 x 2 1/4 - 7/34		
E Propeller (1)	1/32 brass - 2 x 2	N Conning Tower (1)	15/16 x 1 5/16 - 4 1/2		
F Rudder (1)	1/32 brass - 7/8 x 2 1/4	O Companionway (1)	5/8 x 1 3/8 - 1 5/16		
G Lance (1)	7/8 x 7/8 - 3 1/2	P Hatch (1)	3/4 x 3/4 - 7/32		
H Keel (1)	1/8 brass - 3/4 x 5 1/4	Q Lower Viewports (2)	1/4 x 1 3/8 - 2 1/4		
I Lower Prow (1)	1/8 brass - 2 x 4	R Upper Bezels (2)	1/32 brass - 1 1/8 x 1 1/8		

Through Dovetails on Your Table Saw



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to build this jig.
(For a limited
time.)

One of the key skills in cutting dovetails is the ability to make consistent angled cuts. Perhaps this is the reason why some folk think of the table saw, at least for cutting the tails. You tilt the arbor to a specific angle and know that every cut is identical.

To cut the pins, however, the blade needs to be vertical and the workpiece rotated in relation to it. By this point, the various setups feel complex. Allow me to persuade you to transform your dovetailing by making a table saw jig, first. Follow the link to the plans at Woodsmithplans.com. The jig resembles a crosscut sled, but the fence is adjustable to allow for cutting both the pins and tails.

The jig does more than hold a piece in the correct position. It uses custom-made spacers to

- A digital angle gauge offers good visibility to set the blade angle on the table saw, not to mention it's more accurate than the saw's gauge.



establish consistency across all of your project parts.

TAILS FIRST

The approach I demonstrate here starts with cutting the tails. You then use them to lay out the pins. Before you jump in, cut a few test pieces to guide the setup and give you some practice parts.

LAYOUT. As with any joinery, dovetails start with the layout. Begin by scribing the baseline of the joints on all your parts with a marking gauge. (Feel free to run a pencil along this scored line to increase your visibility.) You only need to mark the sides of the tails on one set of parts since the spacers handle positioning, as shown in Step 1 on the next page. Lots of lines can



▲ Careful setup following simple steps results in crisp, snug-fitting dovetail joints across multiple parts.

lead to confusion, so it's a good idea to indicate the waste areas.

With this jig, the size and spacing of the tails can vary, but the arrangement needs to be symmetrical about the centerline of the workpiece. The space between each tail is limited by the thickness of the saw blade. In practice this means about $\frac{3}{16}$ " is about the minimum.

Tilt the saw blade to match the slope of your tails. I like to use a digital angle gauge to set the blade, as you can see in the lower left photo on the previous page. Some woodworkers may want to go all-in and get a blade ground to match the slope of the dovetails. You'll see that kind of blade reflected in these photos.

FIRST CUTS. Raise the blade and make a cut through the jig with the fence set 90° to the blade. Set the blade so the tip just touches the baseline of the tails. This kerf helps determine the location for a stop block and spacers. Align your marked workpiece with the kerf on the waste side of the line. I clamp the piece in place while I position the stop block on the opposite edge.

This is the position for an initial set of cuts at each corner of your tail boards. Rotate and flip the pieces to make each cut. This is shown in Step 2 below.

It comes as a surprise, but that's all there is to cutting the tails. The only difference is that between each set of tails, you slip the appropriate spacer between the workpiece and the



▲ Pencil lines are easy to see and all you need to set up the stops and spacers of the table saw jig. Scribe the baseline.



stop block. (The jig plans include information on how to size the spacers to suit your project.) The cuts are simple, but repetitive, so you need to keep your wits about you. Keep an eye out for dust or chips that could wedge between the workpiece, the spacers, and the stop block. This spoils the spacing and affect later cuts.

STEP & REPEAT. Step 3 and the main photo on the previous page show the continuation of the process as more spacers are added. Once you cross the centerline of the workpiece, the shape of the tails is revealed.

SOME HANDWORK.

A small amount of waste remains between each kerf in the waste areas. Smaller bits lurk in the very corners if you're using a regular blade. The remedy is shown in Step 4 below. After all the table saw cuts, some handwork at the bench offers a welcome change of pace.

Sharpen a narrow chisel to chop out the waste. Flip the piece so that you work in from each face to avoid tearout. The edge of your chisel registers in the scribed baseline to ensure accurate placement.



