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Vol. 45 / No. 268

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- Balance Bike
- Dining Table
- Entry Bench
- Songbird Tower



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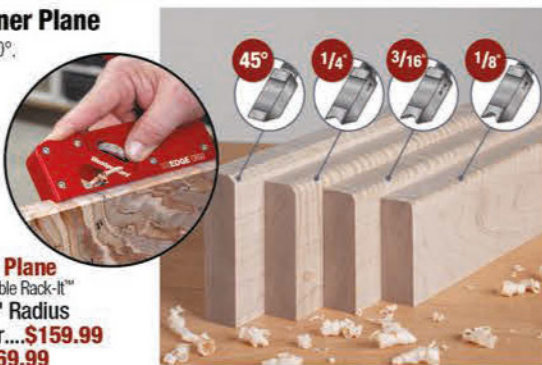
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from the editor Sawdust

There are many ways to measure success in a woodworking project. Here are two I look for. I like feeling the confidence in executing a well-honed skill during the course of building a project. It might be a joinery method or shaping appealing profiles by hand.

The other benchmark is getting to try something new. A prime example is the ebonizing process on the kitchen table (page 34). Shop manager, Marc Hopkins had never done the home-brew process highlighted in the article. Before the final coats of lacquer went on, the table base looked chalky and uneven. He was frustrated. Once the lacquer hit, you could see his face light up. It's a look you can't match with stains or dyes.

One bonus one. While taking the photos for our balance bike (page 28), our two models, Christian and Julian (shown below) broke into huge grins taking turns riding the bike in the park. That kind of joy flows back to the builder. It's a big reason we make projects in the first place. Thanks guys.

Happy woodworking.

Handwritten signature



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designer project

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designer project

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READER'S Tips

Low-Cost Drill Press Table

One of the best upgrades you can make for a drill press is to add a larger table and a fence. While wandering the home center, I found an easy way to make them — slat wall panels.

Both the table and fence are made from pieces of the slat wall panels. I laminated a backer of particleboard to the slat wall for added stiffness, as in the drawing below.

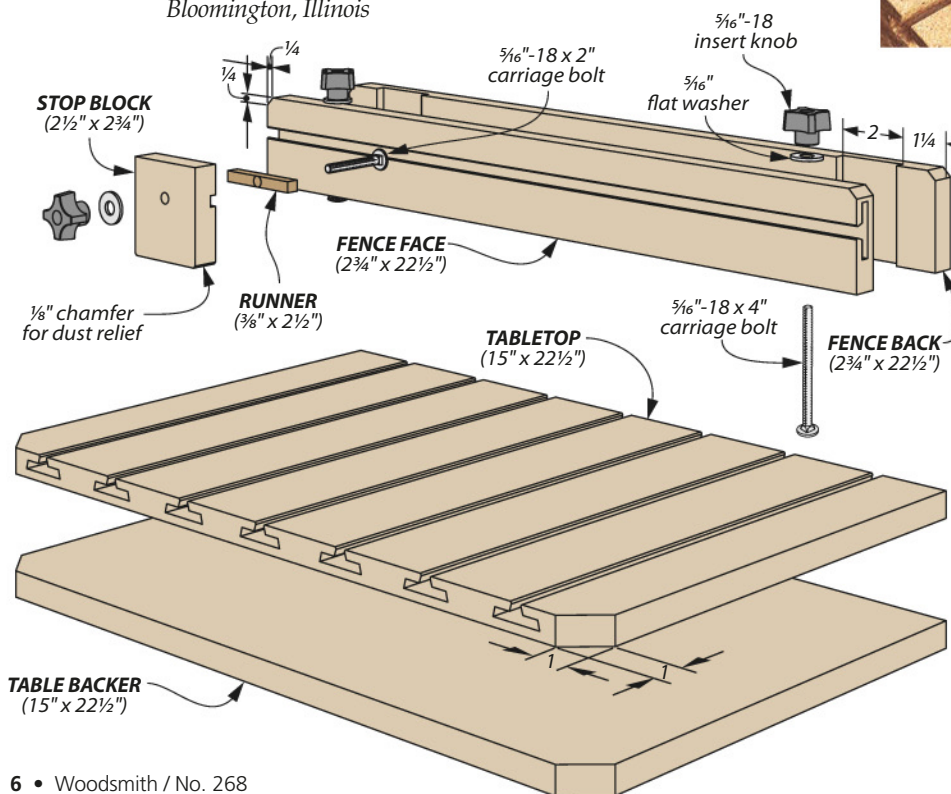
The T-shaped slots are perfect for adding accessories: hold-downs in the table and a stop block (or two) for the fence. Speaking of the fence, I cut a pair of dadoes in the fence backer prior to gluing it up. This forms slots used to secure and adjust the fence to the slots in the table, as shown in detail 'a.'

There are just a few other details to point out. Due to the size of the slots, I found that carriage bolts work best in the slots for the stop block and hold-downs. Then to ease the sharp edges, I added generous chamfers to the corners.

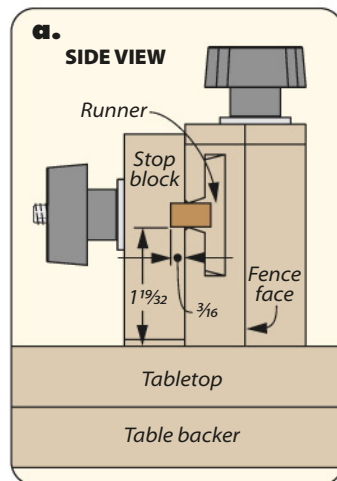
*Mike Heidrick
Bloomington, Illinois*



Having plenty of slots in the table ► gives you a lot of options for positioning accessories to suit workpieces of all sizes.



NOTE: Tabletop and fence face are made from 3/4" slat wall panel. Table backer, fence back, and stop block are 3/4" particleboard. Runner is cut from 5/16"-thick hardwood





Honing Gauge

In order to simplify setting the bevel angle on tools for sharpening with my honing guide, I made this setup gauge. As you can see in the photos, my honing guide has a lower position for chisels, and a upper location for plane irons.

Hardboard stops on the gauge position chisels and plane blades for two different angles each. I chose 25° and 30°. The guide will square the blade, while the gauge's hardboard sets the distance. You can use

a protractor to determine the location of the stops. Just be sure to label them for easy reference. This gauge allows me to quickly set up the proper angle for sharpening and honing chisels and plane irons.

*Don Joyle
What Cheer, Iowa*

◀ A honing gauge provides consistency for sharpening both chisels and plane blades with a guide. The result is square cutting edges in less time.



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- Adam D.

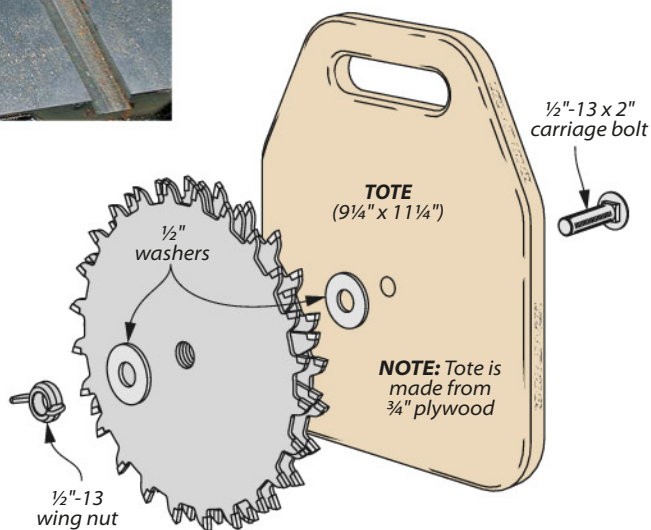
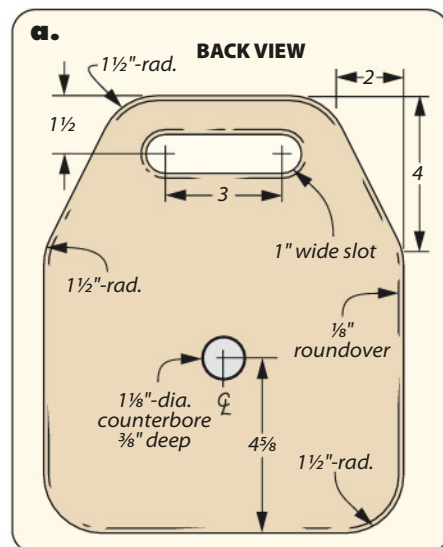
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Dado Blade Tote

There's no doubt that a dado blade is a great accessory for a table saw. The only issue is keeping track of the scoring blades, all the chippers, and the shims. Here's one easy shop-made solution — a plywood tote. Detail 'a' provides all the details for sizing the tote.

A carriage bolt recessed and epoxied in the back face is the anchor point for all the dado blade bits and pieces. A couple washers and a wing nut secure the components for transport. A handhold cut into the top of the tote works for both carrying and hanging the tote on the wall.

*Millicent Doyle
Rostlogan, Pennsylvania*

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▼ The tapered sliding dovetail locks the lid to the back securing the drawknife in place. A thumbscrew pins the lid closed.

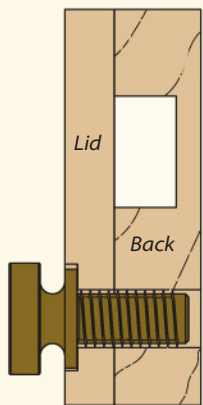
Drawknife Cover

I made this drawknife cover to protect the sharp blade from getting damaged — and from injuring me. It consists of two parts: a front and a back. I traced the shape of the drawknife on the back and cut out the shape with chisels and a router plane. (White pine made this easy, fun work.)

The front is thinner and starts as an extra-long blank. I marked angled lines to define the lid and cut it with a hand saw tilted a few degrees. The pieces on either side of the lid get glued to the back and cut away to allow access for the drawknife. A counterbored clearance hole in the front and a smaller one in the back accept a thumbscrew to pin the front in place, keeping the cover closed.



a. SIDE SECTION VIEW

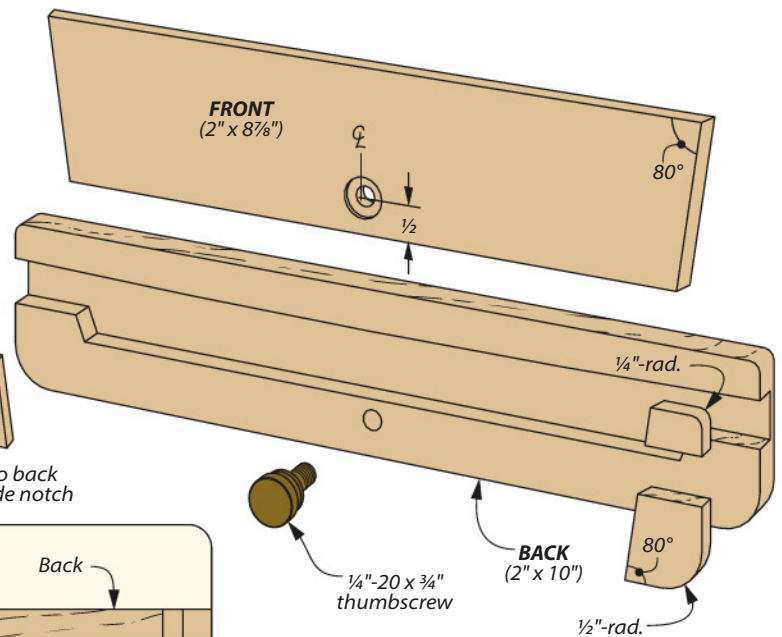
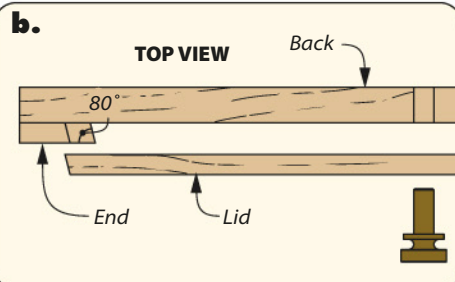


Shallow counterbore for thumbscrew

Phil Huber
Urbandale, Iowa

END
(2" x 1 5/16")

NOTE: Glue end to back before cutting blade notch



QUICK TIPS



Cleaning & Organizing Tray. *Eric Oslund of Millersville, MO* uses ice cube trays to corral small bits of hardware during project construction. The trays also come in handy for minimizing the mess while cleaning and lubricating tiny machine parts like the rabbeting bit set shown here.



Brush Rest. *Barry Waphulkuhn of Hobbs, NM* found yet one more use for a worn-out pool noodle — a brush rest. He cut a short section from the noodle then “resawed” a slice down the length to create a curved bumper. Small notches cut in the foam prevent brushes from rolling or tipping.

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Sandpaper

A lot of folks moan, groan, and do toddler flops when thinking about the task of sanding. I'll admit that sanding isn't high on the list of my favorite duties, but it's one of those instances where you need to put on your big-boy pants and tackle

the job properly. After all, you've spent a lot of time and money up to this point on your project — why have it fall short because of a poor surface preparation?

In *Woodsmith* 267 we focused on working with the dynamic duo of the belt sander and the random orbit sander — tools that mostly are used to aggressively shape wood.

Here we'll go into a little more depth about sanding by hand, the types of sandpaper available and what they do, then we'll finish up with some other accessories and abrasives that are available to help you reach the goal of a fine-looking project.

I use sandpaper throughout the stages of building a project — fine-tuning a joint, easing

edges, smoothing boards (photo above), and sanding between coats of finish. But there's more to sandpaper than getting smooth surfaces. Understanding how different types of sandpaper work helps you choose the right material for the job and get better, faster results.

When it comes to sandpaper for woodworking, there are four commonly used abrasives — garnet, aluminum oxide, silicon carbide, and alumina zirconia (ceramic). Each type has its own unique characteristics and working properties, as you can see from the chart at the top of the next page.

FRIABILITY. Some abrasives break easily when heat or pressure are applied. This is know as



► Blocks to back your sandpaper can be like the ones here, and in the photo above. There are some fancy ones on page 16.

PICK THE BEST PAPER FOR YOUR TASK

	Garnet	Aluminum Oxide	Silicon Carbide	Alumina Zirconia Ceramic
Hand Sanding	☒	☒	☒	☐
Power Sanding	☐	☒	☒	☒
Wet Sanding	☐	☐	☒	☐
Bare Wood	☒	☒	☐	☒
Painted Wood	☐	☒	☒	☐
Clear Finish	☐	☐	☒	☐
Metal	☐	☒	☒	☒
Plastic	☐	☒	☒	☐

friability. Depending on the amount of breakage, the abrasive is said to have a high or low friability rate. Highly friable abrasives break down easily, continually creating new, sharp surfaces. Abrasives with low friability tend to dull or round over faster.

HARDNESS. Another important factor in sandpaper is the relative hardness of the abrasive material. The different

types of sandpaper have varying degrees of hardness. (Hardness is measured by testing with a diamond.) But hardness is no indication of friability, as you'll see.

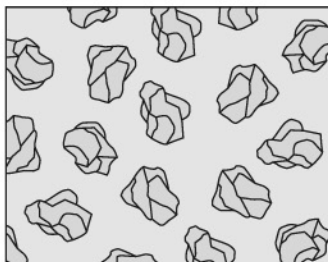
GRIT. Another attribute of sandpaper to consider is the volume of grit that's coating the paper. The box below talks about the difference between open and closed-coat papers.

OPEN- VS CLOSED-COAT PAPER

Two Choices. There are two ways to apply grit to paper — open-coat and closed-coat. These terms refer to the spacing of the individual grains of abrasive, which has a direct bearing on the useful life of the sandpaper.

Open Coat. Open-coat paper (above) has wide spaces between the grains. These spaces acts like the gullets on a saw blade and allow the dust to fall away instead of clogging the paper. It helps the sandpaper last longer.

Closed Coat. The grit on closed-coat paper (below) is tightly packed. It's used where loading isn't an issue, such as when sanding metal. Closed-coat paper produces a more even scratch pattern.







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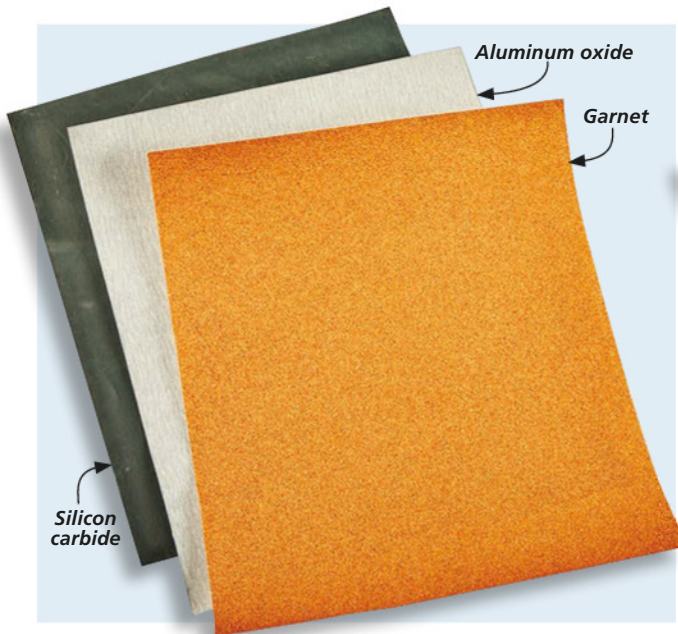
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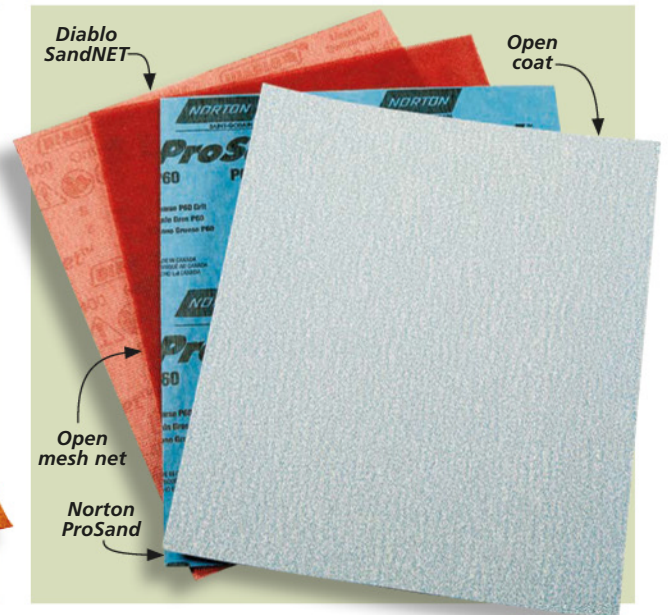
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The Traditional Three



- ▲ The three papers above represent what are historically the trio of sandpapers that you'll find in woodworking, metalworking, and auto body repair shops.

Proprietary Versions



- ▲ The red mesh sandpaper is coated with a "ceramic blend" of abrasive and can be washed and reused. The sandpaper in front is aluminum oxide with "next generation" technology.

WHAT'S IN A NAME?

There are no laws or regulations stating that manufacturers have to identify the type of abrasive they're using on their sandpaper. With that in mind, look at the two photos above. On the left are the papers that go by the names of traditional abrasive minerals. On the right there are two papers that are coated with proprietary versions of alumina zirconia (ceramic) and aluminum oxide abrasives. Now let's take a peek at these abrasives.

GARNET. Garnet is a naturally occurring mineral used as gemstones and as an abrasive. It has a low friability rate, so the tiny grains on this sandpaper don't break. But that doesn't mean the paper lasts longer during use. In fact, it's the opposite.

Garnet tends to round over quickly, which means the grains won't cut as effectively after they've dulled. But rounded grains aren't entirely bad when you're sanding bare wood.

Garnet's limited friability actually makes the sandpaper

better at sanding end grain. Because the grit dulls easily, it does a nice job of burnishing the wood rather than cutting through it, like other sandpaper abrasives. Burnishing seals end grain and results in a cleaner surface. Plus, the burnishing effect also produces a softer scratch pattern, which results in a smoother feel to bare wood.

The wear factor of this sandpaper makes it a poor choice for power sanding. For this reason it's best used for final hand sanding to create a satiny surface.

I have a nostalgic tie to this inexpensive paper from times spent in my grandfather's shop. So I keep plenty on hand to use, and share with my grandkids.

ALUMINUM OXIDE. Aluminum oxide is the most common mineral used to make sandpaper for woodworking. This man-made mineral is as hard as garnet but it has a higher rate of friability. The particles break easily during use, creating renewed cutting edges. As a result, it lasts longer and sands just about any

material — bare wood, painted surfaces, metal, or plastic. Because of its versatility, aluminum oxide is the workhorse of the woodworking shop.

But there are drawbacks to this type of paper too. Since the grains fracture so easily, some grains become smaller and others remain large, which results in an uneven scratch pattern on the wood surface.

Aluminum oxide is not as sharp as garnet. The particles have a rounded, chunky shape, though it still produces a surface that will take a finish well.

SILICON CARBIDE. Silicon carbide is the sharpest mineral mentioned here. The grains are glass-like shards with super-sharp edges that make it great for cutting through dried finishes.

The particles break down easily and create new edges when used on hard surfaces. These edges are good at removing rust from metal, old finish from wood, or removing fuzz and debris between finish coats, but not as useful on bare wood.



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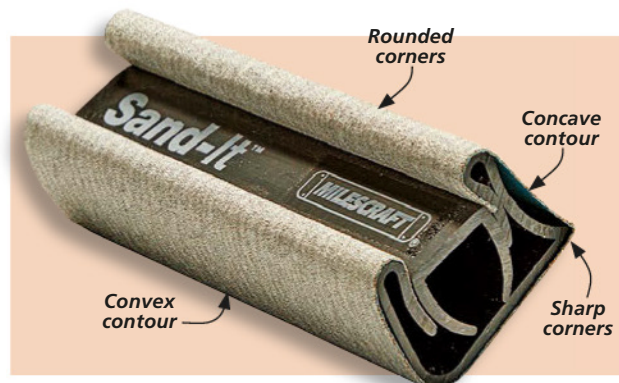
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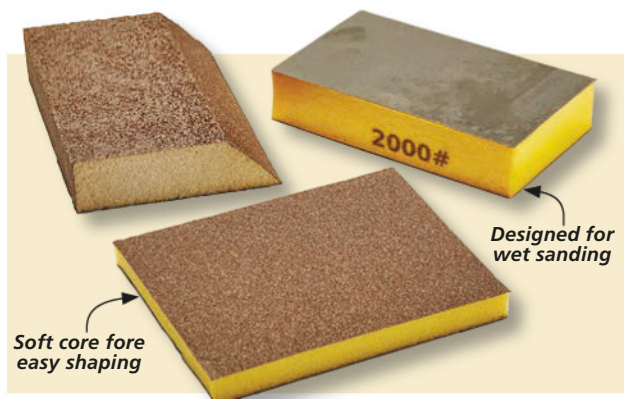
Router not included.



- ▲ This sanding block from *Stikit* has the added feature of holding a roll of self adhesive sandpaper in the front of the block. When the paper is dull, just pull out a fresh section and trim the end.



- ▲ The extruded profile of the *Sand-It* block from *Milescraft* offers multiple contours for detail sanding. To change the paper, pry the sides open and slide out the core.



- ▲ Sanding blocks with foam cores come from *3M*, *Norton*, and a host of other manufacturers. They're versatile products that are made in a variety of grits for dry and wet sanding.



- ▲ The block that is put out by *Diablo* is a multitasking machine. The foam core has a soft and firm side. The open mesh sheets come in multiple grits and can be used for dry or wet sanding.

The tiny, sharp edges of silicon carbide also produce a uniform scratch pattern. Another reason it's good between coats of finish.

Silicon carbide sometimes has a cloth or water-resistant paper back, so it can be used with a lubricant like water or oil. The backing and ultra-fine grits (up to 3000 grit) make it a good choice for sharpening tools or wet-sanding a finish.

ALUMINA ZIRCONIA. Alumina zirconia (also known as ceramic) is another man-made mineral that really lasts. It withstands high temperatures and heavy use, so it's mostly used on sanding belts and discs. I usually use it for leveling and shaping because its tough nature lets me remove a lot of wood at once.

A sanding belt coated with alumina zirconia will last longer

than most other abrasives. So even though it costs a little more, you won't have to replace it as often as other types of sandpaper.

The only sandpapers in this article that might employ aluminum zirconia are the *SandNET* sheets from *Diablo*, which they refer to as a "ceramic blend."

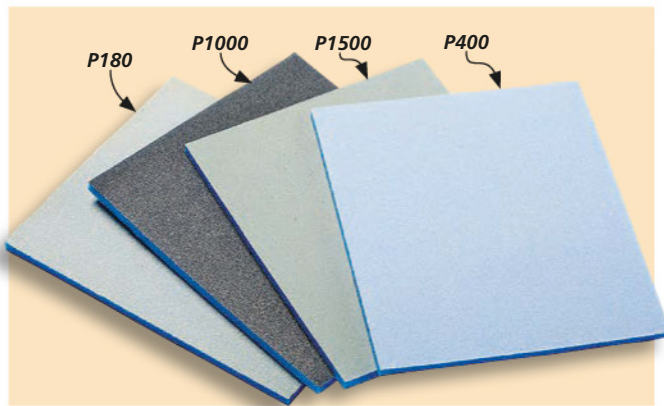
BEYOND SHEETS OF PAPER

Sanding blocks aid your finishing chores in multiple ways. They're great for easing sharp edges and indispensable for reaching tight corners. They also can be shaped to conform to any profile that needs to be smoothed. Back on the first page of this article there's a photo of two sanding blocks. The cork one belongs to Steve Johnson, and the MDF block above it is the property of Marc Hopkins.

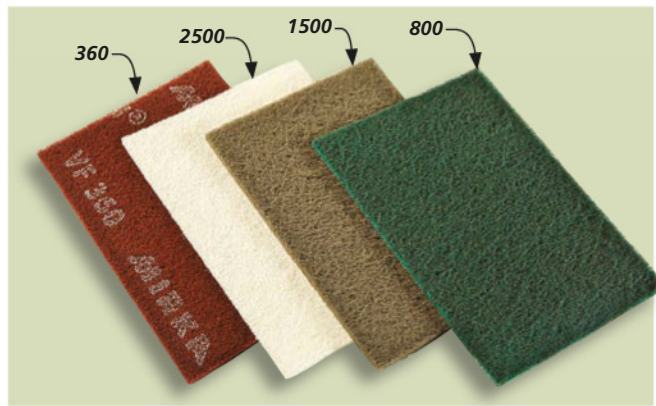
Both said that they keep these humble little blocks close at hand for the reasons I just mentioned. The photos above show examples of how manufacturers have expanded on the concept of attaching abrasives to something other than paper.

SANDING BLOCKS. The top two photos above show worthy upgrades to simple blocks. The block from *Stikit* has a ball-shaped handle that lets you direct the pressure you apply to it. It also stows a roll of self adhesive paper (multiple grits are available) that you can quickly change as the paper dulls.

In the photo to the right, the *Sand-It* block from *Milescraft* you see what amounts to the love child of a sanding block and a French curve. The block has a wide variety of contours, sharp



- ▲ Norton's Soft Touch line of sanding sponges are aluminum oxide particles on soft, easily shapeable sponges that will conform to just about any surface and can be used wet or dry.



- ▲ I know, technically the abrasive pads you see above are not sandpaper. But this quartet from Mirka come in real handy around the shop. These mesh pads redefine the term "open coat."

and rounded edges to tackle most any profile.

SPONGES. Three of the four remaining examples are abrasives that are attached to sponges. They all can be used in dry or wet applications, but to me the block from *Diablo* (lower right photo, previous page) stands above the rest.

The sponge core has a soft and firm side the lets you address flat and contoured surfaces. The open mesh papers attach to the block with something similar to hook and loop technology and can be washed easily.

The photos above show two products that are the thinnest, most supple of all shown here.

I reserve these two for cleaning surfaces between coats of finish. They're washable as well.

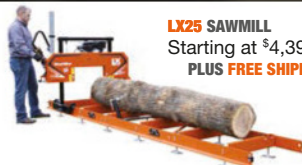
If you keep a variety of grits on hand in these sandpapers, blocks, and pads you'll have what you need for almost every task in your shop. And the results will show in your finished projects. **W**

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Drilling Metals



AN ABBREVIATED HISTORY

Curiously, the drill press has its origins in metalwork before it made the leap into the woodshop. While drills powered by windmills and waterwheels have existed for hundreds of years, the first electric drills came about in the late 1800s.

ELECTRIC DRILLS. The first electric drill was patented in 1889 by two men working at an electrical company in Melbourne, Australia. This first version was quite large, being used in coal mining. A few years later, two brothers in Stuttgart, Germany adapted the design into a portable version they could use in their fabrication shop. Shortly after the turn of the century, electric drills that could be operated by one person alone were in wide production.

Every now and then, it's good to get out of your comfort zone. It gives you time to take a breather from the usual and delve into something (relatively) unknown. For me, this often means crossing over from the woodshop to the metalshop.

I always enjoy a project that involves a bit of metal work (such as the toolbox on pg. 48), and one of the most common operations is drilling. While you may be familiar with the drill press in terms of woodworking, metals can be a different beast. At the left, you'll see our "starter kit," and over the next several pages I'll give you a rundown on the basics before you get boring.



▲ A center punch, cutting fluid, and the right bits are all you need to drill metals. These titanium-coated bits serve better than high-speed steel on metal.

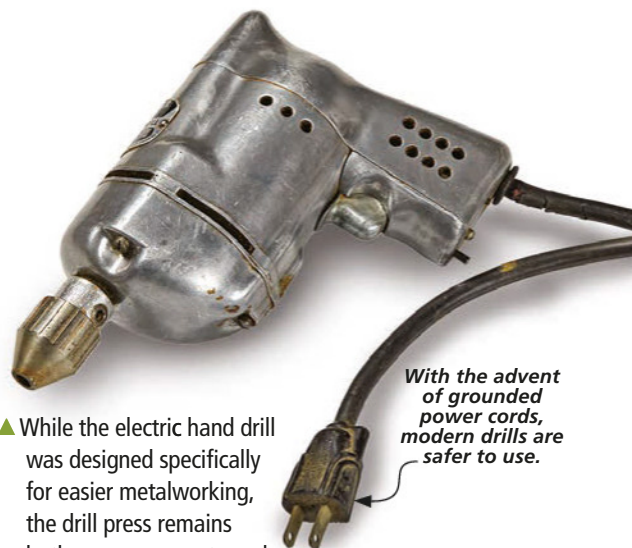
Not too long into the twentieth century, the drill press was born. The drill was mounted upright for a greater mechanical advantage, and tables and fences made drills incredibly accurate. All this massively improved efficiency, and the drill press soon made the jump into the commercial woodworking world as well. Throughout the twentieth century, as production costs became cheaper and power tools became more compact, the drill press became not just a staple tool in commercial shops, but a household necessity for wood and metal workers alike.

THE MODERN DRILL PRESS. Over the last few decades, the drill press hasn't changed much. Technology has allowed them to become much more user-friendly, but the basic design is the same. The fixed, upright head and the table are as accurate now as ever, and the rack-and-pinion lever is still an efficient way to

apply force. Where significant innovations have been made is in the materials of the bits.

BIT MATERIAL. High-speed steel (HSS) is the typical metal used in woodworking bits. This steel works alright on nonferrous metals like aluminum and brass, but there are better options if you intend to work with harder metals, like steel. A HSS bit coated in titanium nitride is the first option — the step bit and twist bits on the previous page have this. The coating provides added hardness and reduces friction, but it will wear off the bit over time.

For a different material entirely, tungsten carbide is the highest-quality option, though it can be costly. Cobalt-alloyed bits are a bit easier on the budget, and still work well on mild and stainless steel. For most woodworkers however, I would recommend getting a set of black oxide bits first.



▲ While the electric hand drill was designed specifically for easier metalworking, the drill press remains both a more accurate and efficient way of drilling.

With the advent of grounded power cords, modern drills are safer to use.

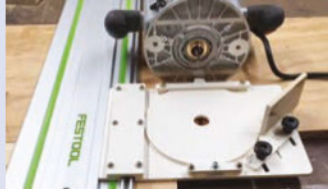
These bits are heat-treated, converting the exterior to black oxide. Like titanium, this coating reduces friction and enhances hardness. However, their biggest attraction is their cost — if you're unsure how much metalwork you'll be doing, this is a great way to stick your toe in without breaking the bank.





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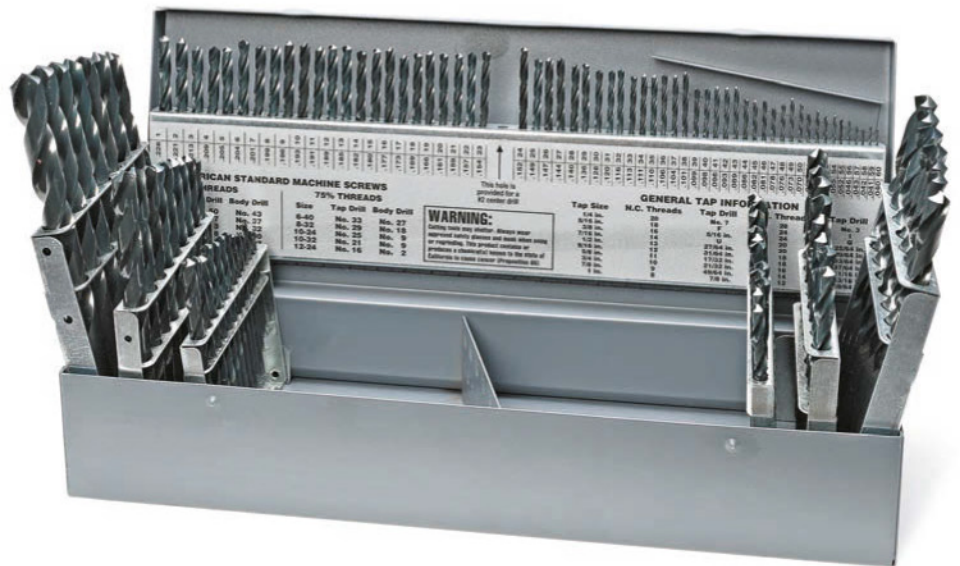
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▲ A wide selection of twist bits is ideal for metalwork, allowing you to work gradually in diameters when drilling.



WHICH BIT IS BEST?

The next thing to look at is what bit to use. A few options are available for different types of metal. Each has its place, and choosing the right bit for the job is the biggest part of the battle.

TWIST BITS. Standard twist bits are the staple of the drill press, and, depending on the metal you're cutting, they work just as well as they do with wood. High-speed steel twist bits can easily drill through aluminum or brass, and even drill small holes in mild steel. However, a material better suited to cutting metal will make a cleaner hole and last longer.

The drawback of twist bits is that they often need to be used in sequence, working up to a

final diameter. Even when using carbide, a bit larger than $\frac{3}{8}$ " will tend to grab the metal and try spinning it rather than cut into it, if there isn't already a hole for it to bore out. Due to that, larger holes will require you to work your way up from a smaller bit to the final one. If you have a series of large holes to make, this can be a painfully slow process.

As with wood, twist bits are a good generic choice. While they excel in depth, they're quite limited when it comes to large diameter holes. Luckily, there are other ways to make broad cuts.

HOLE SAWS. While they're a great choice for rough carpentry, hole saws are often left by the wayside when it comes to fine woodworking. With



▲ Black oxide twist bits are a good balance between cost and quality, for wood and metal alike.

hardwood, a Forstner bit or a router with a circle-cutting jig is cleaner and more accurate. With metals however (and with wider holes in wood), a hole saw is often the best way.

Most hole saws for cutting metal have carbide teeth, and with lubrication they'll cut fairly large holes in aluminum, brass, mild steel, and even stainless steel. Hole saws have a significant advantage over twist bits and step bits on larger cuts, as they remove considerably less material to make the hole. Although they're known for causing rough edges and chipout on hardwood, hole saws cut metal relatively cleanly, usually leaving only a few easily



▲ A carbide-toothed hole saw is an efficient way of making holes over $1\frac{1}{2}$ ". Lubrication is a must, especially for steels.



fileable burrs. All in all, hole saws are a good choice when drilling out any hole beyond 1 $\frac{3}{8}$ "-dia. in metal, though thick blanks of metal can pose issues.

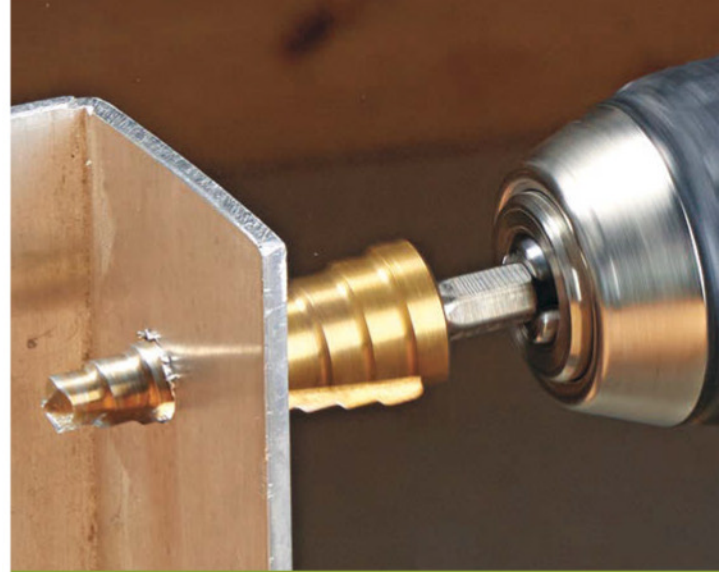
STEP BITS

As the name implies, a step bit is used to "step up" to a final diameter as it drills. These bits cut like a standard twist bit, but their different tiers of diameter save a lot of time that would otherwise be spent changing out twist bits to a final diameter. Their solid, cone shape gives them a stronger driving force than a hole saw, though they are limited in their maximum diameters.

Yet, while step bits are an efficient solution in some cases, they have two big limitations. The first is the height of their "steps." Step bits are limited to use on thin metal stock, as they're meant to drill one step at a time. For most step bits, this range is between $\frac{1}{8}$ " to $\frac{1}{4}$ ", and drilling through

anything thicker would be better done with a twist bit.

The second limitation these bits face is in their maximum diameter. The shorter each step is means a wider maximum diameter the bit can have, but the thinner the material that it's drilling through must be.



▲ A step bit is one of the fastest and cleanest ways to drill through metal. They work well on ferrous and nonferrous metals, though they're limited to use on thinner material.

Step bits that can drill through $\frac{1}{4}$ "-thick material are often only $\frac{3}{4}$ " at their widest, but even the largest step bits rarely go beyond 1 $\frac{3}{8}$ " at their maximum diameter. Despite this, most holes I make are within the bounds of a step bit, and having a quality step bit on hand is certainly helpful.



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▲ A basic center punch needs to be hammered, but the force of the blow works better on harder metals and is often the most accurate method.



▲ A spring-loaded center punch has a self-striking mechanism, making it quick and easy to use. The force it delivers is limited, making it best on softer metals.

PREPARING TO DRILL

Now that we've established what will be chucked into the drill, there's a few pieces of prep-work to be done before drilling. Drilling through metal — especially steel — is more of a challenge than wood, but taking the right steps beforehand can make it just as easy.

CENTERPUNCH. On any hard surface drill bits tend to “wander” until they find purchase, and not always where intended.

Making the first bite into metal can prove difficult. That's where a centerpunch comes in.

There are two types of centerpunches: the standard kind that needs to be hammered, and the spring-loaded kind, with a self-striking mechanism inside. The spring-loaded variety is convenient, as you simply press it down to use. However, I prefer a standard punch with a hammer. Not only can I make a much more distinct divot, but I find I'm also more accurate.

HOLD-DOWNS. Safely drilling metals means securing the workpiece to the table, but clamping a piece to your drill press table can be tricky. The first option — and probably the go-to for many people — is C-clamps. They apply ample pressure, but finding the ideal clamping position can be difficult. For wide pieces, the C-shape may not provide enough clearance, and the ribbed underside to many drill press tables can make locating the right position tricky. Instead, I prefer handscrew clamps.

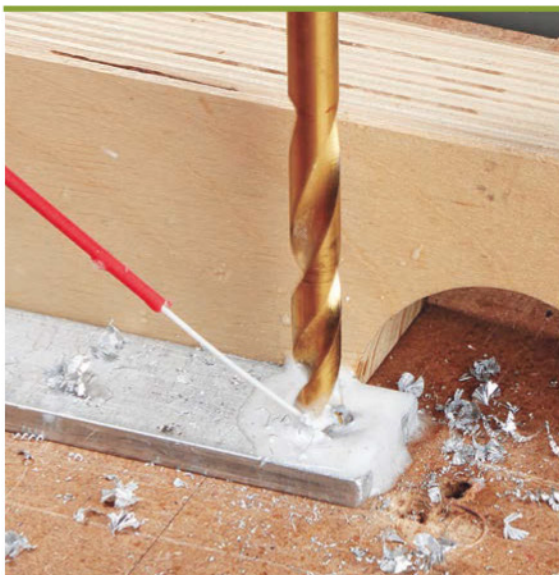
Because of how the tightening works on a handscrew clamp, they're a bit more flexible on where they can be positioned

beneath the table. Additionally, bigger handscrew clamps usually have quite the jaw opening on them, which I find much easier to fit onto a wider workpiece.

CUTTING FLUID. Cutting fluid eases the friction between the bit and metal while also cooling them down. A cutting fluid will reduce wear on the bit's cutters, helping the bit drill more efficiently for longer. Cutting fluid may not be needed on aluminum or brass, but harder metals and larger bits will demand it.

I start out with a bit of lubricant on the workpiece where the bit will first make contact. From there, I add cutting fluid intermittently as friction builds up and the cut becomes more difficult. Not much lubrication is needed for twist bits and step bits, but a hole saw can use a good bit considering its diameter.

There is some contention as to how helpful lubrication really is while cutting metal. Doubtless, it prevents heat buildup and eases bit wear. However, some claim that lubricant prevents the cutters from engaging. While I've never personally had issues, the reduced heat and bit wear is worth it for me.



▲ Cutting fluids reduce friction and heat, improving the quality of the cut and reducing wear on the bit.

SPEED & FEED

One of the trickiest parts of drilling different materials is finding the right speed to use. It depends on a variety of factors. We've made a chart that'll help you find the right speed for what you're working with. In general, a larger diameter bit requires a lower speed, as does a harder material. While this chart will get you started, not all bits are made the same. Be sure to check the manufacturer's recommendations, and err towards the slower side if you're unsure.

One last note should be made on the feed rate. Since the drill press is hand-operated, the feed rate is more difficult to dictate than the speed. Consistency is key, and even pressure combined with lubrication is the way to get through metals. To use another platitude, practice makes perfect. With the basics in hand, drilling holes in metal will soon be a simple task. **W**

Metal Drilling Bit Speed Chart

Twist/Brad Point Bit	Aluminum/Brass RPM	Mild Steel RPM	Stainless Steel RPM
1/16"-3/16"	1250	1700	800
1/4"-3/8"	1000	1250	500
7/16"-3/4"	700	800	300
7/8"-1"	550	350	175
Hole Saws			
1/2"-3/4"	650	500	300
1"-1 3/4"	300	250	200
2"-2 1/2"	200	170	150
3"-4"	100	100	80
5"	75	75	55
Step Bits			
1/4"-3/8"	1500	800	600
1/2"-5/8"	850	450	330
3/4"-7/8"	600	300	215
1"-1 1/4"	400	225	150

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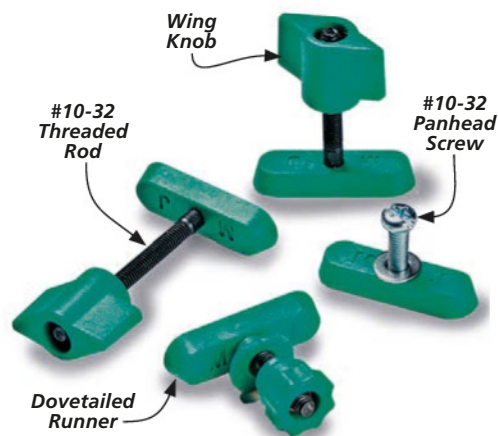
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Staple Improvements



▲ A dovetailed runner, threaded rod, and a threaded knob make up the track screws, while the track nuts feature a threaded rail and panhead screw.

Sometimes the best tools in the shop are simple solutions. And, it can be difficult to innovate on something simple. Too much change and it can become overdesigned and harder to use than need be. Some of my favorite gear are tools that make small, elegant improvements on shop staples.

Which brings me to the focus of this Great Gear: improvements on familiar shop items. The first up is some interesting hardware from *Microjig*. After that, we've got our favorite versions of what's likely to be some familiar faces in the shop. Each of these has its own small but important improvement.

DOVETAIL TRACK HARDWARE

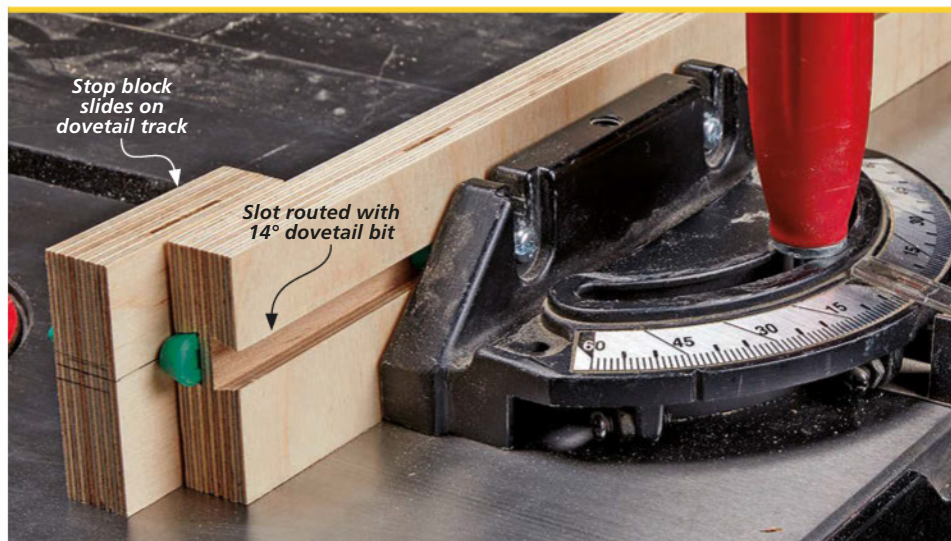
The first products up in line are the hardware sets shown at left. These are nuts and screws featuring a dovetail runner from *Microjig*. They're separated into two kinds: the track nuts, which are panhead screws and washers that thread into the runner, and the track screws, which have a threaded rod mounted to their runners and a knob that threads down overtop. The 1" track screws come with a T-nut as well.

EASY ADJUSTABILITY. Looking at the photo above and on the next page shows one way this hardware can be used, as well as their big advantage. Dovetail tracks are an easy means

of adding adjustability, such as on a jig or on a miter fence with a stop. These tracks are easy to rout, and a few pieces of hardware along with a thin, beveled piece of wood could accomplish the same things as these pieces of dovetail track. However, having them premade is a big time saver. Plus, the tracks are sized for a 14°, ½" dovetail bit — one pass with a router is all it takes to make a track.

TRACK NUTS. The track nuts are ideal in places where you don't want a knob or rod sticking out in your way. In the photo at right, you can see them holding the miter gauge to the fence. These are just #10-32 screws as well, so they can be replaced with longer ones if what you're building calls for it.

TRACK SCREWS. By contrast, the track screws work well for securing something like stop blocks or adjustable fences. The wing knobs on the larger version make them easy to adjust,



▲ Microjig's dovetail track hardware pieces slide through any slot routed by a 14°, ½" dovetail bit. This works well for miter gauges, stop blocks, fences, and any number of adjustable jigs.

and the star knob works well for the smaller, 1" version. Again, the threaded rod on these is #10-32, so they can be swapped out freely with knobs of the same thread type.

All in all, while these hardware pieces can be made in the shop,

I'd certainly say they're worth the buy. Considering the modest cost of these dovetail track pieces, buying the hardware to make the tracks yourself would rack up about the same cost, not even counting the time spent making them.

EASY BLADE CHANGES



Blade Protector. Changing the blade in a table saw is an often overlooked task. I do it so often that it seems to happen automatically — until I find that I've cranked the nut on too tight. The *Blade-Loc* from *Bench Dog* stabilizes the blade while you pry the nut loose, preventing you from damaging the teeth.

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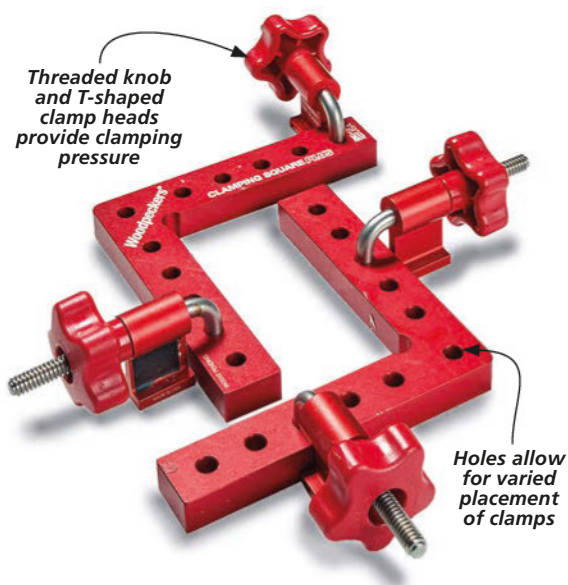


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▲ Woodpeckers' *Clamping Squares Plus* add a simple innovation to a basic concept, but they can save a great deal of time on a glueup.

► Reducing the amount of clamps needed for a glueup is always a bonus. The *Clamping Squares Plus* make aligning mitered corners a much easier task.

CLAMPING SQUARES PLUS

Next on our list are the *Clamping Squares Plus* from Woodpeckers. I don't need to say much about how helpful clamping squares are during a glueup — they're often a necessity. However, these handy tools take clamping square one step further.

These clamping squares feature a series of $\frac{3}{8}$ " holes which angled, threaded rods hook into. Thick, T-shaped clamp heads provide the clamping pressure as the knobs are tightened down.

EFFICIENT & ADJUSTABLE. The first advantage these have over their typical counterparts is efficiency. Rather than finagling squares and clamps into place, the hooks are easy to slip in. Plus, the less clamps I have to get out for a glueup, the better.

The second advantage these squares offer is their easy adjustability. They're easy to reposition without losing the structure of



the assembly, whether for a miter joint or when screwing together butt joints. Additionally, those $\frac{3}{8}$ " holes make the squares easy to hang on rods or dowels.