▲ A stop block registers your workpiece for the first cut. Be sure to rotate and flip the piece as needed.



▲ Slip a spacer between the workpiece and the stop block to set up for the second set of cuts.



▲ The table saw cuts leave little waste to remove by hand. The saw kerfs and scribed line guide the way.

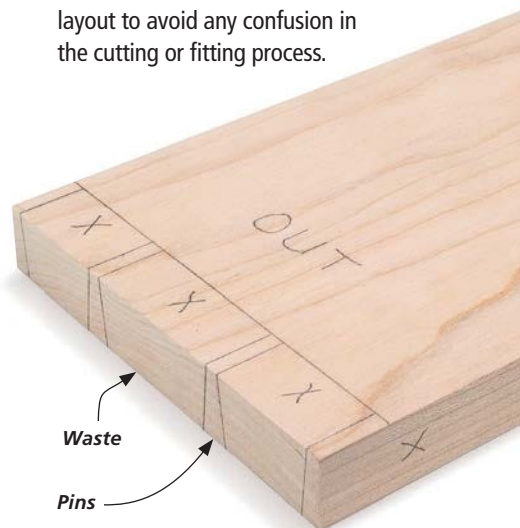


▲ Trace the sides of the tails onto the ends of the pin boards. Sharpen your pencil often to keep a fine point.



▲ Use a small square to extend the lines across the faces of the pin boards and down to the baseline.

▼ Indicate the waste area on the layout to avoid any confusion in the cutting or fitting process.



There's a bit of a reset between cutting the tails and making matching pins. First up is to return the blade to vertical. (Put in a standard blade if you used a special-purpose blade.) When you change the angle, you need to adjust the height of the blade. That's an easy step to overlook.

Angle the fence on the jig to one of the pin-cutting positions. I show it angled back for the first set of cuts.

TRANSFER PORTAL. The actual tails, rather than the numbers in the plans, are the guide for marking the pins. Steps 1 and 2 above show the process. I clamp the pin board in a vise to hold it steady while I trace the tails. Square those marks down each

face of the pin board. Do the same with a test piece to set up the jig and stop. Fine lines are your friends here, so don't let your pencil get too dull. Remember to mark the waste area between each pin.

THE FIRST PIN. Step 3 picks up the process. Line up the pin board with the waste side of the first pin and slide the stop block in place. Make a cut and compare the placement with its matching tail, as shown in Step 4. The idea is to nibble your way closer to perfect alignment in a few cuts. Be sure to nudge the stop block with each pass.

Once the stop block is dialed in, you're ready to start making hay. Set one of your project parts

in place and make a cut like the one shown in Step 5. Then turn the board around keeping the same face against the fence to make the same cut on the opposite corner. Hold off on the other two corners. They get cut later. Repeat this cut on all of your pin boards. You can see why accurate marking, labeling, and organizing are important here.



▲ Position the stop block so the size of the first pin matches the tail workpiece. Then, make a cut on both ends of all the workpieces.



▲ Sneak up on the final size of the first pin until it matches its mating opening in the tail workpiece. This is the final position of the stop.



▲ After making one cut, flip the workpiece and make a cut for the pin at the opposite corner. Keep the same face against the fence.



6 ▲ Add a spacer and make the next set of cuts. With the last spacer in place, cut all the workpieces to complete one angle.



7 ▲ After adjusting the fence to angle forward, reposition the stop block to form a complete pin on the workpiece.



8 ▲ Then, install each spacer in turn to complete the remaining pins, cutting on opposite corners.

SPACER SEQUENCE. Bring back the spacers to this side of all the remaining pins. The same advice applies for pins as for the tails. Your initial marked workpiece is your standard to gauge your progress. Step 6 above shows the results.

A NEW ANGLE. To cut the other side of the pins, you need to reset the fence to its third position so that it angles forward. You need to reset the stop block and follow the steps we just worked through for this side of the pins. Step 7 highlights the differences in what this looks like.

Spacer blocks come next as you work across the pin boards. By now the process should feel second nature.

By the end of the cuts, the pins have been traced by the saw blade. There's still considerable waste to remove. Do that with a progression of nibbling cuts between each pin. You can see this in Step 9. It takes time, but not as much as you think it might. Pay attention here. You don't want to cut into the side of the adjacent pin.

CHISEL TIME. This stage of cuts leaves small, wedge-shaped

waste areas alongside each pin. Back at the bench, trim it away with your chisel, as you can see in Figure 10.