These squares are an excellent addition to any shop. Despite their simplicity, they've certainly

earned their frequent flier miles here at Woodsmith.

SETUP BLOCKS

The final set of items on our list are ones you'll hear touted quite often, and not without reason: setup blocks. As keen as



▲ The blocks from *Infinity Cutting Tools* are a good general choice for setup blocks. They offer a decent selection of sizes, including a 1" x 2" x 3" block for wider fence set ups.



▲ *Woodpeckers'* setup blocks feature the widest variety amongst competitors, ranging from 13-piece to 42-piece sets.

▲ Stacking setup blocks is an accurate way of setting the height on a blade or bit, and aluminum blocks won't dull your cutters. Raise the blade and give it a spin, checking for when it just barely makes contact with the block at its apex.

anyone's eye can be, there's no surer way to set the height of a blade, a bit, or the position of a fence than to physically register them. And for that, there are a few manufacturers we prefer.

INFINITY. Our first setup blocks are from *Infinity Cutting Tools*. These are fairly standard setup blocks, but good quality. Like the other blocks shown here, they're made from aluminum so registering against a blade or bit won't dull it. Additionally, these feature a ruler on each, a small convenience, and a 1" x

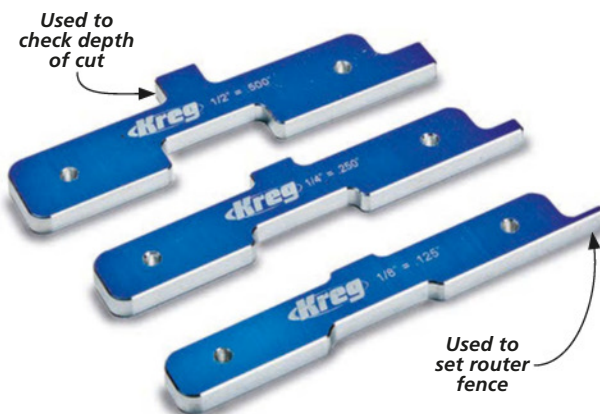
2" x 3" block. By putting blocks beside each other, the setup blocks from *Infinity* offer the largest range of sizes.

WOODPECKERS. The second set of blocks here is also our second feature from *Woodpeckers*. While the blocks from *Infinity* may feature the highest-end range, these blocks have the smallest increments, in both standard and metric options.

KREG. Our last set of blocks are quite different, as you can see below. The setup blocks from *Kreg* have a unique shape. The

small tab in front is used to set the fence position, while the arch underneath is used to set the height of the blade or bit. The little nub on top can then be used to verify your cut is at the right depth.

SELECTING A SET. Among any of these setup block sets, it's hard to go wrong. For most woodworkers, I recommend the set from *Infinity* for its capacity. For those who prefer to work down to the $\frac{1}{32}$ ", I'd say *Woodpeckers* blocks are the best choice. As for *Kreg*, anyone who prefers to do their joinery at the router table should give them a shot — they may look strange, but they're surprisingly useful. **W**



▲ The setup blocks from *Kreg* feature a unique shape compared to other options, meant for the router table in particular. The bottom arch is used to set the height of your bit.

▲ *Kreg's* setup blocks offer a much more unique shape than other options. These blocks are especially handy for verifying the depth of dadoes and grooves.

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Balance Bike

Here's an easy way to turn a few pleasant days of shop time into a lifetime of enjoyment.

Few woodworking projects will lead the life of adventure that this balance bike will. While most projects sit in one place, this bike introduces kids to the freedom of having their own set of wheels and the open road — well sidewalk anyway.

A balance bike foregoes pedals and chains to get kids used to the idea of staying upright on two wheels. It's a proven way to learn about riding a bike. This first step means that a balance bike needs to be tough. A bike can't be heavy though or it's difficult to control.

Our version strikes a balance between durability, light weight, and being easy to build. Plywood makes up most of the bike's frame. Clever cutouts reduce weight. The joinery is limited to woodscrews and glue with just a few dados and mortises. I'm pretty confident that this bike is a weekend project. That's good, because there's no doubt the user is eager to get moving.

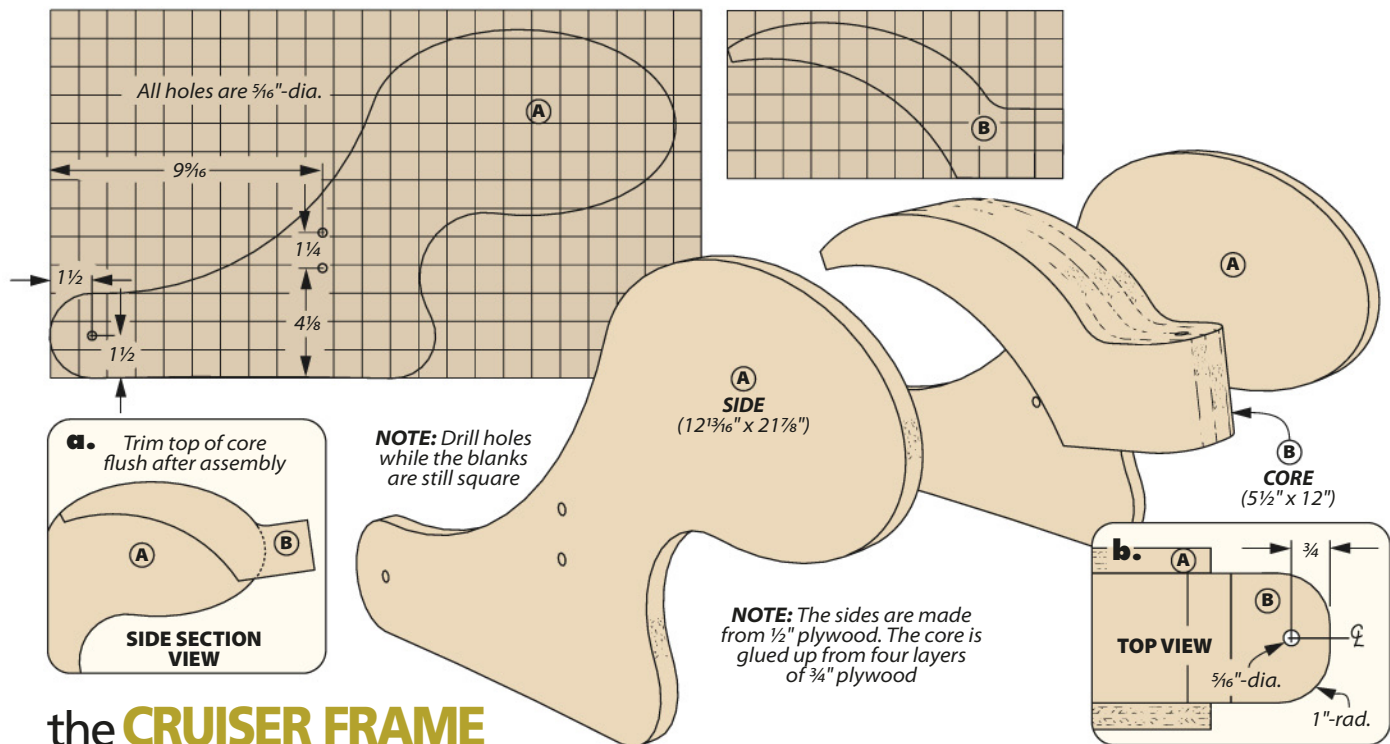
Creative director Chris Fitch knows the importance of design — even if it means a little more weight. A faux gas tank, headlight, and the handlebar grips lend a classic motorcycle vibe that turns heads. Perhaps one of the best aspects of a balance bike is that it's meant to be passed on. Once a new rider graduates to a full bike, the balance bike can move on to its next adventure. Along the way, introducing woodworking to the next generation.



▲ Simple hardware joins the bike's parts. Acorn nuts used throughout eliminate sharp edges and give a clean, smooth look. Baltic birch plywood adds to the sharp style.



▲ Lock nuts, washers, and carriage bolts secure the adjustable hardwood seat in one of three positions.



To find patterns for the balance bike, go to:

Woodsmith.com/268

The main assembly of the bike is the frame. The seat, wheels, and forks are all attached to it. This makes a logical place to start.

The frame consists of two sides and a thick, glued-up core. Our version is made from Baltic birch plywood for a consistent appearance on the edge grain.

START SQUARE. Don't get distracted by the final shape — in spite of its good looks. We need to drill some holes in the square blanks. The first is a hole for the rear axle.

Two other holes in the middle of the sides are used to attach the seat posts and allow you to adjust the height of the seat. These dimensions are shown in the upper left drawing.

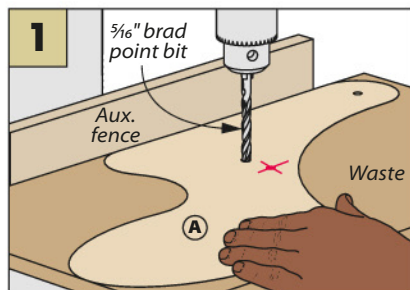
TEMPLATE. The overall shape isn't really critical. It's more about what looks good to you. For complex shapes, I prefer to make a hardboard template. You can print off the profile available on the website (see the margin box).

Use the template to trace the shape onto the sides. After rough cutting the sides, the template is used to trim the sides to match with a router and a flush-trim bit.

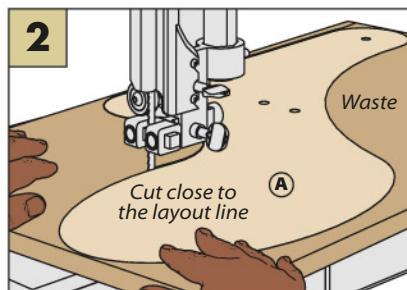
CORE. The core bulks up the thickness of the frame, as shown in the drawing above. We just don't want to add too much weight. I glued up several layers of plywood for a blank.

The final thickness of the blank depends on the width of the hubs on the wheels, plus two

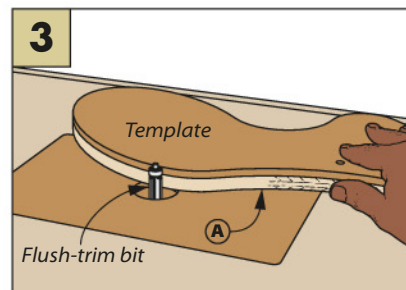
SIDE BY SIDE



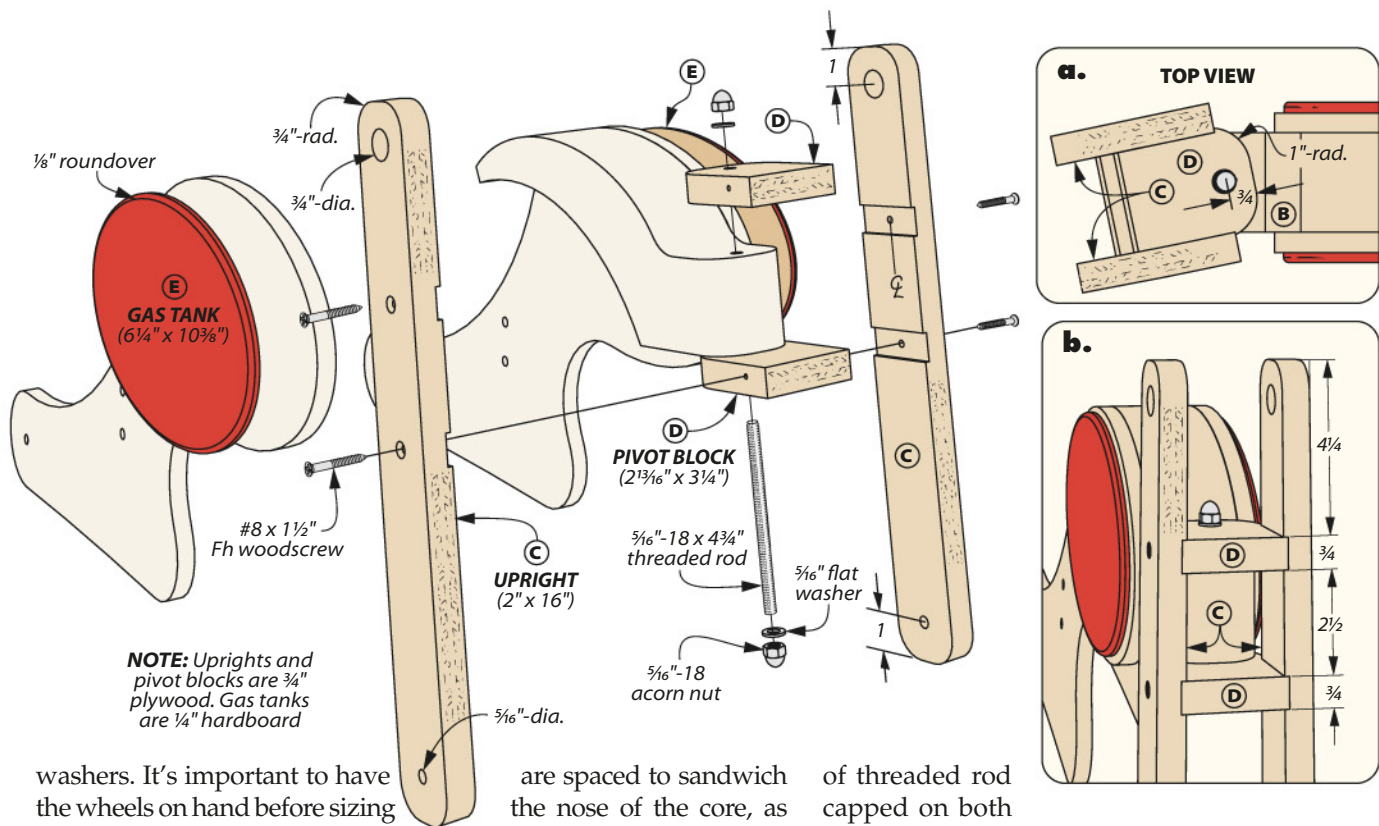
Holes First. Use the square blank for reference edges in order to drill consistent holes.



Rough Cutting. Cutting as close to the line as possible minimizes tearout during flush trimming.



Trim It. A router table supports the bike side while trimming it to match a hardboard template.



washers. It's important to have the wheels on hand before sizing the core. I had to cut mine down with a band saw (to $2\frac{9}{16}$ "). Take an equal amount off each face.

Rough cut the upper profile next. Besides removing most of the waste, this step forms the nose that the front forks pivot around. Take the core to the drill press to drill the pivot hole. Back at the band saw, round the front corners. Only after these steps should you cut the lower profile of the core.

ASSEMBLY. Bring the sides and core together with glue. I added a few brads in order to keep the process going. Flush up the top of the core with the sides.

FRONT FORKS

Working toward the front of the bike, we'll focus on the front forks. There are just four parts to create here.

Make two uprights, as shown in the drawing above. A hole at the top accepts the handlebar. At the bottom end, another hole is for the front axle.

DADOES. Along the middle of the uprights a pair of dados house two pivot blocks. The dados

are spaced to sandwich the nose of the core, as you can see in detail 'b.' Once the dados are cut, round the corners and drill screw holes for attaching the blocks.

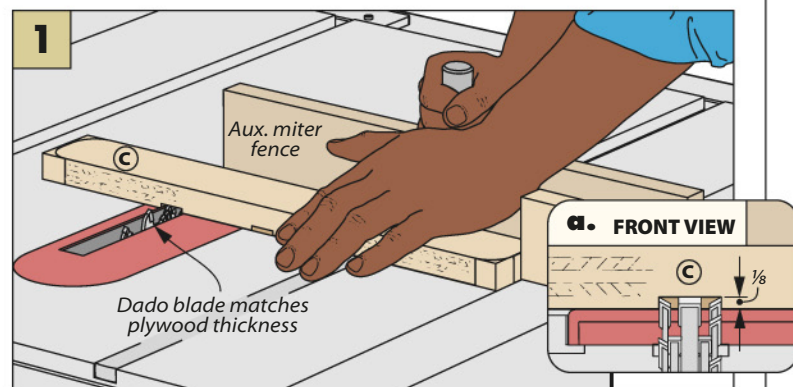
PIVOT BLOCKS. The pivot blocks are drilled for the pivot rod (detail 'a'). The corners are then rounded to ease the sharpness.

Assemble the fork components with glue and screws. The main drawing shows the necessary hardware: a section

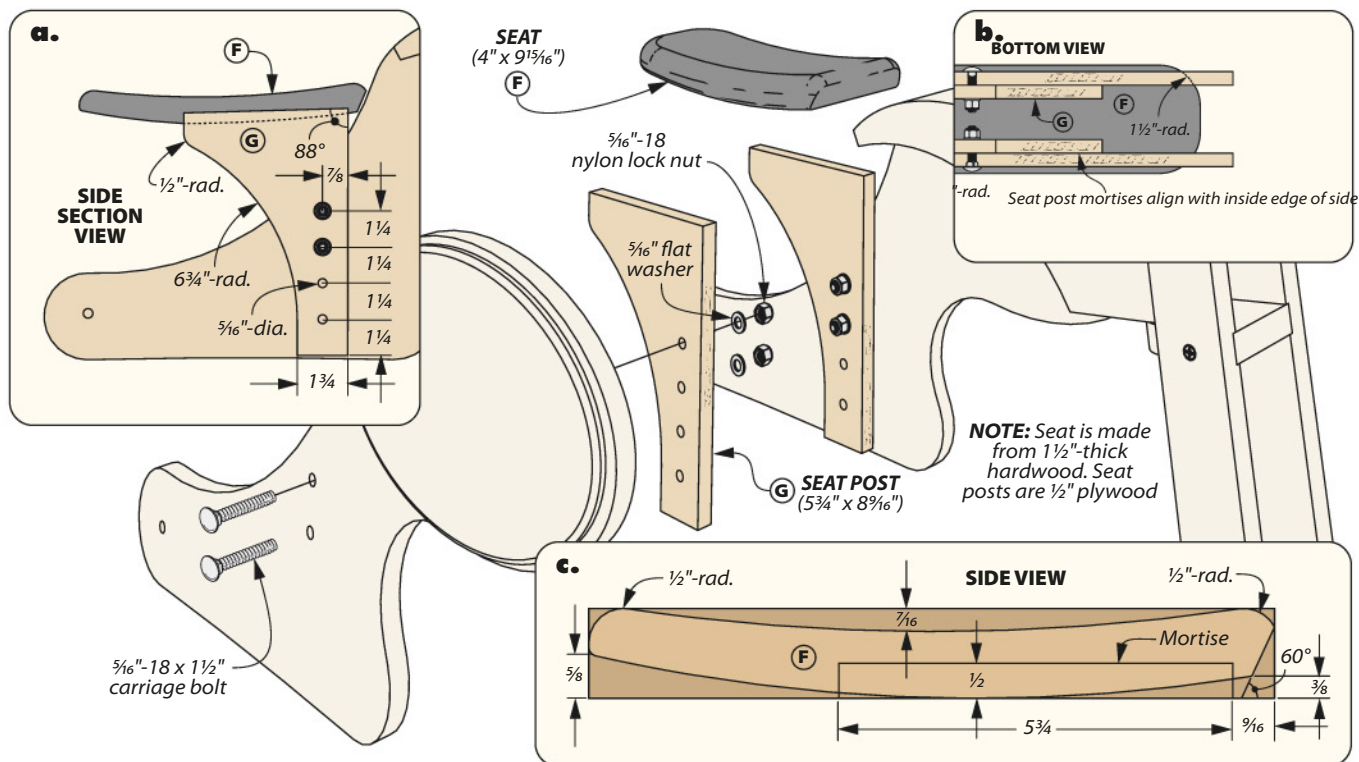
of threaded rod capped on both ends by washers and acorn nuts.

GAS TANK. Let's add a couple more pieces here. Two hardboard ovals are shaped to look like a motorcycle's gas tank. I shaped one using a paper pattern as a guide. Then that one turns into the template for making the second one. The edges are softened with a roundover. Paint the tanks before attaching them to the frame.

FORK JOINERY



Dadoes. Shallow dados register the pivot blocks in the uprights. The blocks are also anchored with screws.



Go **SPEED RACER!**

If there's one universal fact about kids, it's their growth rate. This bike is designed to accommodate that growth, as well as kids of different sizes. To do that, the seat can be located in one of several positions.

STOUT JOINERY. The seat is one of only two hardwood parts on the bike. We'll cut it to shape in a bit. The first step is to rout a

pair of mortises on the bottom face to accept the posts you'll make next.

Figure 1 below shows the setup I used. The dimensions for the mortise are in detail 'c' above. Mark the leading and trailing edges of the bit on the table's surface. On the workpiece, mark the location of the ends of each mortise. Select a bit that matches the thickness of the plywood you're using.

You'll form the mortise by lowering the seat blank over the spinning bit. Align the front mortise mark with the leading bit mark. Lower the piece and rout until the end line meets the trailing bit mark. I routed the mortise in a couple passes, raising the bit between each pass. Then square the ends of the mortises.

CURVED & COMFORTABLE. Refer again to detail 'c' (along with detail 'b') to lay out the profile of the seat. A band saw is ideal here for roughing out the form.

I like using a rasp and file to smooth and refine the curves.

Use these tools to round over the edges of the seat, as well. A roundover bit in a router just can't follow the curves. Paint the seat before working on the posts — just be sure to keep paint out of the mortises.

POST UP. The seat joins to two identical posts in order to attach to the bike's frame. Take square blanks to the drill press to drill the mounting holes (detail 'a').

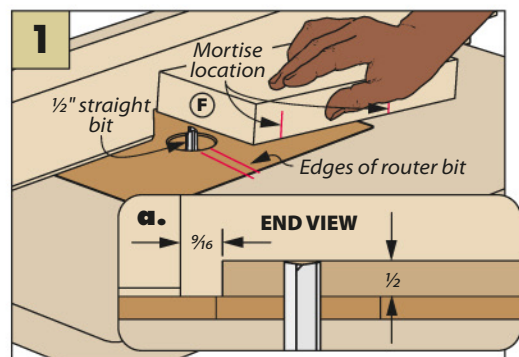
The top of the posts are tilted back a couple degrees to give the seat a better feel. Then you can cut out the curved swoop at the back edge.

The posts are glued into the mortises in the bottom of the seat. This assembly is joined to the frame with carriage bolts, washers, and lock nuts.

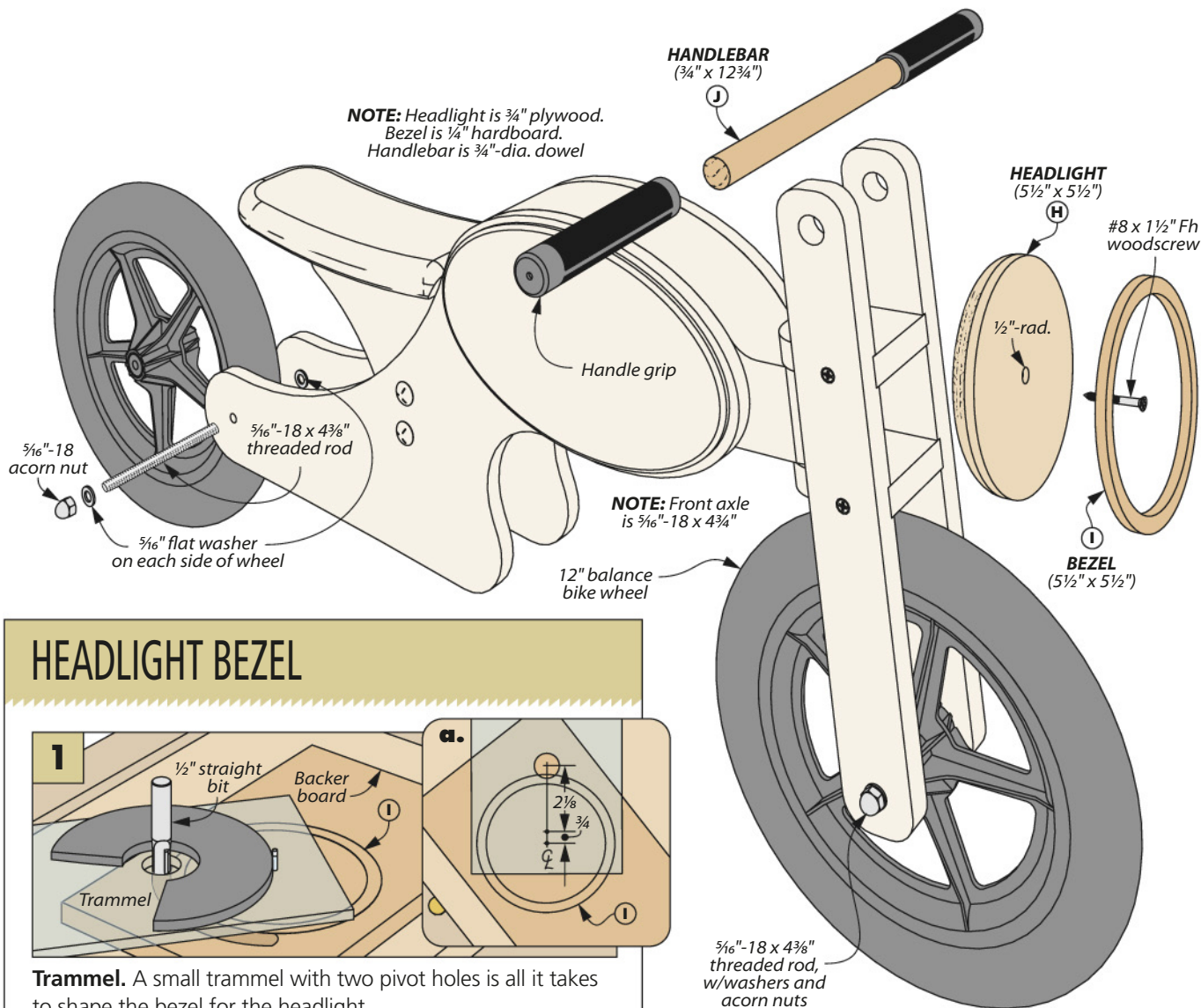
HEADLIGHT

In a purely decorative touch, a plywood headlight is added to the front of the bike. The headlight is a plywood disc. Round over the back edge to mimic the styling of the real thing.

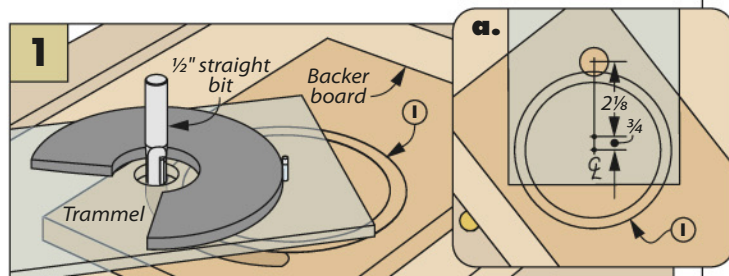
SEAT MORTISES



Stopped Grooves. Lower the seat blank over the spinning bit to create a mortise.



HEADLIGHT BEZEL



Trammel. A small trammel with two pivot holes is all it takes to shape the bezel for the headlight.

BEZEL. A hardboard ring glued to the front acts as a bezel to give the light some depth. Figure 1 above shows how to do this with a simple router trammel. Once glued in place, the light can be attached to the upper pivot block with a screw.

HANDLEBAR, NO MUSTACHE. The handlebar for the bike is a hardwood dowel, cut to length (drawing above). A pair of grips slipped on the ends holds the handlebar in place. If your dowel is a bit undersized, you can add a nail through the uprights.

NICE WHEELS. At last the wheels can be attached. I ordered a pair meant for balance bikes. Threaded rods, washers, and acorn nuts secure the wheels. Don't overtighten them. Then stand back while the world's newest cyclist takes the stage. **W**

Materials & Supplies

- | | | | | |
|----------------------------|---|---|--|---|
| A Sides (2) | $\frac{1}{2}$ ply. - $12\frac{13}{16} \times 21\frac{7}{8}$ | I Bezel (1) | $\frac{1}{4}$ hdbd. - $5\frac{1}{2} \times 5\frac{1}{2}$ | • (1) $\frac{5}{16}$ "-18 x $4\frac{3}{8}$ " Threaded Rod |
| B Core (1) | $2\frac{9}{16}$ ply. - $5\frac{1}{2} \times 12$ | J Handlebar (1) | $\frac{3}{4} \times \frac{3}{4}$ - $12\frac{3}{4}$ | • (2) Plastic Handle Grips |
| C Uprights (2) | $\frac{3}{4}$ ply. - 2×16 | • (5) #8 x $1\frac{1}{2}$ " Fh Woodscrews | | • (2) 12" Balance Bike Wheels |
| D Pivots Blocks (2) | $\frac{3}{4}$ ply. - $2\frac{13}{16} \times 3\frac{1}{4}$ | • (2) $\frac{5}{16}$ "-18 x $4\frac{3}{4}$ " Threaded Rods | | |
| E Gas Tanks (2) | $\frac{1}{4}$ hdbd. - $6\frac{1}{4} \times 10\frac{3}{8}$ | • (6) $\frac{5}{16}$ "-18 Acorn Nuts | | |
| F Seat (1) | $1\frac{3}{8} \times 4$ - $9\frac{15}{16}$ | • (14) $\frac{5}{16}$ " Flat Washers | | |
| G Seat Posts (2) | $\frac{1}{2}$ ply. - $5\frac{3}{4} \times 8\frac{9}{16}$ | • (4) $\frac{5}{16}$ "-18 x $1\frac{1}{2}$ " Carriage Bolts | | |
| H Headlight (1) | $\frac{3}{4}$ ply. - $5\frac{1}{2} \times 5\frac{1}{2}$ | • (4) $\frac{5}{16}$ "-18 Nylon Lock Nuts | | |

ALSO NEED: One 48" x 48" sheet of $\frac{3}{4}$ " Baltic birch plywood. One 24" x 24" sheet of $\frac{3}{4}$ " Baltic birch plywood. One sheet 24" x 24" sheet of $\frac{1}{4}$ " hardboard

DESIGNER Project



Kitchen Table

This sturdy table has a lot going for it — it's warm, light-hearted, and hospitable, making it the perfect addition for a busy kitchen.

A table in the kitchen often fills multiple roles. Unlike its fancy-pants cousin that resides (mostly alone) in the dining room, a kitchen table is often center stage for all manner of hijinks. Whether it's a last-minute homework project, or a rowdy game of cards, the table you see here will take it all in stride and look good for the wear.

Take a gander at those large boomerang-like legs. Not only are they strong, they're tucked out of the way of foot traffic and joined at the center. This makes moving the table around the room a wobble-free task.

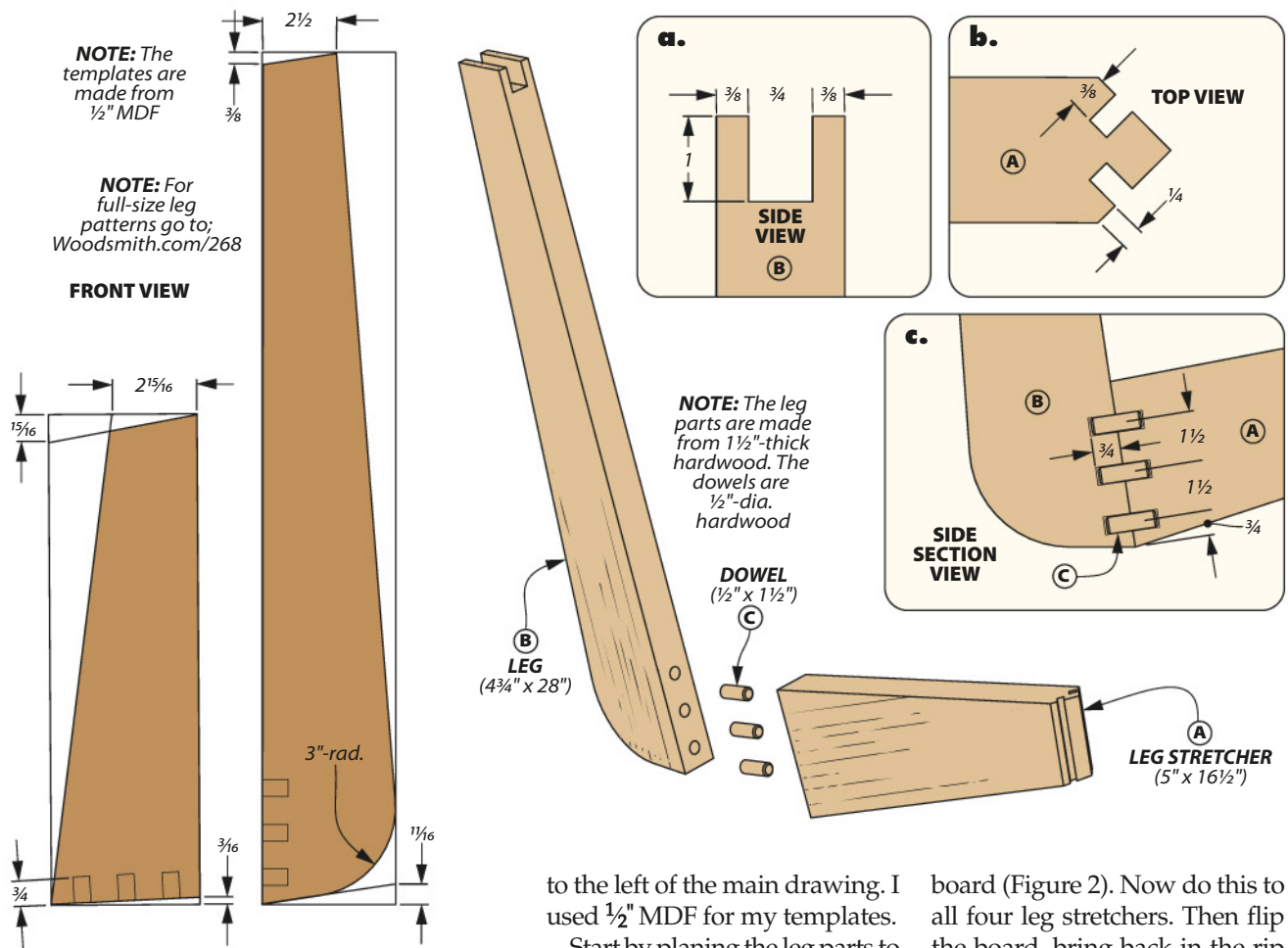
The table is mostly made of 8/4 material. The legs and stretchers are rift sawn oak. These two parts that make up the base get treated with an ebonizing process that gives a subtle graphic feel to the project.

The top is cherry. As you see in the inset photo, there's some epoxy inlay work to do around the perimeter of the top. To make the inlay groove (and shape the table top) you'll spend some time with your plunge router and a trammel to make perfect circles.

In the words of a famous pitch man, "*But wait, there's more!*" If you leaf to the last page you'll find a design lagniappe that you just might want to add to the table. The journey starts with making those boomerang legs — so let's get after it.

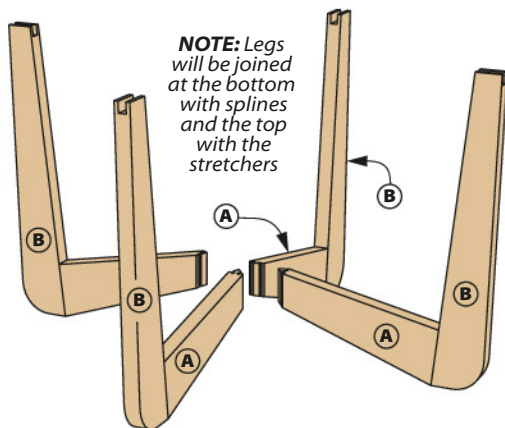


- ▲ The table top features a black epoxy inlay that visually ties it to the ebonized base. The chamfered edge creates a contrasting flick of light that complements the dark details.



Making strong LEGS

Out of the gate we'll tackle the legs. There are lots of angles, tapers, and bevels to contend with so I suggest you make templates with the information shown in the illustrations above



Meeting in the Middle. The junction at the end of the legs make for a strong base.

to the left of the main drawing. I used 1/2" MDF for my templates.

Start by planing the leg parts to thickness, then trace the profile of the template on each part and cut them out on the band saw. Next, you'll attach the template with double-sided tape. Use a flush-trim bit in your router table to shape each leg part. Figure 1 on the next page shows this.

JOINERY, LEG STRETCHER. As you see in the drawing below, the leg stretchers converge in the center and are held together with splines and epoxy. I chose to start with the leg stretcher pieces first. To begin, you need to set the proper angle on your miter gauge fence.

Lead off with placing the inside end of the leg stretcher against the table saw rip fence. Loosen and adjust the face of the miter gauge fence to match the end of the stretcher. Move the rip fence out of the way and tilt the blade to 45° to make the bevel cut on the end of the

board (Figure 2). Now do this to all four leg stretchers. Then flip the board, bring back in the rip fence, readjust the miter gauge fence and repeat the process on the other side.

GROOVES. The same method is used to make the grooves in the bevels that hold the splines (Figure 3). Here though, use a dado set and the rip fence as an end stop. Later, we'll make the splines that tie the four legs together in the center.

To make sure the grooves line up, draw their locations on the edges of the leg stretchers (detail 'a,' above). Cut all the grooves on one side, readjust the miter gauge and complete the remaining grooves.

DOWELS. The leg stretchers are joined to the legs with three dowels (detail 'c'). Lay out and drill the holes for the dowels with your handy doweling jig, Figure 4 shows this. For a strong connection between the two, you'll be using 1/2" dowels.

You have to drill these holes in the end of the legs also. Then you can set aside the leg stretchers and focus on the other end of the long, vertical legs.

JOINERY, LEG. Making the notch in the top of the leg to hold the table stretchers is next on the agenda. You'll need to make the saddle jig you see in Figure 5. It rides the fence of your saw and accurately guides the leg.

The details for the jig are available online at Woodsmith.com/268. The saw and fence are set up to make a centered cut on the workpiece.

ASSEMBLE THE LEGS. To ensure the glueup goes smooth and the parts are flush to each other I sanded down the dowel circumference to allow for a little play in the joint. Epoxy is the adhesive of choice for gluing up

the legs. As you see in Figure 6, I kept the parts flush by using a small block and F-style clamps that span the two parts.

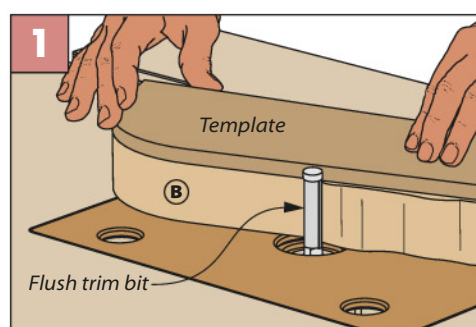
As for clamping across the two parts, you want to protect all the work you've done on the ends of the leg stretcher. To do that I made the V-block that you see in Figure 6a. When the epoxy has cured, you can focus on bringing the four legs together.



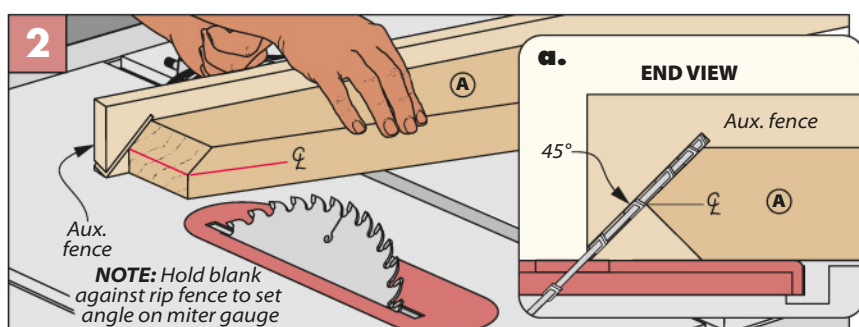
For leg patterns and details on making the Saddle Jig, go to:

Woodsmith.com/268

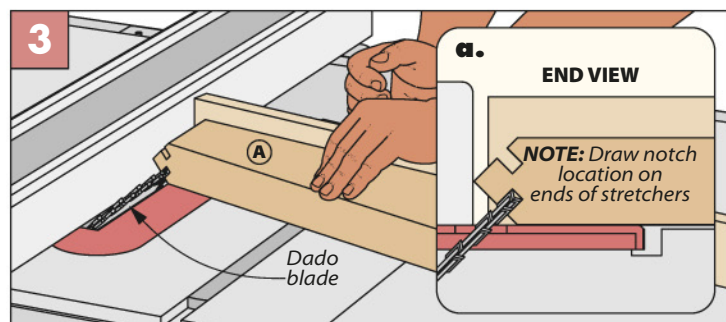
LEG DETAILS



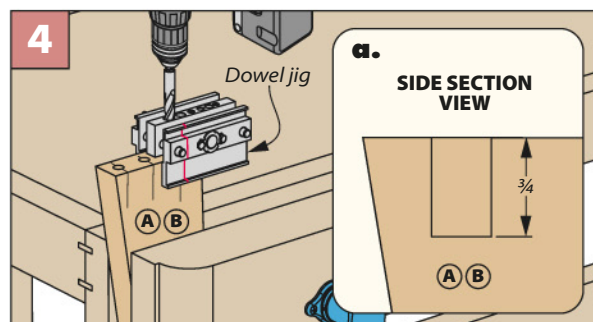
Final Profile. A template attached to the leg blank makes for a perfect profile.



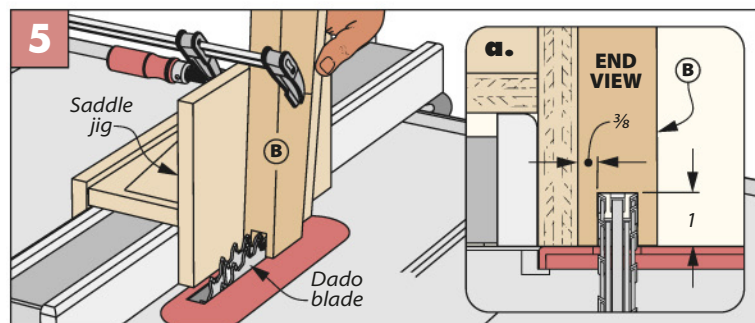
Compound Centers. After adjusting the miter gauge to the proper angle, tilt the saw blade to 45° to make the miters on the ends of the leg stretchers.



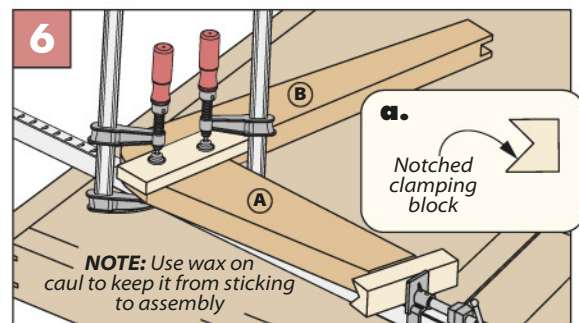
Notches Next. Cut all the notches on one side of the stretchers, then adjust the angle of the miter gauge to cut the other notches.



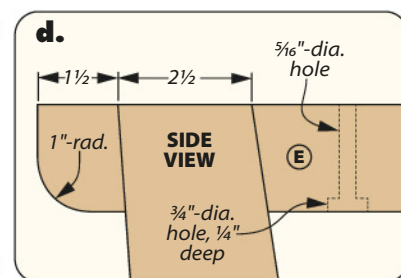
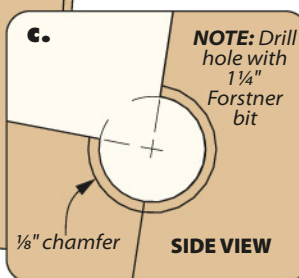
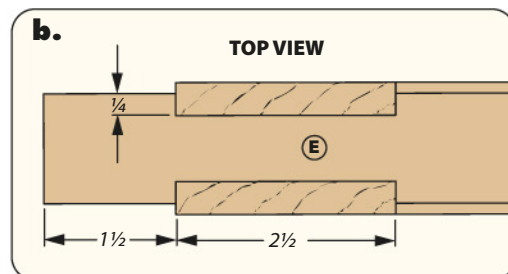
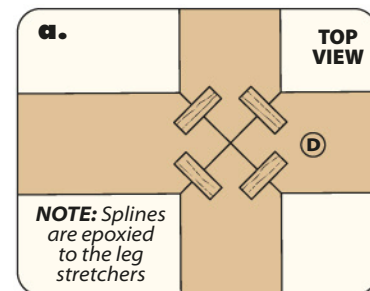
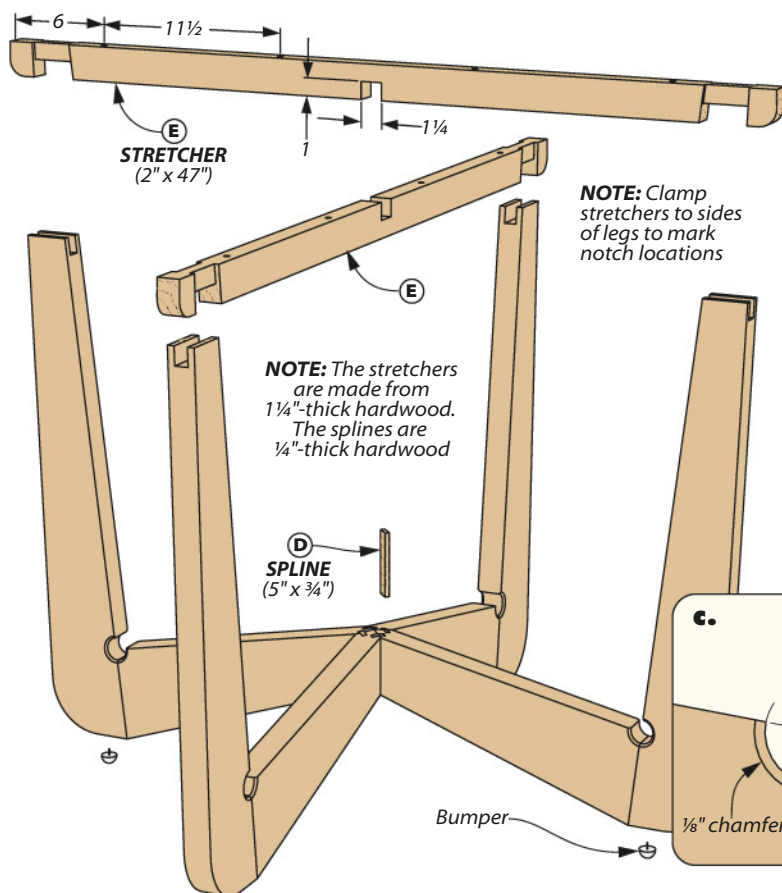
Dowels. Use a doweling jig to make the holes in the end of the leg and leg stretchers.



Big Dado. The saddle jig that rides on your rip fence allows you to cut the centered dado on the top end of the legs.



Keep Things Flush. A notched clamping block protects the end of the leg stretcher.



Bringing together the **BASE**

Along with the thick wood used to make the table base, there's the cage-like design of the legs being joined at the top with stretchers, and at the bottom with splines. These details make the table ready and able to take

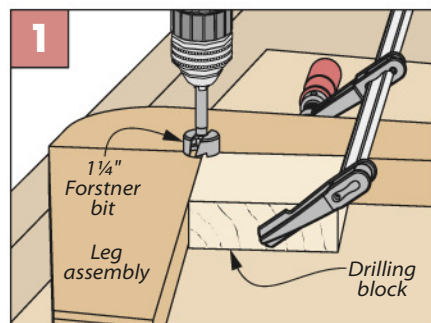
any abuse a lively kitchen can dish out. Before bringing the four legs together, there's one more detail to attend to.

DECORATIVE TOUCH. Lay out the location of the decorative hole on the legs (detail 'c'). It reminds me of a dimple — so, see Figure 1 below for the details of making a dimple in the legs.

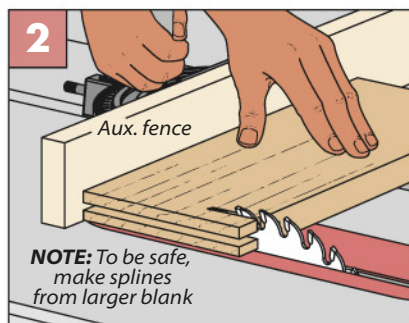
Clamp a backing block to the inside of the leg and use a Forstner bit to drill the through hole in the leg. To add a little sass to this accent, the hole is chamfered with an 1/8" chamfer bit.

SPLINES. Make the four cross-grain splines that join the legs in the center (Figure 2). Then you can start assembling the legs.

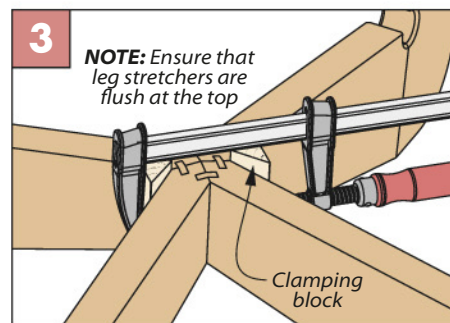
BRINGING THE LEGS TOGETHER



Leg Dimple. A block clamped to the leg prevents the bit from wandering.



Strong Splines. Crossgrain splines are the best option to join the legs.



Joined at the Center. Clamping blocks provide plenty of clamping surface.

TWO-STEP ASSEMBLY. There's no reason to go looking for trouble in the shop so I clamped up the leg assembly, in two sections first. Use a clamping square to ensure the legs are square to each other. Coat the spline with epoxy and when you're sure the legs are flush to each other, use a spring wire miter clamp to hold the two together while the epoxy cures. If you want to try a spring clamp there's information on them in *Sources* on page 66.

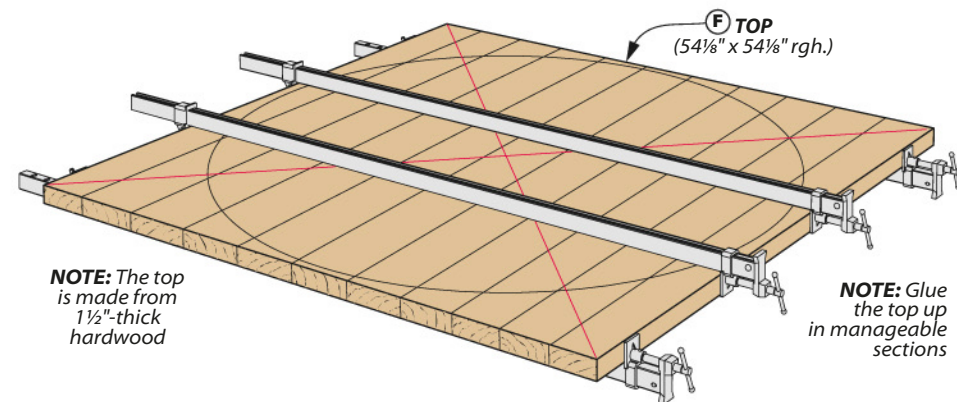
Then you can bring the two halves together as shown in Figure 3. Make two V-blocks to clamp the leg stretchers together in the center.