The moment of truth arrives when all the waste is gone. Test the fit of the joint. The steps I've outlined err on the side of a too-tight fit, but aim for the parts to come together with firm hand pressure. If you can press the parts halfway, as Step 11 shows, then you've made it.

More than that, you've learned a new skill and taught your table saw a new trick. Not bad for an afternoon's work. **W**



9 ▲ Remove the spacers the remove most of the waste with a series of cuts between each pin location.



10 ▲ Just as with the tails, so also with the pins, remove the last bits of waste with a chisel, working to the baseline.



11 ▲ The pins should be sized so they just slide into the tails. If they're too tight, you'll need to fine-tune the pins.

Sources

Most of the materials and supplies you'll need to build the projects are available at hardware stores or home centers. For specific products or hard-to-find items, take a look at the sources listed here. You'll find each part number listed by the company name. See the left margin for contact information.

MAIL ORDER SOURCES

Project supplies may be ordered from the following companies:

Antique Hardware Supply
734-728-8890
antiquehardwaresupply.com

Diablo Tools
diablotools.com

Festool
festoolusa.com

Marshalltown
800-888-0127
marshalltown.com

McMaster-Carr
630-833-0300
mcmaster.com

Old Masters
800-747-3436
myoldmasters.com

Parts Express
1-800-338-0531
parts-express.com

Rockler
800-279-4441
rockler.com

Woodcraft
800-535-4486
woodcraft.com

TIPS & TECHNIQUES (p.6)

- **Marshalltown**
Grout Floats RRF94F

CLEAN JIG SAW CUTS (p.14)

- **Diablo Tools**
Fine Cut Blade DJT101BF5
Scroll Cut Blade . . . DJT101AOF5
Ultra-Fine Cut DJT308BFP5
- **Festool**
Straight Cut Blade 204261
Curve Cut Blade 204265
Fine Cut Blade 204256

METALWORKING TOOLS (p.18)

There's a low barrier to entry for metalworking tools. Find quality tools at hardware stores, home centers, and even discount tool stores (you know who I mean). The one that stumped me was the nibbler.

- **McMaster-Carr**
Nibbling Tool 3623A24

NOOK TABLE & CHAIRS (p.26)

We chose to finish the table and chairs of the breakfast nook with linseed oil, which really brought out the warmth of the cherry. Alternative, poplar and pine would make fine woods to build this set from, and would look excellent with coat of paint overtop.

TOOL TOTE (p.36)

The tote requires no hardware. If you don't have a box joint jig, you can find plans for one at WoodsmithPlans.com. Walnut looks its best with a coat of oil to bring out the chocolately browns. We used tung oil from *Old Masters*. A couple coats are all that's needed. It will acquire dents and dings from use that only add to the look.

COLLECTOR'S BOX (p.42)

You may be tempted to mortise the hinges without using *Rockler's* jig and template. I recommend against that plan. Quadrant hinges are tough to keep aligned, and you'll spend a lot of unnecessary time accomplishing the task.

Since we used cherry for the box, I applied a coat of *Old Master's* tung oil varnish to draw out the warm tones. Then a coat or two of paste wax give this project all the protection it needs.

- **Rockler**
Quadrant Hinges 24300
Hinge Mortising Jig 58822
Hinge Template 51331

NORDIC CHEST (p.48)

We used our standard shop finish on the chest of drawers:

a couple coats of flat, pre-catalyzed lacquer. It doesn't add much color to the oak plywood, and I like how this looks. You get a similar effect with water-based finish like *Old Master's* Masters Armor.

- **Antique Hardware Supply**
1½" Art Deco Knobs SH125US26
- **Rockler**
18" Drawer Slides 47648

NAUTILUS SUBMARINE (p.54)

Most of the hardware for the submarine can be ordered from *McMaster-Carr*. Additionally, I've included an SKU for a ¼" parting tool made by *Robert Sorby* and retailed by *Woodcraft* for turning the channels in the hull.

The green in those channels was made by spackle mixed with green dye. You'll want to add the spackle after you finish the rest of the model (Chris went with a wipe-on varnish) so the spackle only adheres to the channels.

- **McMaster-Carr**
½" Brass Stock 8956K124
⅜" Brass Stock 8954K148
⅜" Brass Rod 8953K101
½" Brass Rod 8859K481
1" dia. Acrylic Ball 1383K58
- **Woodcraft**
¼" Parting Tool 124054

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