TABLE STRETCHERS

As you see in the main drawing on the previous page and details 'b' and 'd,' the stretchers are notched on the ends. They also have a half lap in the center to connect them and create a flush surface for the table top. Cut the pieces to size and round over the corner (detail 'd,') at the band saw, then sand the arc smooth.

To ensure a perfect fit, I clamped each stretcher in place on its legs and marked the location of the notch with a pencil.

TWO JIGS. After you've marked the location of notches on the stretchers, use the marks to pin

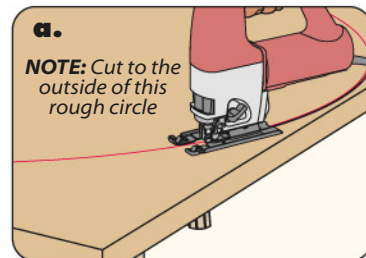


nail together two mirrored jigs made of 1/2" MDF, like you see in the box below. Your router with a dado clean-out bit installed will remove the waste on the face of the stretchers (Figure 1). When that step is done, there's waste on the underside of the notches that needs to be removed. Figure 2 shows how to deal with that task.

CENTER HALF LAPS. To locate the half laps, drop one of the stretchers in place on the legs. Rest the other stretcher on top of its legs to mark the location of the shoulders for the half laps to be cut at the table saw.

MOUNTING HOLES. The other detail that needs attended to on the stretchers are drilling the counterbore and shank holes for the top. The information for this is in detail 'd' on the previous page.

All that's left to complete the base is to glue the stretchers to the top of the legs. When that's done you can turn your attention to the top of the table, starting with the glueup.

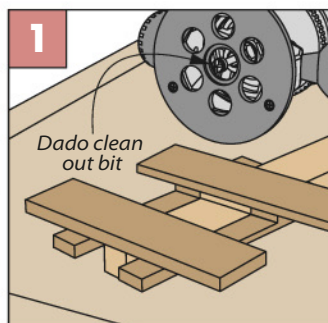
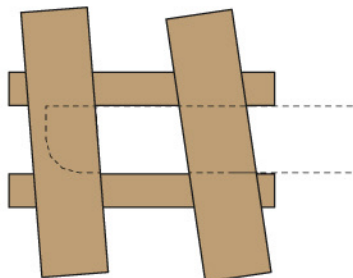


THE TOP

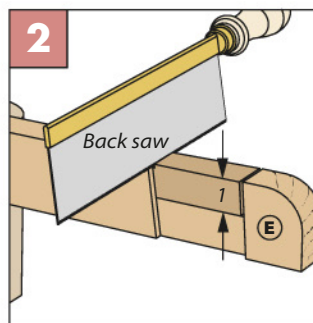
The top, like the legs, is made from 8/4 material. It's too big to glue up all at once so I staggered the process by gluing up smaller sections first, cleaning up the glue seams, then joining those sections to each other, alternating the growth rings along the way. I used a pencil on a string to make the rough circle that's cut out with a jig saw (detail 'a').

SHAPING THE STRETCHERS

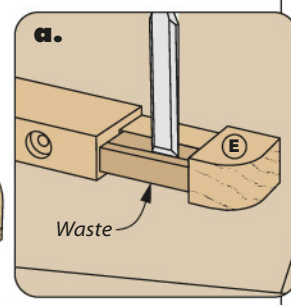
NOTE: Use the marks drawn on the stretcher to assemble the jig

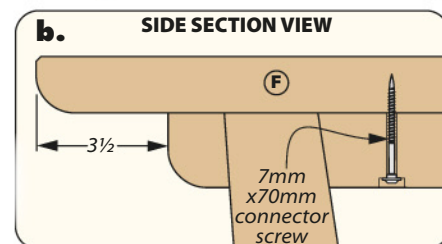
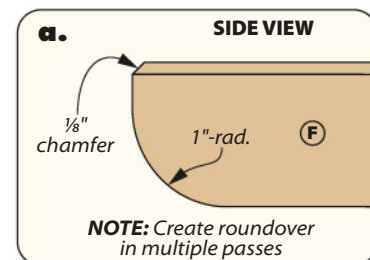
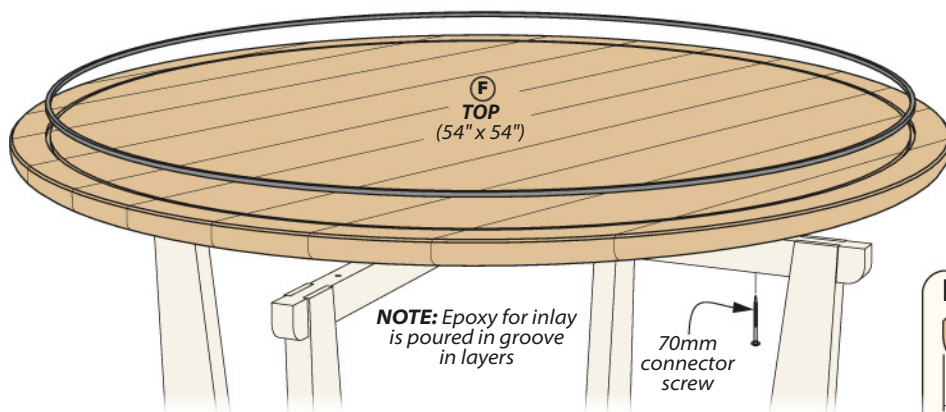


Cheeks. Use a dado clean-out bit on the cheeks of the notch.



Stretcher Notch. Use a back saw to cut the walls of the notch. Then remove the waste with a chisel.





Adding a good-looking **TOP**

Now that you've got your table top roughly shaped, you can dial in on it and bring it to a crisp circle (and add the groove for the epoxy inlay). To do this you'll need a trammel. If you don't already have a trammel there's a simple version in the box below you can make.

I invested in a large (long) straight bit for occasions such as this. Still, it's best to shape the edge in multiple passes to prevent burning the edge of the top.

When the profile is done, change out the bit and move the router and trammel assembly to the other hole to make the groove in the outer edge of the top. As you see in Figure 1, the groove is 1/4" wide and deep.

EDGE PROFILE. As you'll notice in detail 'a' above, the underside of the top has a large roundover. The profile is too large to shape all at once — so I used a parade of roundover bits from 1/4" to 1" in size to slowly make the profile in manageable passes. While the top was upside down, I sanded the surface and roundover in preparation for applying the finish later. Also in that detail you see there's a chamfer on the top edge that you'll need to rout, but I saved that for that last woodworking detail. It's time to fill the groove.

EPOXIED GROOVE

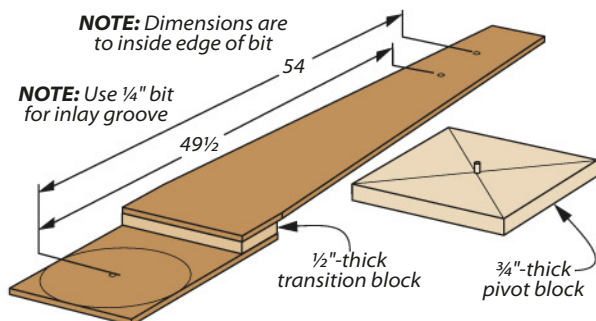
There are many ways to skin the cat that is filling a groove with

epoxy. None of them actually involve harming cats. The process starts by protecting the top where it meets the groove. This is done with a wide band of tape.

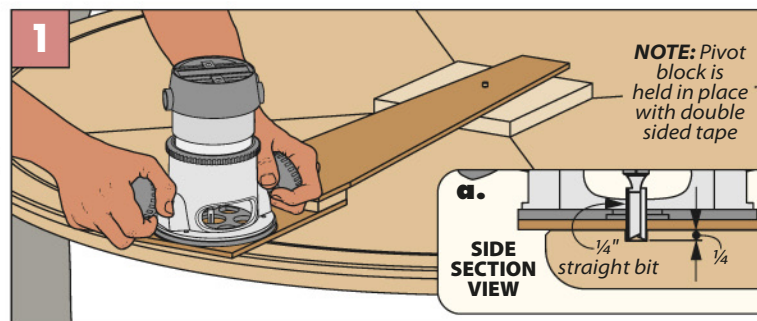
After the tape was in place, I used my Xacto knife to cut away the tape in the opening of the groove. To avoid any unruly runs and overflow issues, make sure the table is sitting level.

To tint the epoxy, I added an epoxy pigment that's listed in *Sources* on page 66. Then pour the mixture into the groove. Fill the groove in layers. (You want the epoxy to stand a little proud of the table surface.) When you're done pouring, use a torch to remove any remaining bubbles from the epoxy.

TRAMMEL STUFF



A Basic Trammel. This simple trammel is a perfect jig to shape the table and make a groove for inlay.

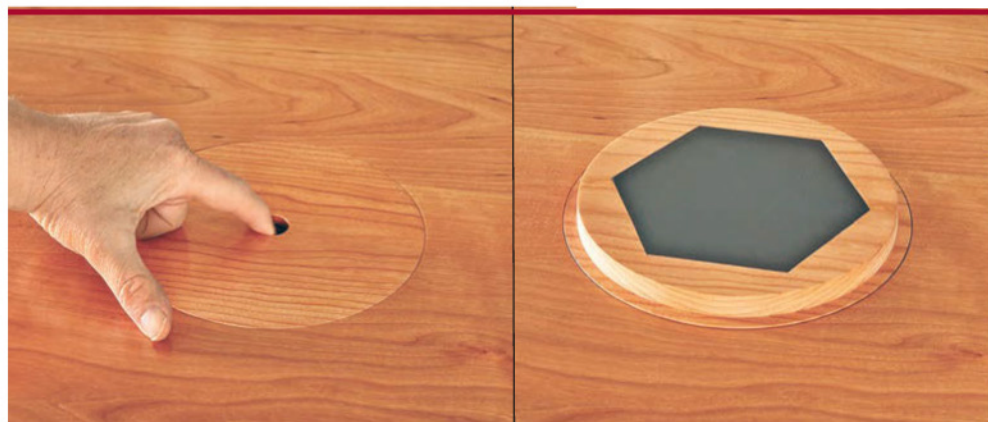


A Groove for Inlay. Change out the bit and reposition the trammel on the pivot block to make the inlay groove.

The next day, when the epoxy has cured, it's time to remove the tape. In some instances the tape will be buried underneath some of the epoxy — use a card scraper to remove this excess. In fact the card scraper proved to be a good tool to bring the surface of the filled groove flush to the top of the table. Once the scraping was done (and the chamfer routed on the outside edge detail 'a,' previous page), sand the top progressively to 220 grit. I took the surface to this level for the sake of the sheen of the epoxy. No stain was used on the top (let that cherry mellow), just a couple of coats of lacquer. The base is getting a different treatment — an ebonized surface.

EBONIZING THE BASE

To prepare for this step you'll need to ease the edges of the base and sand the surface to 100 grit. Ebonizing wood unfolds in two steps: first there's a tannin wash that prepares the wood. When dry, this is followed by a dark coat of that's made of a concoction of steel wool and vinegar.



▲ You can add a trivet to the center of the table. In the photo to the left the trivet is hidden under the surface of the table. You can lift it out with the finger hole and flip it to hold a warm dish or kettle. If you want to add this trivet to the table there are directions online at Woodsmith.com/268.

Make the tannin wash using two heaping tablespoons of mixed tannins in a cup of water. The tannins can be bought online or from a local brewery supply store. Flood the base with this wash using a sponge brush then let the surface dry.

The ebonizing mixture is simply steel wool that's been soaked in vinegar over night. You'll want to strain the mixture through a coffee filter to remove unwanted sediment. Brush this liquid on in the same manner as

the tannin wash. No need to worry about lap marks at this stage. To build depth you can make a second application. At this point the surface will look like a disaster, but take heart — once you've applied lacquer the look evens out and you can breathe again. After the base is dry you can attach it to the top with screws through the stretchers (detail 'b,' previous page). Now the table is ready to host good conversations over dinner for years to come. **W**

Materials, Supplies & Cutting Diagram

A Leg Stretchers (4)	1½" x 5" - 16½'	E Stretchers (2)	1¼" x 2" x 47'	• (8) M7x70mm Connector Screw
B Legs (4)	1½" x 4¾" - 28'	F Top (1)	1½" x 54" - 54'	• (4) 7/8" Rubber Tack Bumpers
C Dowels (12)	½" x ½" - 1½'	G Trivet (Optional) (1)	¾" x 8" - 8'	• (1) Ceramic Tile (Optional)
D Splines (4)	¼" x 5" - ¾"			

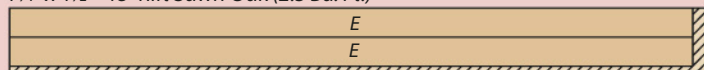
1½" x 5½"- 72" Rift Sawn Oak (5.5 Bd. Ft.)



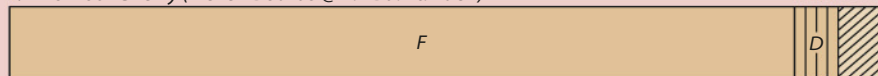
1½" x 5"- 60" Oak (Two boards @ 4.2 Bd. Ft. each)



1¼" x 4½"- 48" Rift Sawn Oak (2.3 Bd. Ft.)

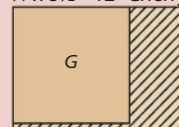


1½" x 5"- 60" Cherry (Eleven Boards @ 4.2 Bd. Ft. Each)



ALSO NEEDED: One ½" x 24" Oak dowel

¾" x 8½"- 12" Cherry (0.7 Bd. Ft.)



NOTE: Part G is optional trivet

NOTE: Part D is milled to ¾" thick

Entry Bench

This welcoming project isn't just a convenience for your entryway, but also a pleasant piece of furniture to greet guests and family alike.

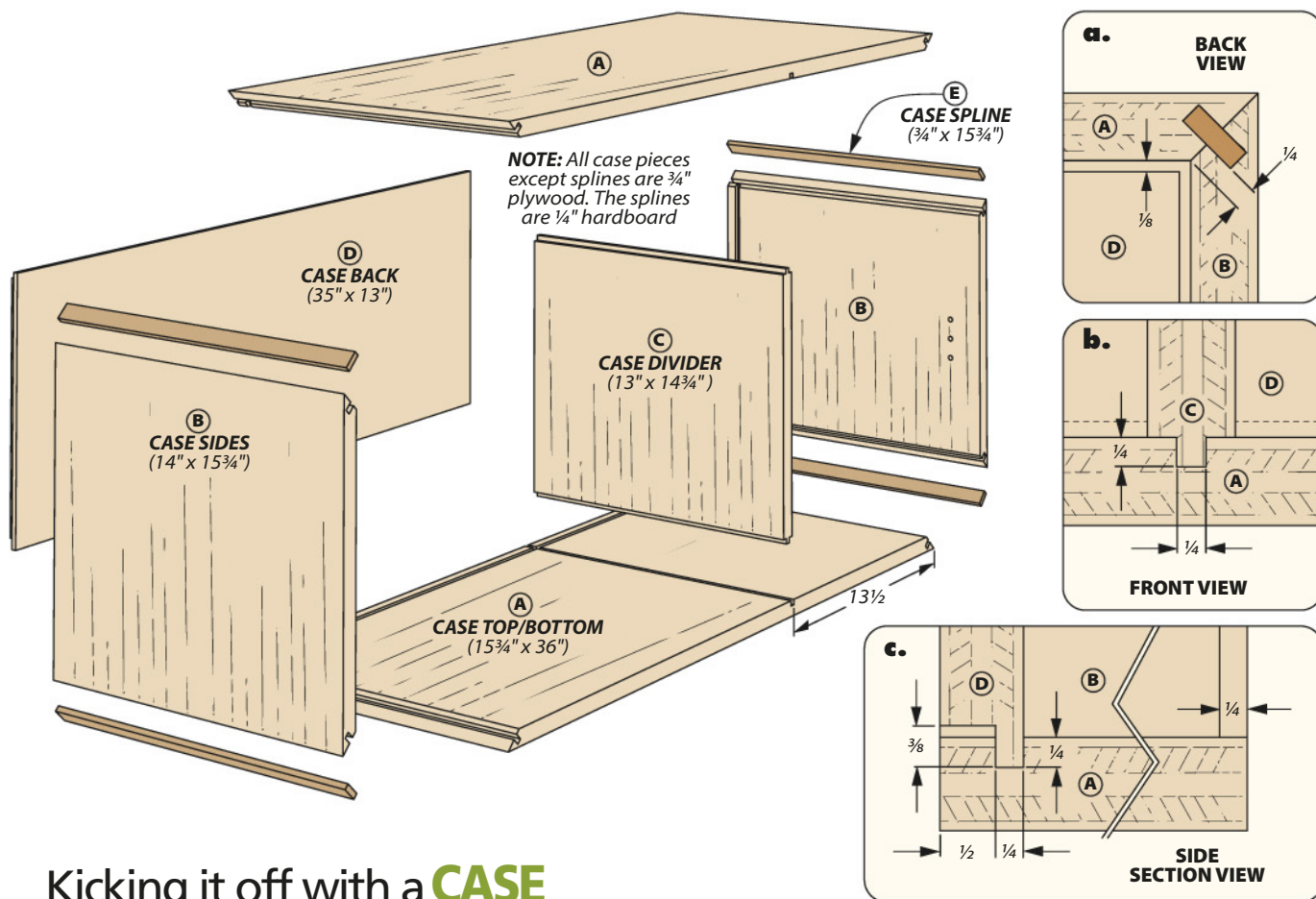
First impressions are important. While it may be foolish to judge a book by its cover, most people will likely form an opinion after the first few pages. The same is true with many things, a home included. An entryway, whether grand or humble, says a lot. The entry bench you see here isn't just about function, but also about revitalizing the feel of your home — for your guests and yourself.

SPACIOUS DESIGN. The bench is split into two sides. On the right, open shelving accommodates two pairs of shoes, whatever their heights. On the left sit two drawers with full-extension slides. These drawers are wide and deep, allowing you to keep a number of things easily at hand as you leave the home.

AN ARRAY OF CONTRAST. One of the first things that stands out about this bench is the colors. The birch cabinet sits on a base of black walnut while within lie the drawers, standing out starkly with their coat of matte gray. The shapes too provide subtle contrasts — hard lines are offset with rounded feet and edging. All in all, the bench attracts attention without hogging the spotlight, giving your home the perfect first impression.







Kicking it off with a CASE

The best place to begin with this entry bench is the body that the rest will be built around: the case. The case consists of a top, bottom, and sides joined by splines, as well as a divider and a thick, rabbeted back panel. I started with the exterior of the case before moving inside.

TOP, BOTTOM, & SIDES. First, cut the top, bottom, and sides of the case to size. All four pieces

are mitered. I crosscut these to length at the table saw with the blade tilted at 45° .

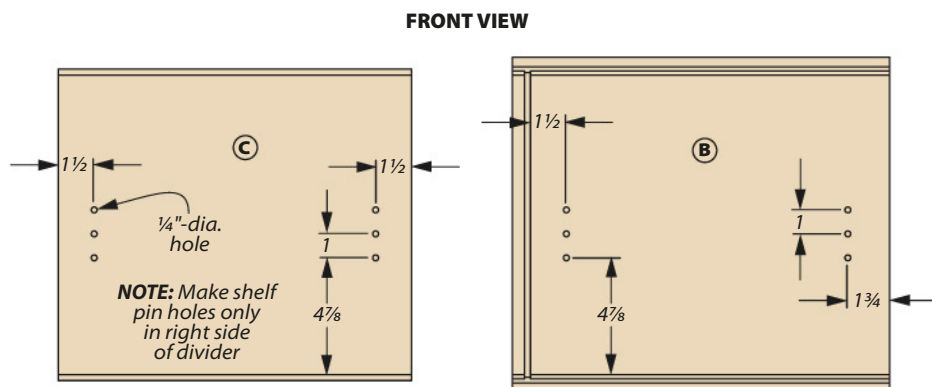
The next task is to cut the angled grooves for the splines (detail 'a'). You can see this done in Figure 1 on the next page. Using a $\frac{1}{4}$ "-wide dado blade tilted at 45° (Figure 1a), cut the grooves for the splines into the mitered edges of the top, bottom, and side pieces.

CASE JOINERY. With the edges finished, there's just a bit of joinery left on the perimeter pieces of the case before moving inward. First comes a dado in the top and bottom pieces. As you can see in detail 'b' above, these accept the tongues on the ends of the divider.

Next up are the grooves for the back panel. Shown in detail 'c,' these form a sort of locking rabbet, with a small gap left around the back side. Set up the cut at the table saw, then cut the grooves in the top, bottom, and sides to keep all the grooves aligned.

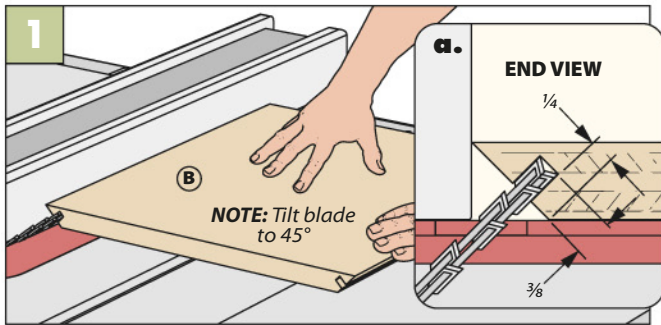
RABBETS. There are just two pieces left on the case: the case divider and the back panel. Once these were cut to size, I worked on the last bit of joinery.

Tongues along the top and bottom edges mate with the dados in the top and bottom. Using a dado blade at the table saw

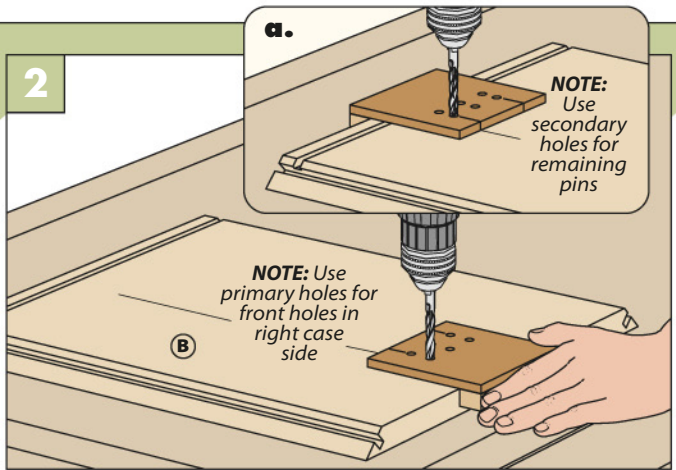


SPLINE GROOVES & PIN HOLES

2



Mitered Grooves. After mitering the sides, use a tilted dado blade to create the grooves for the splines.



Drilling Guide. A simple hardboard guide with a cleat ensures consistent spacing when drilling the shelf pin holes.

(buried in an auxiliary fence), cut rabbets on each side of the top and bottom to form the tongues. From here, cutting the rabbets on the case back is easy. Simply widen your dado stack and rabbet each edge of one face.

SHELF PIN HOLES. All the pieces are made, and only one task is left before assembling the case. There are pin holes for the shelves in the right case side and the divider, which, as you can see in Figure 2, I drilled in using a guide. The guide has two rows of holes: one for the front of the case side, and one

for the back of the side as well as the case divider.

ASSEMBLY. Finally, assemble the case. After cutting the splines to length, I glued up the case. Cauls across the top and bottom and clamping squares in the corners helped ensure tight joint lines throughout.

SHELF. The shelf simply sits on top of some commercial shelf pins. Once it's cut to size, just set it in place.

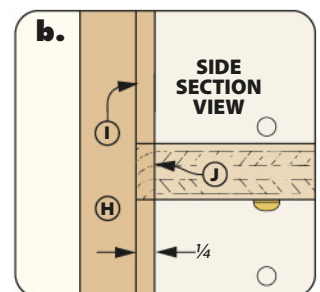
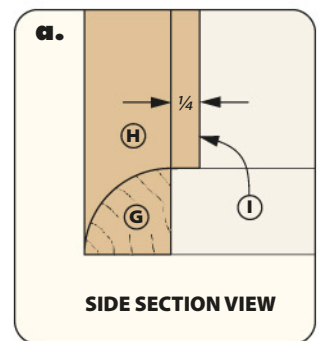
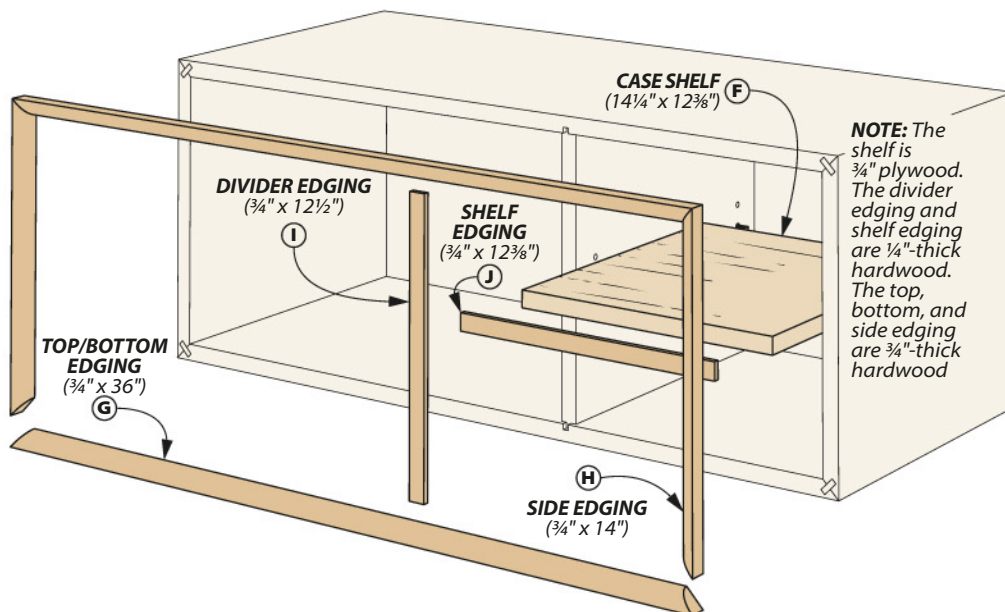
FACE EDGING

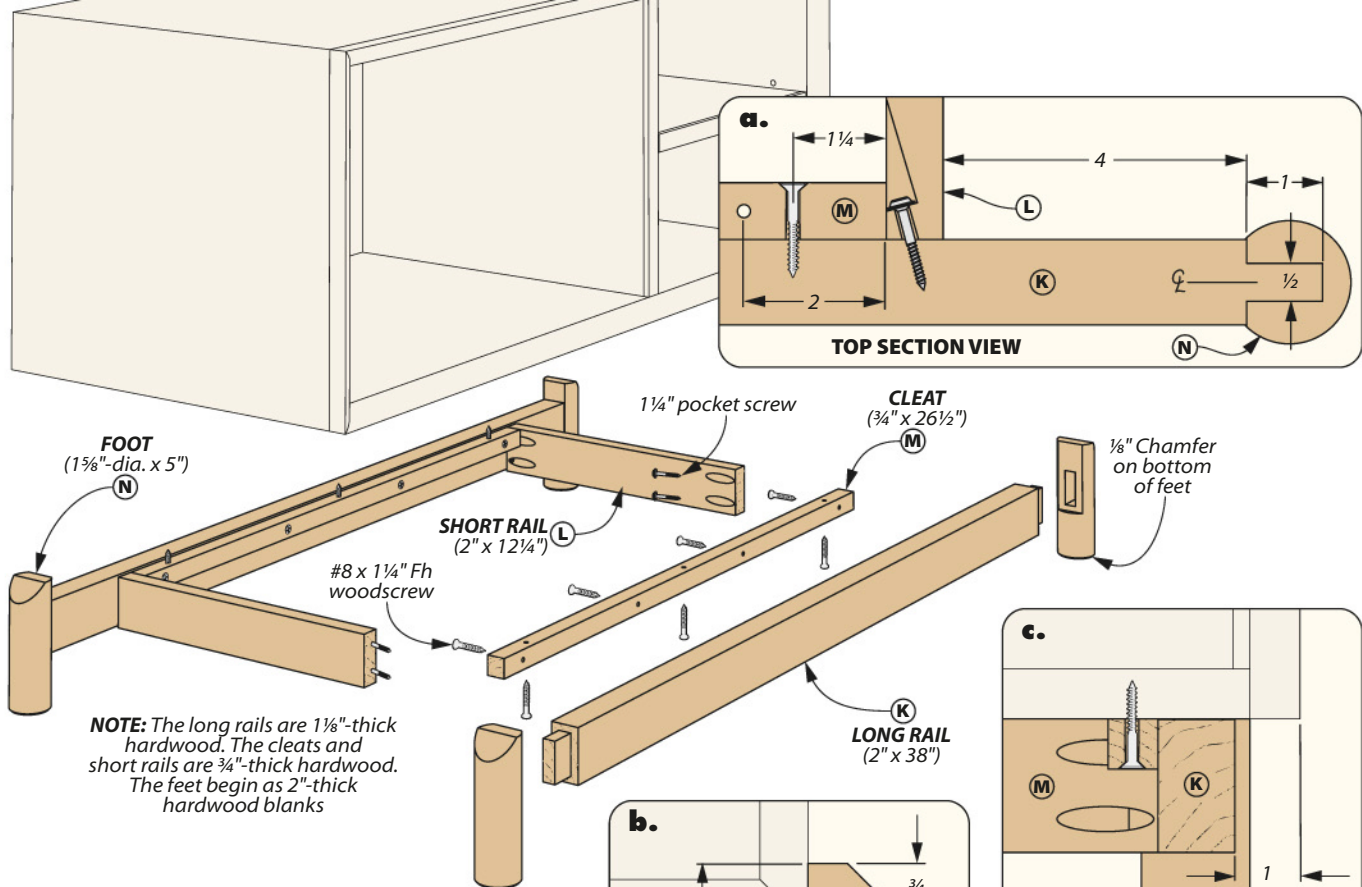
As you can see in the illustration below, a series of edging pieces

will complete the case. These are easy to make, but can be a bit dangerous if not done cautiously.

EDGING. First I made the top, bottom, and side edging. Since they needed rounded over, I started with two extra-wide blanks cut to length (one for the top and bottom, one for the sides). I rounded over the edges at the router table and ripped them to width at the table saw. Lastly, I mitered their ends.

The divider and shelf edging simply need cut to size. To attach the edging pieces, set the case on its back and glue them in place.





NOTE: The long rails are 1 1/2"-thick hardwood. The cleats and short rails are 3/4"-thick hardwood. The feet begin as 2"-thick hardwood blanks

Four-footed **BASE**

The case of the entry bench sits on a base that somewhat resembles a four-post bedframe. The feet and long rails are the focus here, beginning with the joints.

TENONS & MORTISES. Start out by sizing the pieces you see above. The foot blanks will need to be left a couple inches long so they can be turned fully round later. From there, the joinery between the long rails and the feet is first.

I find it best to begin with the mortises, so I first laid them out on the foot blanks (details 'a' and 'b'). I removed most of the waste with a series of holes at the drill press. A chisel cleaned up the mortises and squared the corners. I marked out which foot would be going where, then went to the table saw to make the tenons. Be sure the length between the shoulders matches the overall length of the case.

SHAPING THE FEET. A well-fit joint is only the first step on the feet. Next comes some shaping

before turning them round. While you've still got your dado blade in, use it to cut the shallow rabbet around the mouth of the mortise (detail 'b'). Now swap your dado stack for a crosscut blade and tilt it to 45°. Flip the blank over and cut the mitered corner at the top, as in detail 'b.'

Finally, you'll need to round these feet out. I turned them down, mounting the bottom of the feet in the headstock of my lathe. For more on rounding out the feet, visit Woodsmith.com/268.

ASSEMBLY & MOUNTING. The rest of the parts on the base are assembled with screws. I began with the glueup, mounting the feet on the ends of the long rails.

Once dry, I used pocket screws to attach the short rails, then woodscrews to attach the cleats. To mount the case onto the base, drive screws up through the cleats into the case bottom.

DRAWERS

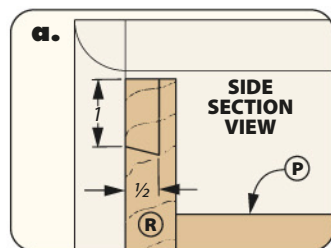
The final addition to this project is a pair of drawers. These are wide, making them great to store hats, gloves, and scarves for easy access on your way out the door.

JOINERY. After sizing the front, back, and side pieces, joinery is next on the docket. The front, back, and sides connect with a tongue and dado joint, while the plywood bottom fits in grooves. To kick it off, first cut dadoes in each end of the side pieces. Then, rabbet the ends of the fronts and backs to fit those dadoes. Lastly, cut a groove at the bottom of each piece for the plywood drawer bottom.

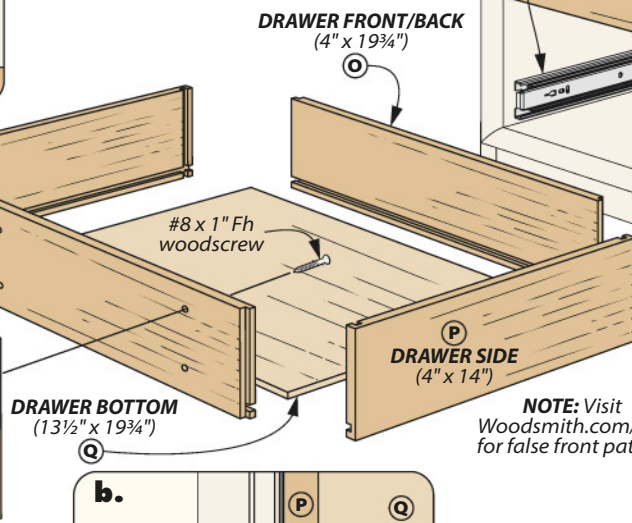
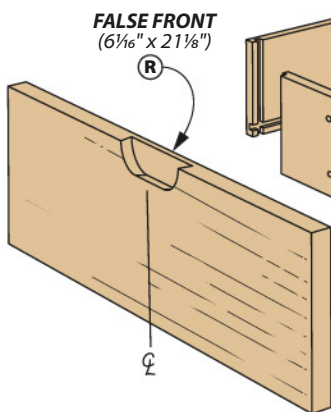


For more on making the rounded legs and routing the pull on the false fronts, go to:

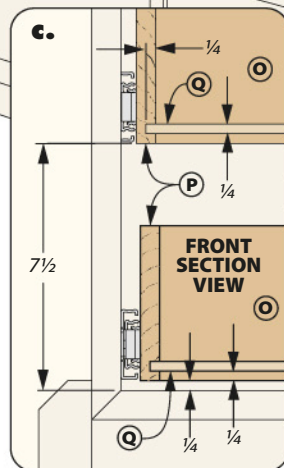
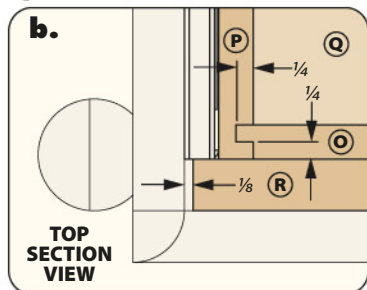
Woodsmith.com/268



NOTE: The front, back, and sides of the drawers are 1/2"-thick hardwood. The bottoms are 1/4" plywood. The false fronts are 3/4"-thick hardwood



NOTE: Visit Woodsmith.com/268 for false front pattern



GLUEUP. Now you can glue up the drawer parts. Once dry, they can be installed. The drawers are mounted on full-extension slides, and details 'b' and 'c' show you their positioning.

FALSE FRONTS. With the drawers in place, you can size the false fronts to fit the opening in the case. After that, the false fronts only have one order of business: their fingerpulls. I made these

using a template to help me rout with a bushing. I started off with a straight bit to establish the pull's perimeter, then swapped out for a dovetail bit to achieve

the angle you see in detail 'a.' I then painted the fronts and screwed them in place once they were dry.

With the drawers in, the entry bench is complete. Now it's ready to help you start your day, to greet you when you return home, and to provide a warm welcome to whoever visits. **W**

Materials, Supplies & Cutting Diagram

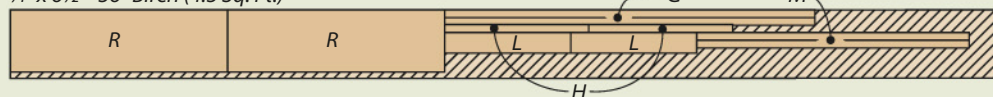
A Case Top/Bottom (2)	3/4 ply. x 15 3/4 - 36	I Divider Edging (1)	1/4 x 3/4 - 12 1/2	Q Drawer Bottoms (2)	1/4 ply. - 13 1/2 x 19 3/4
B Case Sides (2)	3/4 ply. x 15 3/4 - 14	J Shelf Edging (1)	1/4 x 3/4 - 12 3/8	R False Fronts (2)	3/4 x 6 1/16 - 21 1/8
C Case Divider (1)	3/4 ply. x 14 3/4 - 13	K Long Rails (2)	1 1/8 x 2 - 38		
D Case Back (1)	3/4 ply. x 13 - 35	L Short Rails (2)	3/4 x 2 - 12 1/4		
E Case Splines (4)	1/4 hdbd. x 3/4 - 15 3/4	M Cleats (2)	3/4 x 3/4 - 26 1/2		
F Case Shelf (1)	3/4 ply. x 12 3/8 - 14 1/4	N Feet (4)	1 5/8-dia. x 5		
G Top/Bottom Edging (2)	3/4 x 3/4 - 36	O Drawer Sides (4)	1/2 x 4 - 14		
H Side Edging (2)	3/4 x 3/4 - 14	P Drawer Fronts/Backs (4)	1/2 x 4 - 19 3/4		

- (4) 1/4" Shelf Pins
- (14) #8 x 1 1/4" Fh Woodscrews
- (8) 1 1/4" Pocket Screws
- (2 pr.) 14" Full-extension Drawer Slides
- (8) #8 x 1" Fh Woodscrews

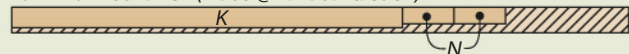
1/2" x 5 1/4" - 72" Birch (2 Bds @ 2.3 Sq. Ft. each)



3/4" x 6 1/2" - 36" Birch (4.3 Sq. Ft.)



1 3/4" x 2 1/2" - 60" Birch (2 Bds @ 2.1 Bd. Ft. each)



ALSO NEEDED: One 4' x 8' sheet of 3/4" birch plywood, one 2' x 4' sheet of 1/4" hardboard, and one 2' x 4' sheet of 1/4" birch plywood



- ▶ The lid stay holds the lid open. The latch locks the lid closed. Both brass pieces perform their duty with style.



Vintage Toolbox

What you have here is a toolbox that lets you either dispense with or catch the overflow of the pegboard items cluttering the back of your bench.



▲ The architectural-grade brass flange that's attached to the door snugs the door to the case and enhances the soft, warm glow of the toolbox.

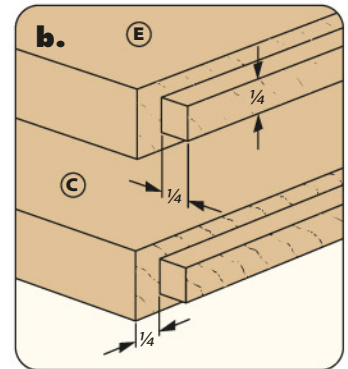
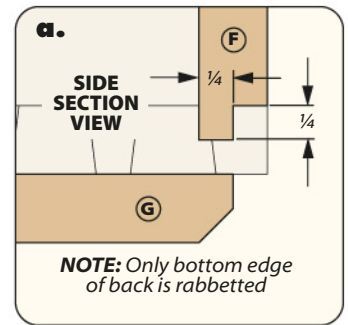
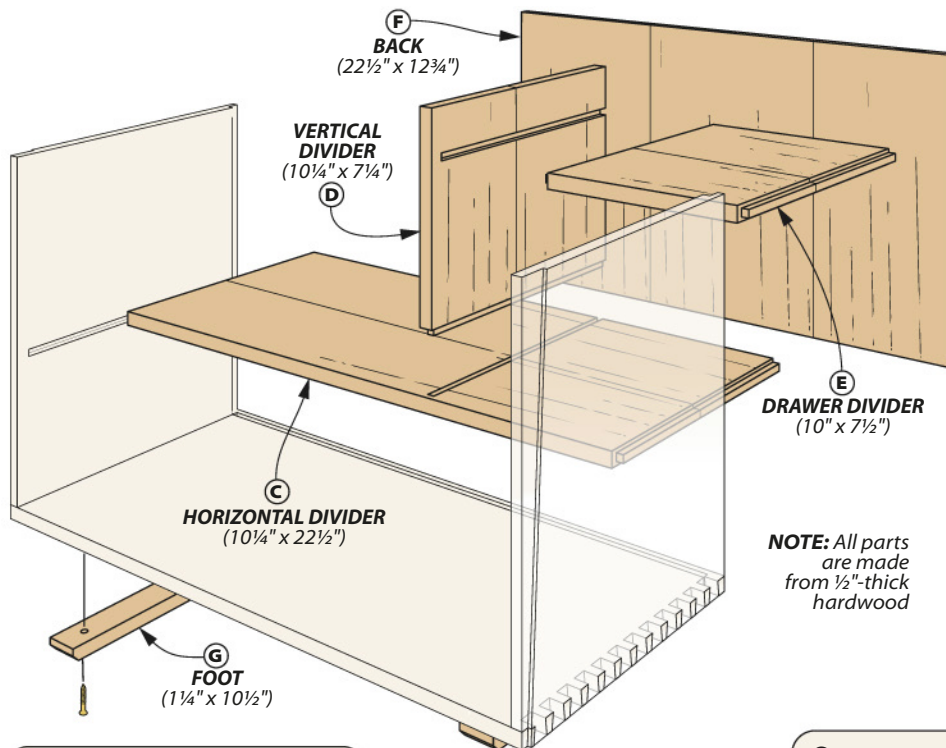
I often refer to projects like this toolbox as a “chip away” project. It's a project that can be addressed in between other duties, or serve as a break when you've hit a wall or are waiting on material for other projects. It's also an aid on the weekends to fend off the ever present *golf-on-TV nap* that I catch staring at me — when they think I'm not looking.

Yes, this toolbox is an ideal small project in that it has some challenges that will keep you awake, while not demanding a lot of space to work on in the shop. All the parts can be set aside or easily stowed away when more important issues arise.

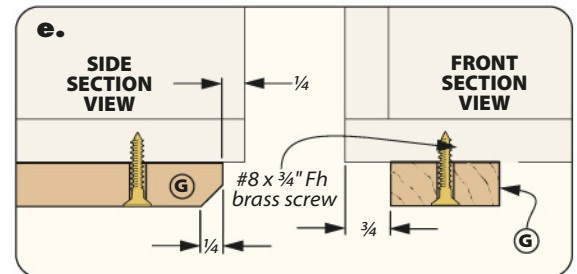
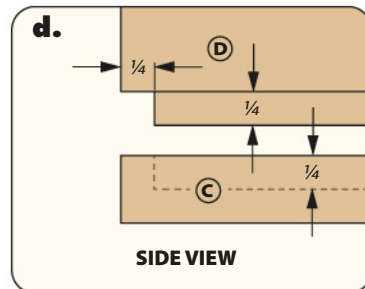
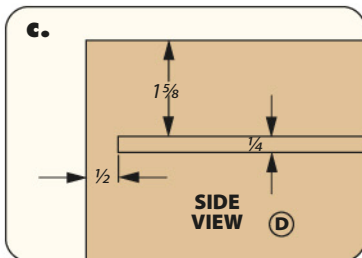
As for the look of the toolbox, all you need to do is an image search on the web for *rare-Louis-Vuitton-tool-box* and you'll see the inspiration behind Dillon Baker's design. Notice the brass trim on the top inset photo. This isn't your run-of-the-mill hobby shop brass strip. This is architectural-grade brass that has a soulful luster. Also the corrugated door that keeps things contained evokes a cloth-like warmth to the front of the toolbox. When the door is lowered there are the whimsical leather-tabbed drawer pulls that adorn the beveled drawer fronts. Throw into the mix the hand-cut dovetails that join the case bottom to the sides and punctuate the rim of the lid. All these elegant details makes for a convincing argument that you've got an instant classic on your hands.



▲ The clever drawer pulls are an assembly of a shop-made leather tab, a brass binding barrel and screw, and a custom-made spacer that you'll make from a length of brass rod.



NOTE: All parts are made from 1/2"-thick hardwood



to Woodsmith.com/268 for details. There's a stopped groove along the back edge of the bottom that you need to rout (detail 'c,' previous page) before you cut the dovetails. The groove is for the rabbet on the back you'll make in a little bit.

STOPPED DADOES. When you're done with the dovetails, head back to the router table and rout the stopped dadoes in the sides (detail 'b,' previous page). Follow this with the rabbet along the rear edge of the side (detail 'a,' previous page).

THE INSIDE STORY

It's time to chip away at the remaining parts that make up the case. Making the stopped grooves needed in these parts is an encore performance at the router table. Detail 'c' shows

the one that goes in the vertical divider. If you haven't already, now's the time to square up the stopped grooves with a chisel. Then you can hop over to the table saw to make the tenons that go in all these grooves.

TENONS. Detail 'b' above shows the size of the tenons on the ends of the horizontal and drawer dividers. Also, cut the lone tenon on the bottom of the vertical divider (detail 'd').

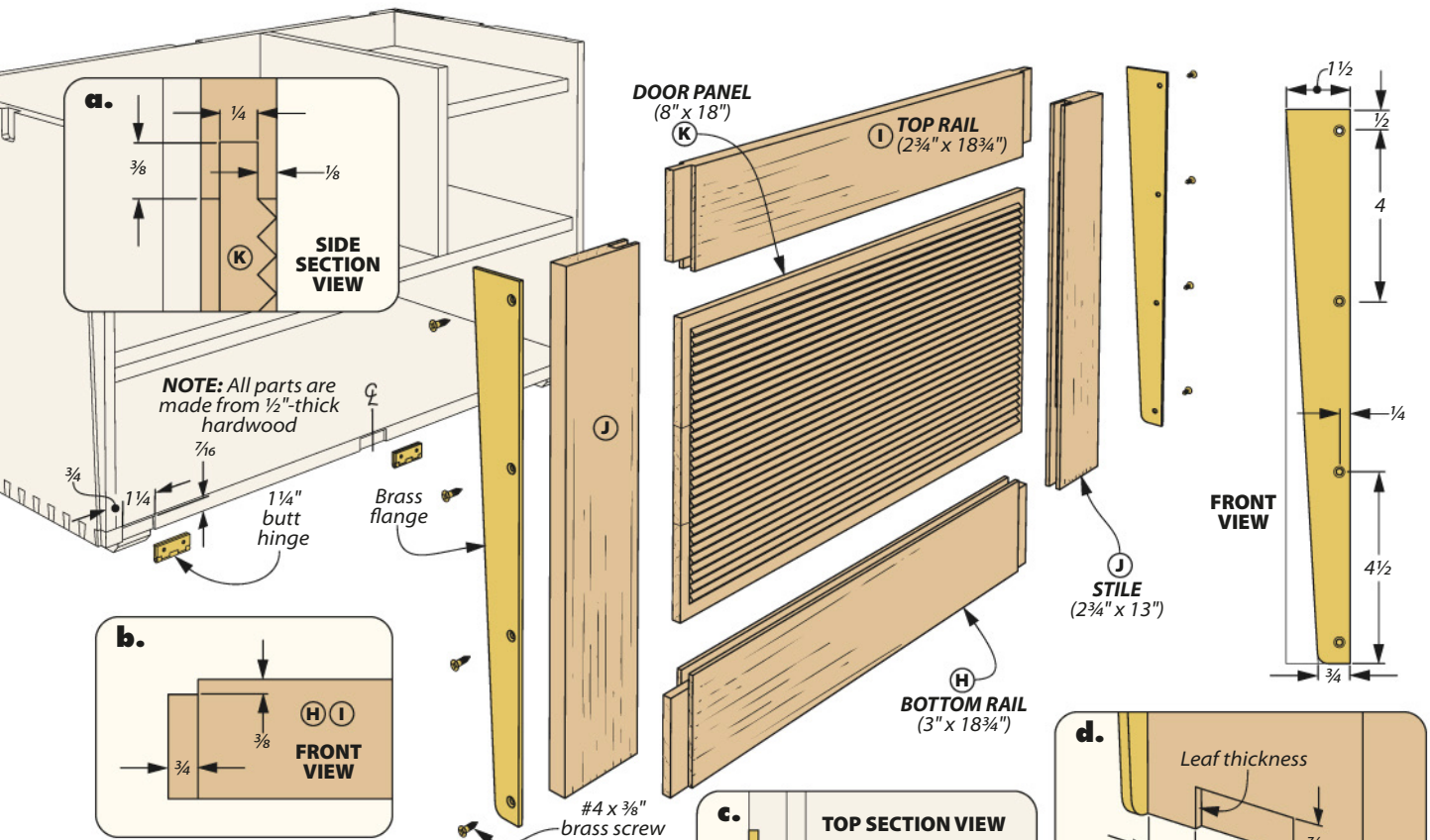
The back panel is up next. After trimming it to size there's a rabbet you need to rout along the bottom edge (detail 'a').

GLUE UP — SHORTLY. Before you glue up the case there's one little detail to attend to. Notice the angled recess you see in the case side (far left detail on

the previous page). This recess accommodates the brass strips that are screwed to the outer edge of the door. The box on the bottom of the previous page shows how to make the recess.

With the router put away, it's time to gather up the clamps and accessories you'll need to glue up the case. Epoxy was used on the case for several reasons — first, epoxy provides lots of open time. Also, you could mix mahogany sawdust in with the epoxy to fill any voids in the joinery. It's best to leave clamps on overnight until the epoxy is cured.

THE FEET. The feet lift the case off the surface and provide some clearance for the door. Start by cutting the feet to final size, then chamfer the ends. Detail 'e' shows their location on the underside of the toolbox.



Next — the DOOR & LID

If you took the time to explore the link I shared with you at the beginning of the project, you'll see a couple of things that sparked the unique look of the door shown above. First, the frame and panel door has been visually enhanced with a corrugated pattern applied to the panel. Second, the brass strips attached to the door cradle the

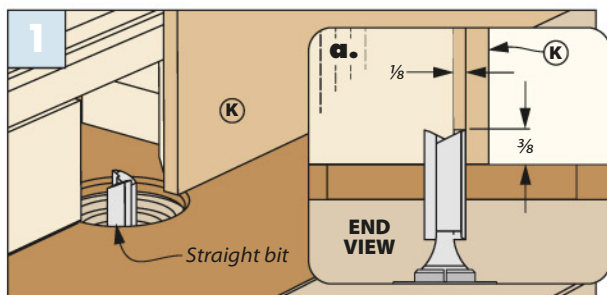
sides of the toolbox, bringing a vintage aesthetic to the project.

As for the practical duties of these parts, the door prevents the drawers (and shelf contents) from spilling. The lid holds the door closed via the shelf pins in the top edge. If so desired, you could design custom brackets to

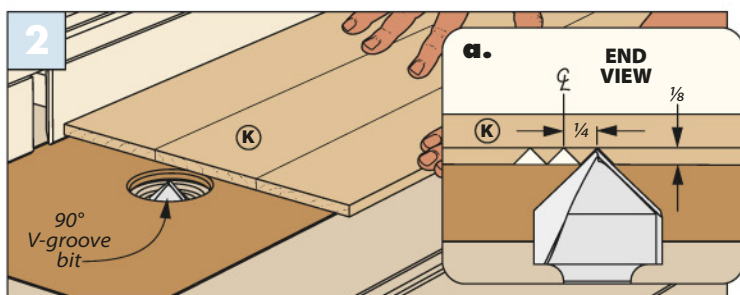
hold favorite tools and mount them to the underside of the lid. You can ponder those ideas while you make the door.

THE DOOR. Gluing up the panel for the door is the first order of business. While that's curing you can plane to thickness and cut to final size the rails and stiles. Then it's off to the router table to make some grooves.

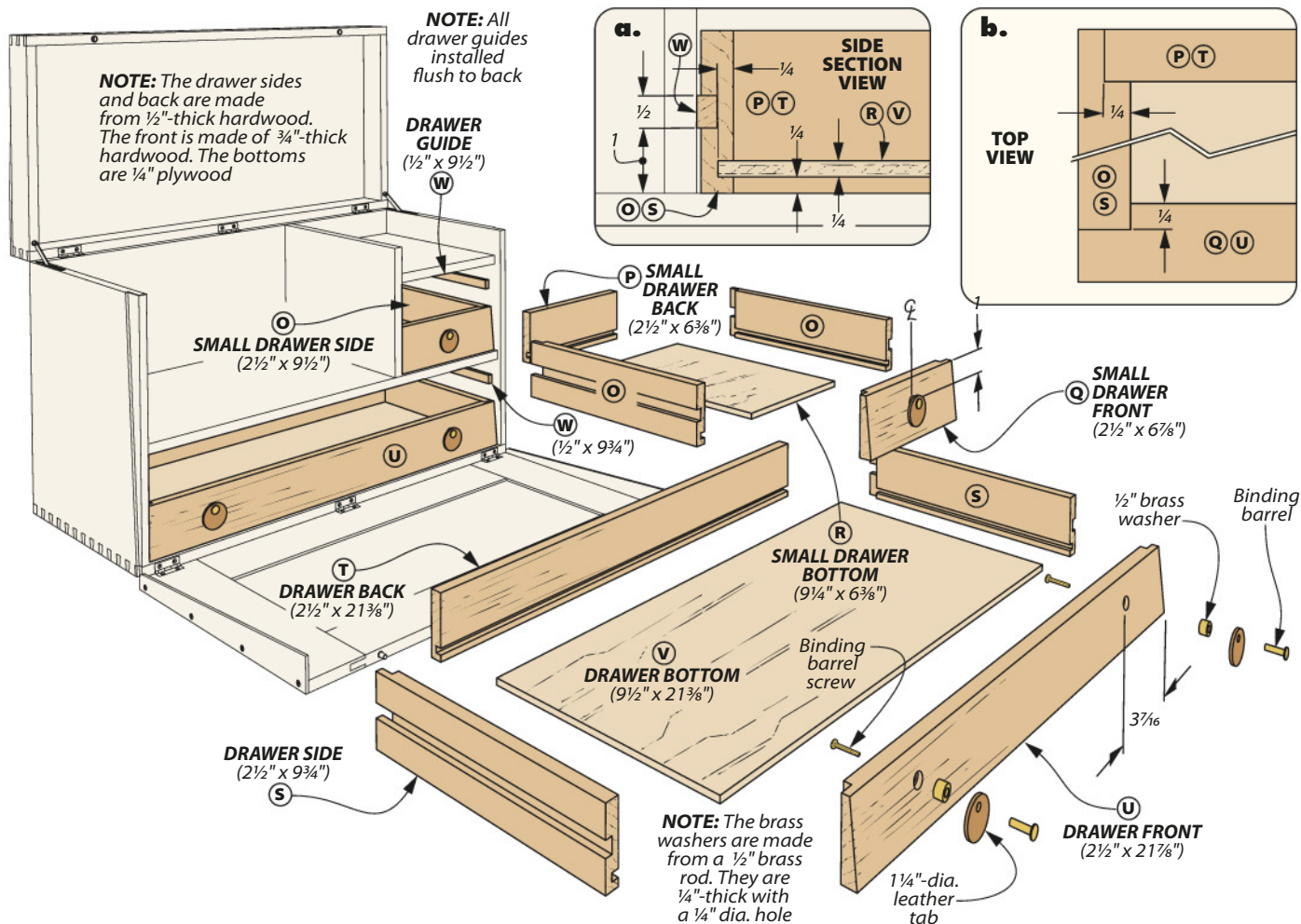
MAKING A CORRUGATED PANEL



Rabbet the Edges. Use a straight bit in your router table to make the rabbet on the door panel.



Start in the Center. Create the wavy pattern starting from the center and working your way out with a 90° V-groove bit.

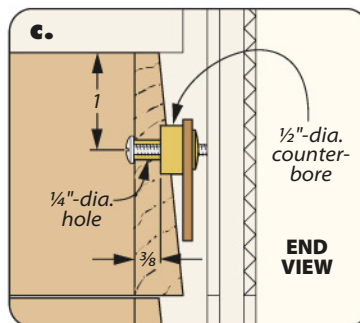


Lastly, the DRAWERS

There are four drawers in the toolbox. Two smaller drawers in the upper right of the box. Two large drawers run the length of the box at the bottom of the case.

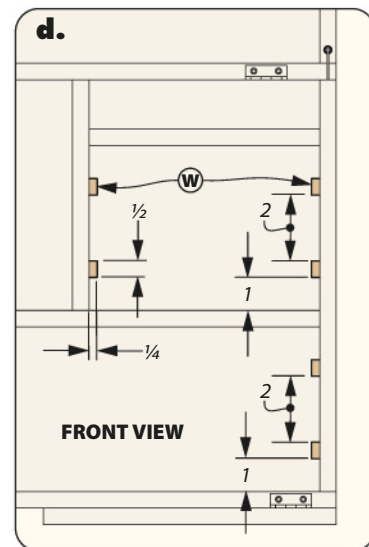
SIZING PARTS. Cut the sides, front, and back to final size. You'll notice that the fronts are made of 3/4" material. This is to provide room for the beveled face (detail 'c') that will throw a subtle shadow detail across the front of the project.

MORE GROOVES & RABBETS. Get the ball rolling by cutting the grooves for the bottom along the lower edge of the inside faces of all the parts (detail 'a'). Then reset the dado blade on your saw and cut the rabbet on the back end of the drawer sides, and both ends of the drawer fronts (detail 'b').



The last bunch of grooves needed here are the ones you see in Figure 1 on the next page. These grooves are in the outside face of all the drawer sides and travel along the drawer guides that you'll glue to the case.

HOLES FOR PULLS. There's one more thing to do before gluing up the drawers. You'll need to lay out and drill the holes for the pull hardware on the drawer fronts. Notice the counterbore for the

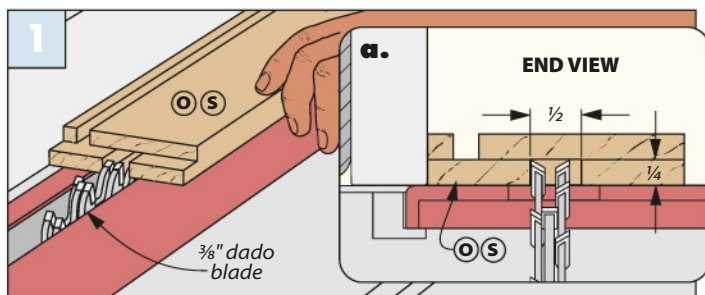


hardware in detail 'c.' Drilling the holes before cutting the bevel will keep the hardware square to the drawer front.

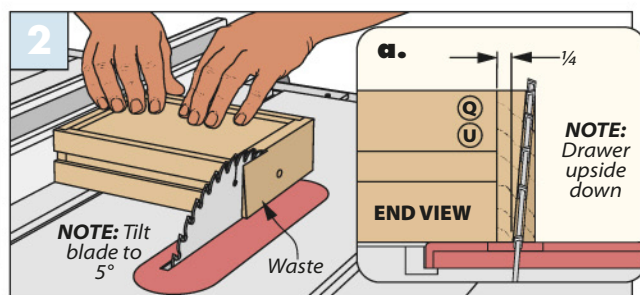
Gluing up the drawers is the next task. The rabbets do a good

▲ These two punches make quick work of creating the leather tabs that are part of the drawer pull assembly. Sources on page 66 tells you where to find them.

DRAWER DETAILS



Grooves for the Guides. Use a dado set for the groove in the drawer side. Spin the part end for end to center the groove.



Bevel the Face. Make the bevel in the face of the drawers at the table saw with a freshly sharpened blade.

job of keeping the boxes square, but I always do a quick check with my combination square — better safe than sorry.

It's also safer (and easier) to cut the bevel on the drawer fronts after the drawer is glued up (Figure 2). Sand out any blade marks

left in the face of the drawers. Then attach the drawer pulls.

DRAWER GUIDES. Cut the guides to final size and ease the outer edges. Detail 'd' on the previous page shows the placement of the guides. Stand the case on end and glue them in place.

To wrap up this project you'll use a leather punch to make the tabs that are fastened to the drawer front through the binding screw (detail 'c,' previous page). However you choose to use this gem of a toolbox, it will only get better over the years. [W](#)

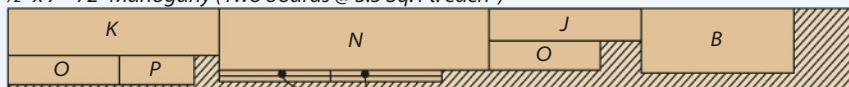
Materials, Supplies & Cutting Diagram

A Bottom (1)	$\frac{1}{2}$ x 11 - 23	L Lid Sides (2)	$\frac{1}{2}$ x 2 - 11 $\frac{1}{2}$	W Drawer Guides (8)	$\frac{1}{4}$ x $\frac{1}{2}$ - 9 $\frac{3}{4}$
B Sides (2)	$\frac{1}{2}$ x 11 - 13	M Lid Front/Back (2)	$\frac{1}{2}$ x 2 - 23	• (3) Pairs of Hinges	
C Horizontal Divider (1)	$\frac{1}{2}$ x 10 $\frac{1}{4}$ - 22 $\frac{1}{2}$	N Lid Panel (1)	$\frac{1}{2}$ x 11 $\frac{1}{2}$ - 23	• (2) Lid Stays	
D Vertical Divider (1)	$\frac{1}{2}$ x 10 $\frac{1}{4}$ - 7 $\frac{1}{4}$	O Small Drawer Sides (4)	$\frac{1}{2}$ x 2 $\frac{1}{2}$ - 9 $\frac{1}{2}$	• (2) $\frac{1}{4}$ " Shelf Pins and Sleeves	
E Drawer Divider (1)	$\frac{1}{2}$ x 10 - 7 $\frac{1}{2}$	P Small Drawer Backs (2)	$\frac{1}{2}$ x 2 $\frac{1}{2}$ - 6 $\frac{3}{8}$	• (2) $\frac{1}{8}$ " x 1 $\frac{1}{2}$ " - 13" Brass Plates	
F Back (1)	$\frac{1}{2}$ x 22 $\frac{1}{2}$ - 12 $\frac{3}{4}$	Q Small Drawer Fronts (2)	$\frac{3}{4}$ x 2 $\frac{1}{2}$ - 6 $\frac{7}{8}$	• (8) #4 x $\frac{3}{8}$ " Brass Screws	
G Feet (2)	$\frac{1}{2}$ x 1 $\frac{1}{4}$ - 10 $\frac{1}{2}$	R Small Drawer. Btms. (2) $\frac{1}{4}$ ply. x 9 $\frac{1}{4}$ - 6 $\frac{3}{8}$		• (6) #8 x $\frac{3}{4}$ " Brass Screws	
H Bottom Rail (1)	$\frac{1}{2}$ x 3 - 18 $\frac{3}{4}$	S Drawer Sides (4)	$\frac{1}{2}$ x 2 $\frac{1}{2}$ - 9 $\frac{3}{4}$	• (6) 1 $\frac{1}{4}$ "-Dia. Leather Tabs	
I Top Rail (1)	$\frac{1}{2}$ x 2 $\frac{3}{4}$ - 18 $\frac{3}{4}$	T Drawer Backs (2)	$\frac{1}{2}$ x 2 $\frac{1}{2}$ - 21 $\frac{3}{8}$	• (6) $\frac{1}{2}$ " Brass Washers (made from rod)	
J Stiles (2)	$\frac{1}{2}$ x 2 $\frac{3}{4}$ - 13	U Drawer Fronts (2)	$\frac{3}{4}$ x 2 $\frac{1}{2}$ - 21 $\frac{7}{8}$	• (6) #8-32 Brass Binding Barrel & Screw	
K Door Panel (1)	$\frac{1}{2}$ x 8 - 18	V Drawer Bottoms (2)	$\frac{1}{4}$ ply. x 9 $\frac{1}{2}$ - 21 $\frac{3}{8}$	• (2) Lid Latches	

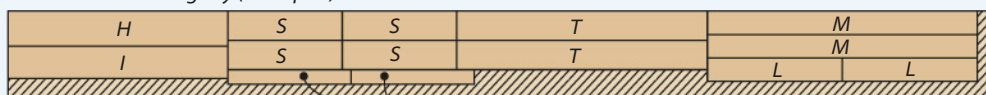
$\frac{1}{2}$ " x 6"- 78" Mahogany (Two boards @ 3.3 Sq. Ft. each)



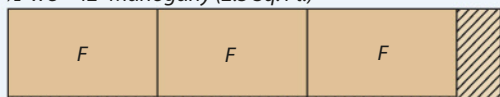
$\frac{1}{2}$ " x 7"- 72" Mahogany (Two boards @ 3.5 Sq. Ft. each)



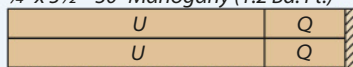
$\frac{1}{2}$ " x 7 $\frac{1}{2}$ " - 84" Mahogany (4.4 Sq. Ft.)



$\frac{1}{2}$ " x 8"- 42" Mahogany (2.3 Sq. Ft.)



$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " - 30" Mahogany (1.2 Bd. Ft.)



ALSO NEEDED:
One 24" x 48" Sheet
of $\frac{1}{4}$ " Mahogany
Plywood



Songbird Tower

Liven up your yard this summer by inviting over a few avian friends. This bird feeder is sure to keep them coming back for more.

One of the most pleasant reminders that spring has returned — more than green leaves and blue skies — is hearing the birds sing again. Of course, even if you aren't a fan of their warbling or their colors, having some feathered fellows nearby is still a boon. Few animals eat as many bugs as songbirds do. Whether you're looking for a summer serenade or a few backyard guardians, this tower bird feeder is an excellent way to make sure the birds visit your home.

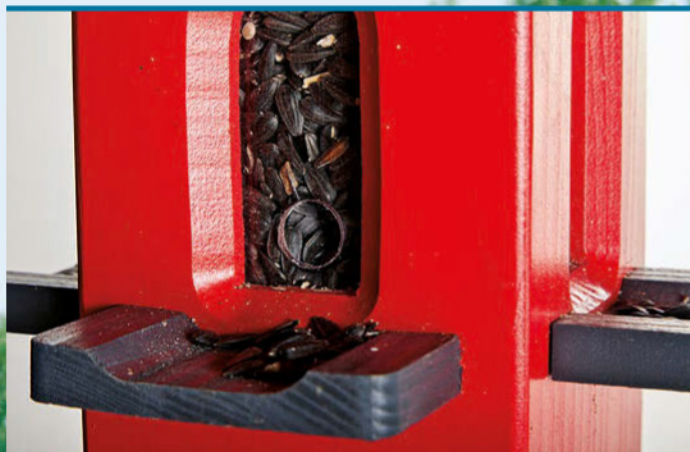
The main body of the tower is essentially a large tube. Windowed sides and retainers within hold plexiglass panels in place. Small holes in the plexiglass allow the tower to act as a gravity feeder for the birds.

You may have noticed as well that, rather than simple dowels, trays sit in front of the windows. These are relatively small, and won't provide purchase to larger birds like blackbirds, grackles, and crows who will often scare away their smaller cousins.

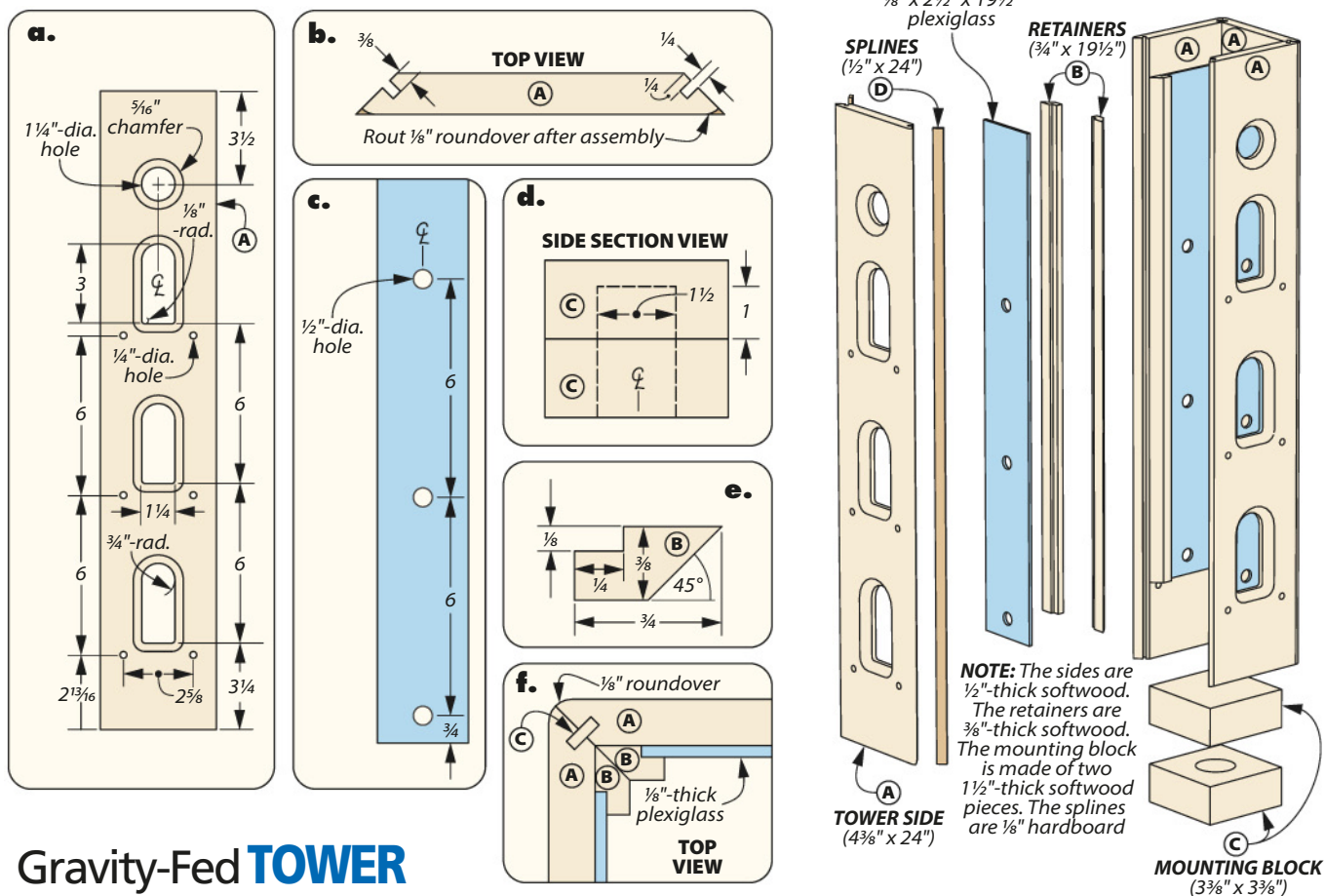
As shown in the upper inset photo, the roof is left loose, so it can be easily removed to refill the tower. Its sweeping design, inspired by the curved, pyramid-shaped "hogyo" roofs of Japan, allows the wind to blow easily by. Additionally, the whole tower is made of cypress, a rather stable softwood. Similar to cedar, the natural oils in cypress make it resistant to rotting and warping. If you're looking for a beautiful and long-lasting way to bring the birds in, you won't go wrong with this tower.



▲ A removable top makes it easy to refill the tower for your winged guests, while the well-fit tower plug and shallow, sweeping roof will keep it in place through wind and storms.



▲ Plexiglass windows back the sides of the tower. The trays are an easy perch for small songbirds, and small holes allow them to eat their fill while gravity keeps the seeds coming.



Gravity-Fed TOWER



For a detailed window template pattern, go to:
Woodsmith.com/268

The first thing to address on this tower is the feeder itself. The sides make up the meat of the work here, and are the optimal place to begin.

SIDES. Start off by cutting the four sides to length. When it comes time to rip them to width, take a look at the box (and

detail 'b'). The edges of the sides are beveled to fit together, so cut these at 45° (Figure 1 in the box below), then cut the slot for the splines (Figure 2).

Next on the docket are the "windows" of the tower. These will be backed with plexiglass, allowing you to see how full the

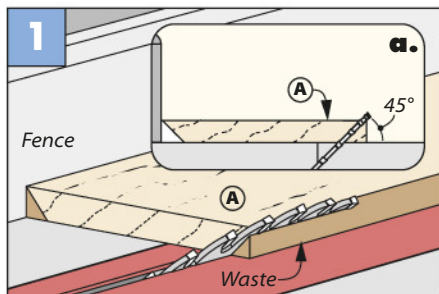
tower is. To shape these windows, I used a template.

TEMPLATE ROUTING. The pattern I used to make the template for the sides can be found at Woodsmith.com/268. I made the template from hardboard, but before attaching it I wanted to remove some waste from the windows.

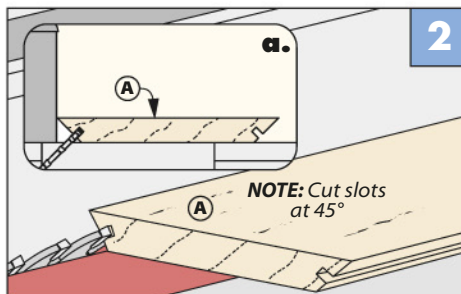
Shown in Figure 1 at the top of the next page, I drilled a hole to define the top of each window and smaller holes at the lower corners. I then connected them with a jig saw to remove most of the waste from the windows. After this was done, I stuck on the template with double-sided tape. As you can see in Figure 2, I routed the lower three windows in the sides using a pattern bit.

FINISHING TOUCHES. The windows have a wide chamfer around their outside edges, which can be routed now. Then drill out the dowel holes for the seed trays (detail 'a,' previous page).

A MORE SOLID BEVEL



Bevel Cuts. Begin by ripping bevels along the edges of the sides so they'll fit together in a square assembly.



Spline Slot. Using a 1/8" dado blade, cut the slots in the angled edges. These will hold the splines to align the bevels.

With that, the tower sides are completed, but some work needs done before they're ready to glue up. Next, we'll cut and shape the rest of the parts for the tower, then they'll all be brought together.

RETAINERS & WINDOWS

Long strips of plexiglass fill the windows, and each is held in place by a softwood retainer (shown in detail 'e'). These retainers will be glued to the inside faces of the sides for the plexiglass to sit loosely within.

THREE CUTS. The retainers are small, oddly shaped pieces, but the box below breaks down how to safely make them. I began with four extra-wide blanks ($\frac{3}{8}$ " x $1\frac{5}{8}$ " x $19\frac{1}{2}$ "). The $1\frac{5}{8}$ "-wide blanks account for a $\frac{1}{8}$ " kerf. From here, the first step was the groove down the center (as in Figure 1). After this, I flipped the blank over and swapped out the dado blade for a rip blade. As shown in Figure 2, rip down the centerline to separate the two retainers.

The last step on these is to bevel their edges (Figure 3). Since this is a thin, narrow piece to bevel, I recommend using a heeled push block to help make the cut.

MOUNTING BLOCK. The mounting block is a thick piece glued

up from two identical, thinner blocks. The mounting block will be used to mount the feeder. After sizing the two initial blanks, glue them together (detail 'd,' previous page). Once dry, head to the drill press to drill out the hole for the mounting pole.

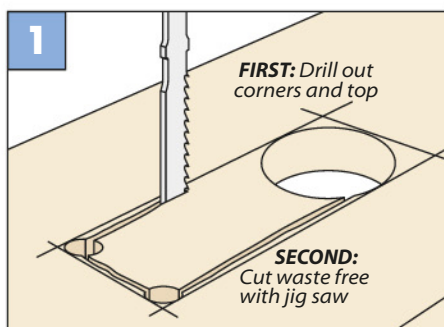
ASSEMBLY. The first step in assembly is gluing the retainers to the inside faces of the sides. These sit 3" up from their bottoms, allowing the mounting block to sit below them and flush with the bottom of the case. Be sure to wipe up any squeezeout that gets into the window slots.

Once the clamps come off the retainers, the tower can be

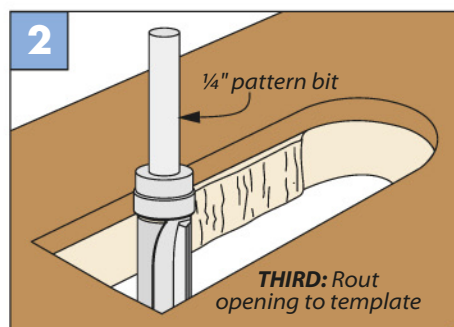
glued up. Before assembling these though, you'll need to cut the splines. These are thin pieces of hardboard (main illustration, previous page). Once sized, glue up the sides with the splines in place. The mounting block is then glued in beneath the retainers. Once the tower is dry, finish it up by rounding over the edges at the router table (details 'b' and 'f').

PLEXIGLASS. The last step on the tower is the window panes. Cut the plexiglass pieces to size and drill three holes in each piece (detail 'c'). Then, simply slide them in place between the retainers.

TOWER WINDOWS

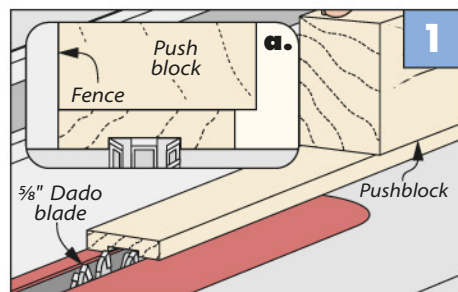


Jig Saw. After drilling out the tops and lower corners of the windows, remove the waste with a jig saw.

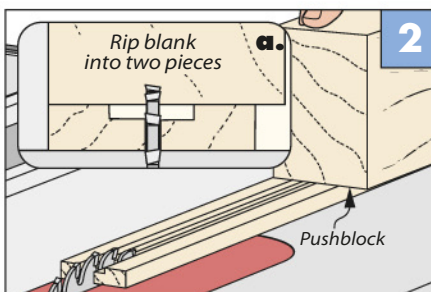


Template Routing. Follow the template with a pattern bit to remove the remaining waste in the openings.

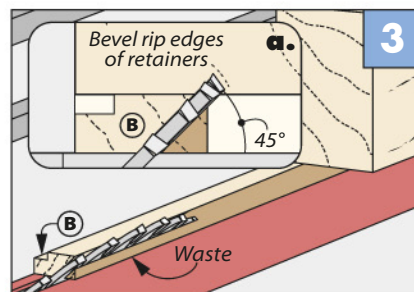
WINDOW RETAINERS



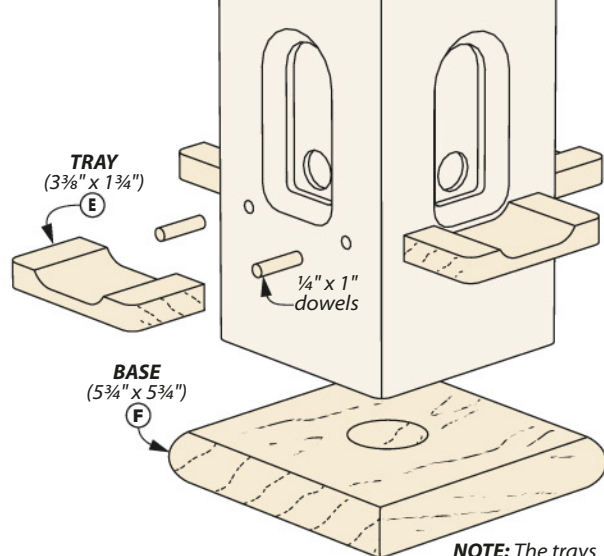
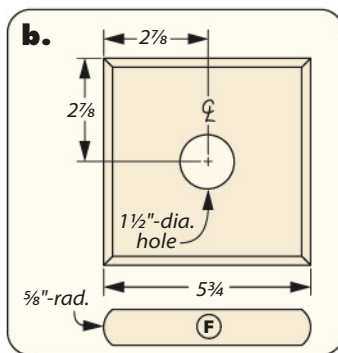
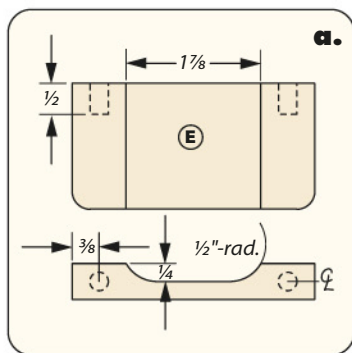
Groove. A dado blade plows a groove down the blank to create a rabbet that will hold the plexiglas panes.



Rip. Swap out for a rip blade and cut the blanks down the centerline, creating the eight $\frac{3}{4}$ "-wide retainers.



Bevel Cut. Rip the corner opposite the rabbet on each retainer at 45°. Use a push block to prevent tipping.



NOTE: The trays are 1/2"-thick softwood. The base is 1"-thick softwood

Towering DETAILS



▲ **Centers.** Dowel centers like these are the perfect way to transfer the dowel holes from the tower to the tray.

With the body of the tower constructed, it's time to finish up with some finer details.

SEED TRAYS. There are twelve trays, shown in detail 'a' above, each with a central channel, rounded corners on the front, and holes in the back for the mounting dowels. I began with these all as one extra-long blank, routing the channel down the center before cutting them apart (Figures 1 and 2 below).

Next, I took the trays over to the edge sander to round off their front corners. Lastly, I drilled out the dowel holes for attaching the trays to the tower (Figure 3).

TOWER BASE. The tower sits on a bullnosed base. After sizing the base, I used a Forstner bit to drill

out the central hole. To shape the edges, I used a roundover bit at the router table to rout the top and bottom edges all around.

PYRAMID ROOF

The tower is capped off with a sweeping, pyramid-shaped roof. It adds style and offers some unique shaping work.

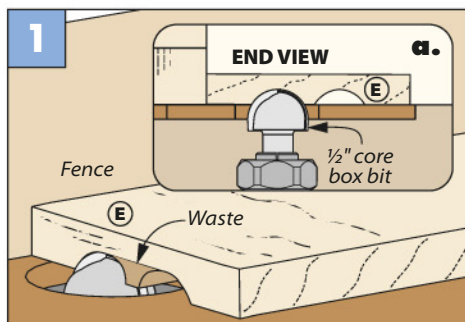
ROOF PANELS. Detail 'a' on the next page shows the profile of the roof panels, which begin as one blank. The box on the following page shows how to shape their curves. Once finished with the shaping, cut the panels free from the blank. This cut will be a compound one, as the panels' edges are not only mitered, but beveled at 30° (detail 'd' and

Figure 3 on the following page). Lastly, cut the grooves for the splines (detail 'd,' next page).

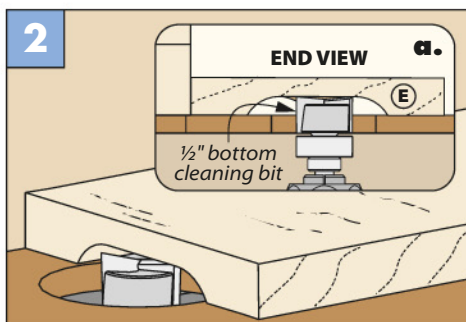
ASSEMBLING THE ROOF. To finish the roof, you'll first need to cut the splines and plugs to size. The edges of the roof plug need mitered as well, as in detail 'b.'

Now, glue the roof panels together with the splines. I cut a few angled blocks to match the roof's angle for better clamping pressure and attached them with double sided tape. While I waited for the roof to dry, I face glued

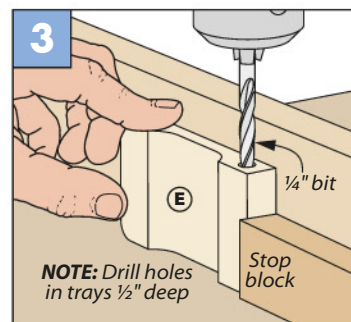
SHAPING THE TRAYS



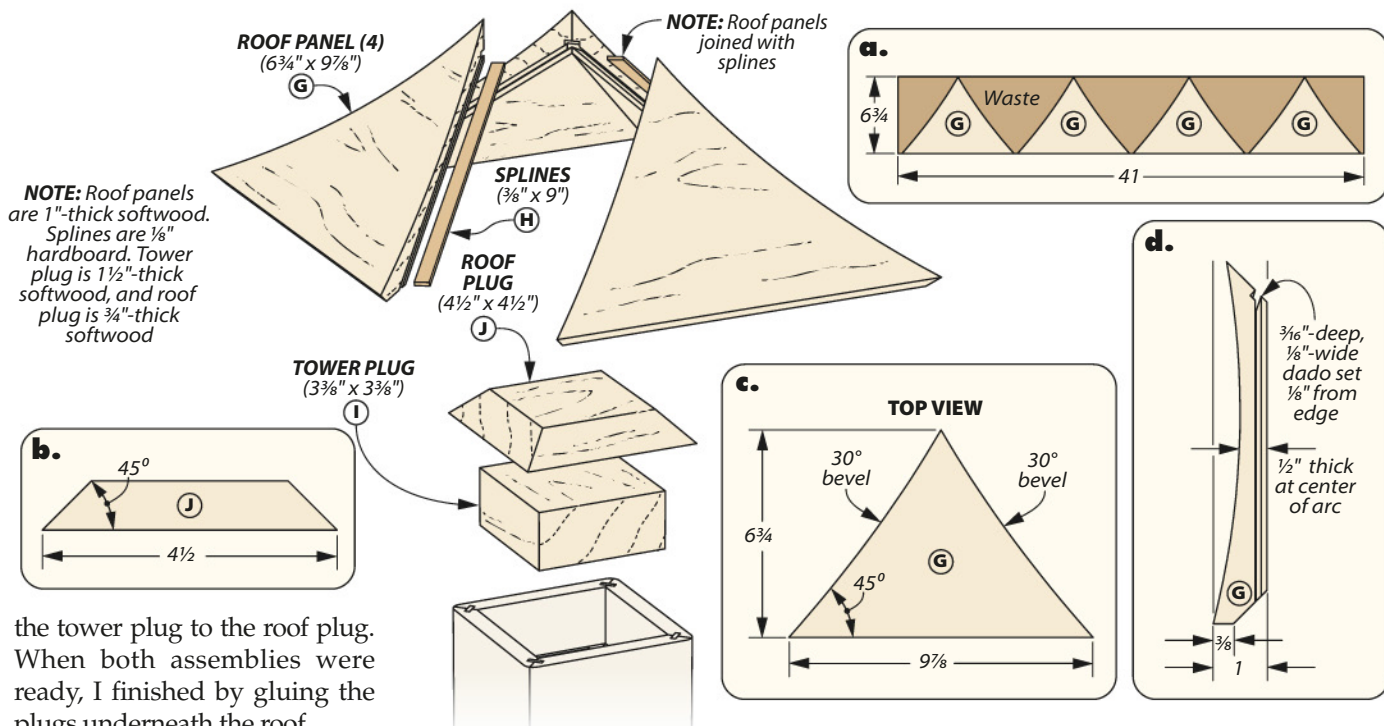
Two Grooves. Using a core box bit at the router table, rout two grooves to establish the sides of the channel.



One Channel. Swap out the core box bit for a bottom cleaning bit. Rout the center of the channel to connect the grooves.



Dowel Holes. At the drill press, drill out the holes for the dowels to match the tower sides.



the tower plug to the roof plug. When both assemblies were ready, I finished by gluing the plugs underneath the roof.

PAINTING & MOUNTING. Before putting it all together, paint the individual pieces (keeping paint off the top of the base). Once dry, I glued the tower bottom onto the assembly and attached the seed trays to the tower sides.

All the tower needs now is a home. After finding the right spot to mount the pole, slip the tower assembly onto the pole. Fill the tower with bird seed and place the roof on top. Now, just wait for your first feathered friends to arrive. [W](#)

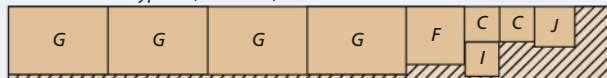
Materials, Supplies & Cutting Diagram

A Sides (4)	$1\frac{1}{2} \times 4\frac{3}{8} - 24$	F Base (1)	$1 \times 5\frac{3}{4} - 5\frac{3}{4}$
B Retainers (8)	$\frac{3}{8} \times \frac{3}{4} - 19\frac{1}{2}$	G Roof Panels (4)	$1 \times 6\frac{3}{4} - 9\frac{7}{8}$
C Mounting Block (1)	$3 \times 3\frac{3}{8} - 3\frac{3}{8}$	H Roof Splines (4)	$\frac{1}{8}$ hdbd. - $\frac{3}{8} \times 9$
D Splines (4)	$\frac{1}{8}$ hdbd. - $1\frac{1}{2} \times 24$	I Tower Plug (1)	$1\frac{1}{2} \times 3\frac{3}{8} - 3\frac{3}{8}$
E Trays (12)	$1\frac{1}{2} \times 3\frac{3}{8} - 1\frac{3}{4}$	J Roof Plug (1)	$\frac{3}{4} \times 4\frac{1}{2} - 4\frac{1}{2}$

$\frac{1}{2}'' \times 4\frac{3}{4}'' - 84''$ Cypress (Two Boards @ 2.8 Sq. Ft.)

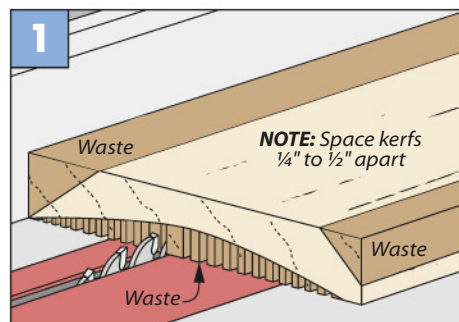


$1\frac{1}{2}'' \times 7\frac{1}{2}'' - 60''$ Cypress (4.7 Bd. Ft.)

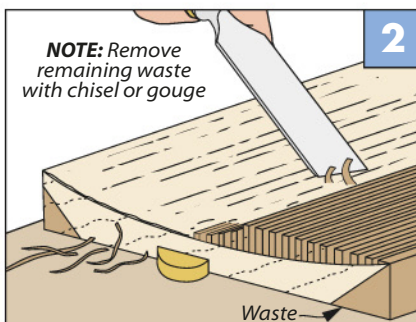


ALSO NEEDED: One 2' x 4' sheet of hardboard

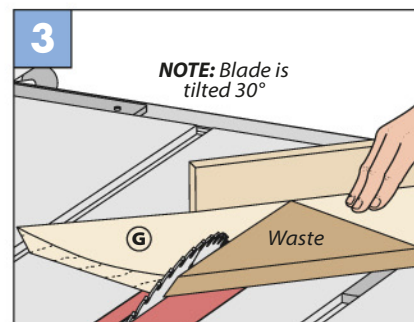
SCOOPING THE ROOF



A Curve of Kerfs. Most of the waste can be removed at the table saw by making a series of cuts to match the layout.

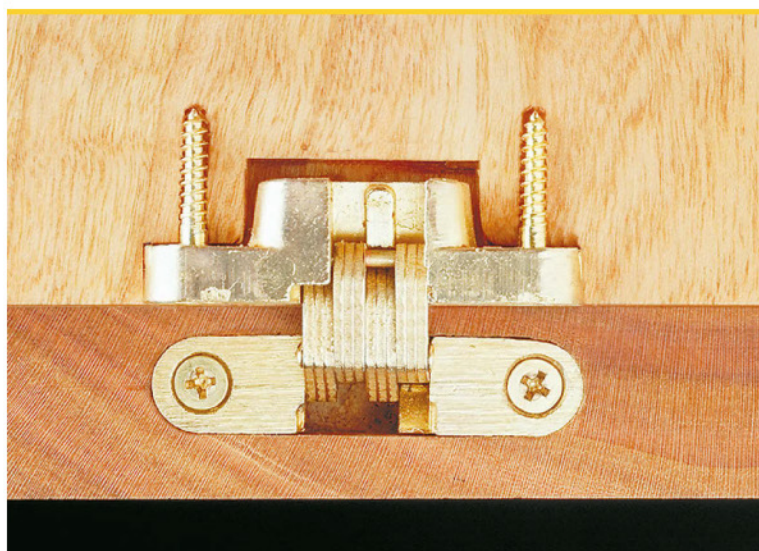


Finish By Hand. Remove the rest of the waste by hand. Final shaping can be done later with rasps and sandpaper.



Freeing the Panels. Make beveled miter cuts at the table saw to free the roof panels from the blank.

SOSS Hinges



▲ SOSS hinges are designed around interlocking links that allow the parts to open and close. The links nestle into the two bodies of the hinge, resulting in a fully concealed look in the closed position.

Woodworking involves making a series of decisions about how (and in what order) to perform certain tasks. Deciding among several approaches can be part of the fun of building a project. Other times, particular operations provide clues that guide you to a reliable method. Hardware installation is a good example.

A few recent projects around here all used SOSS hinges. Never heard of them? The key to this hinge is the knuckle mechanism. It's a set of boomerang-shaped links connected by a hinge pin. As the hinge closes, the links fold inside the body of the hinge and disappear, as shown in the left photo.

Everyone who sees the hinges inevitably picks one up and spends a few minutes opening and closing the hinge. It's mesmerizing.

HISTORY DETOUR. I figured the hinges are a relatively recent invention. Turns out, SOSS hinges have been around for more than 100 years. Around 1903, Joseph Soss came up with the idea after

tripping on an exposed hinge on the deck of a ship. By the end of the voyage, he designed and built a prototype.

The hinge design found its initial use in car doors. Now they're used in everything from small boxes to large passage doors.

INSTALLATION CUES. The hinge slips into a pair of matching mortises cut in the workpieces. As you can see in the photos on the previous page, each half of the hinge has a mounting flange and a larger body section. This means you need to create a stepped mortise.

Notice also that the ends of the mounting flange and the body are rounded. So the mortises need rounded ends for a clean look. This indicates that methods of work that create round recesses work best. In other words, a router.

I mean, you could use a drill to form the mortises. (We've shown that approach back in the day.) The hinges come with a paper pattern you can use for layout. However since a project usually requires two or more hinges,

drilling out each hinge with multiple paper patterns invites inconsistency.

With a small investment in time, you can make a router jig that will work reliably and with a minimum of fussing. The process is outlined in the box below.

PATTERN MAKES THE JIG. The first thing to do is photocopy the paper pattern for the hinge. (Or print several patterns from the SOSS website, soss.com.) You know, just in case.

The jig consists of two parts: a fence and a plate. A slot in the jig accepts a guide bushing to control the router and bit. I like to pin the fence to the plate so that the fence is slightly proud of the plate, as in Step 1. It's a trick I picked up from Steve Latta that ensures that the fence (not the plate) is the reference edge for the following steps.

Cut the paper pattern right at the indicated fold line. Spritz a coat of spray adhesive on the back side and attach the pattern to the fence (Step 2).

Use a Forstner bit that matches a guide bushing that won't

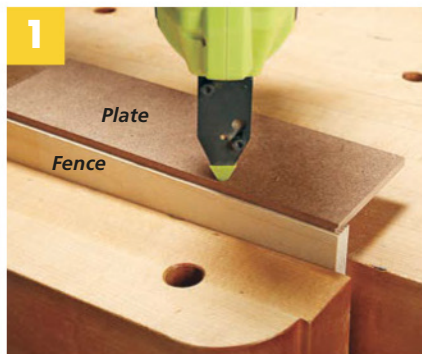


▲ **Copy the Pattern.** Just make sure the photocopies of the patterns are exactly the same size as the originals. You can also find patterns online.

interfere with the fence and drill out the ends of the slot using the centerpoints on the pattern, as in Step 3. Complete the slot at the router table. This is shown on the next page.

Transfer the centerline and body layout lines from the pattern around the inside of the slot and onto the top face (Step 2 on the next page). One more thing — label the jig with the hinge model number, bushing and bit size required for easy reference.

INSTALLING A SOSS HINGE



Two-Part Jig. Nail the plate and fence together, making sure the fence is slightly proud.



Attach the Pattern. Cut the pattern at the fold line and attach it to the bottom of the jig with spray adhesive.



Drill the Ends. Use the centerpoints of the pattern to align the drill bit to define the ends of the jig's slot.



▲ **Dot to Dot.** Set up a matching straight bit in the router table to complete the slot. The jig's fence registers off the router table fence for consistent alignment.



▲ **Transfer Lines.** Carry over the centerlines and marks from the paper pattern to the upper face of the jig. Marks inside the slot are used to align the workpiece.

PUTTING THE JIG TO WORK

The jig is an aid for consistency and effective work. There are still some other elements of the process that you need to take care of: layout, router setup, the actual routing, and hinge installation.

ESSENTIAL LAYOUT. Thanks to the centerlines on the jig, the layout necessary is reduced to marking the mortise centerlines on the workpieces. Where possible, I prefer to group the pieces side by side or even stack them. This helps me to keep the parts aligned and the centerlines can be made with a single stroke of the pencil.

ROUTER SETUP. A plunge router is the best option for making two-tiered mortises with a jig. The plunge base means the guide

bushing stays engaged with the jig throughout the process.

The bit you use should match the width of the hinge. This may mean getting a metric bit. A spiral upcut bit makes routing the deeper section of the mortise easier, though it isn't essential.

With the bit installed, you can set up a couple of depth stops on the router. One stop matches the thickness of the mounting flange on the hinge. The second stop is for the deeper mortise that houses the body of the hinge.

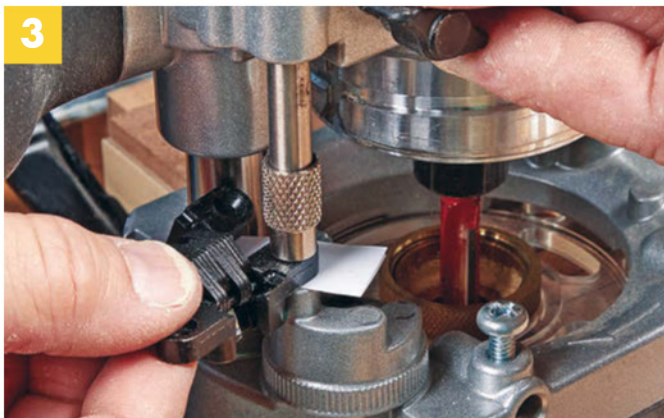
Don't forget to account for the thickness of the jig's plate. I like to set the jig on a scrap piece and lower the bit until it touches the surface. With the bit locked in place, pinch the hinge flange, along with a folded piece of paper

between stop and the adjustable rod (Step 3). This sets the hinge a hair below the surface.

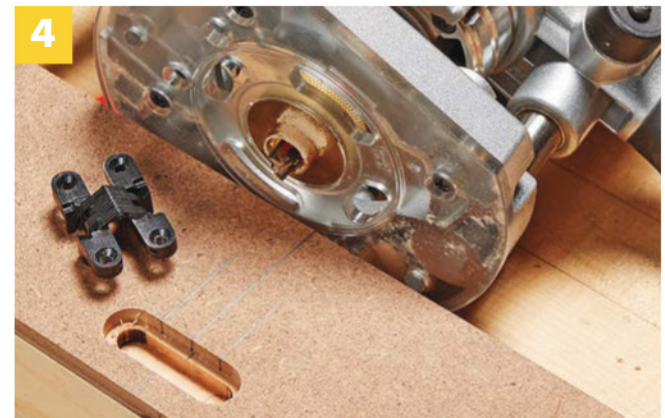
On my router, one of the other stops matched the body of the hinge (plus paper). If it doesn't, most depth turrets have an adjustable stop with a screw you can use for the deeper mortise.

ROUTING A MORTISE. Let's bring the jig and the router together now and make some mortises. It's a good idea to do this first mortise on a test piece. This will give you an idea of any tweaks that need to be made to the jig or router setup.

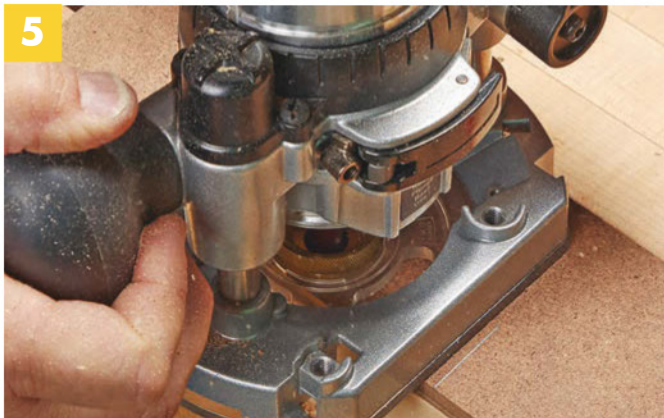
Secure the workpiece in the face vise and then clamp the jig in place, aligning the centerline of the jig with the line on the piece. The guide bushing nestles



▲ **Depth Stops.** Using the actual hinge (plus a piece of paper) offers a more reliable way to set the depth stops on the plunge router than trying to measure.



▲ **Flange Mortise.** The shallow flange mortise runs the full length of the slot in the jig. Keep an eye out for dust that could come between the bushing and the ends of the slot.



▲ **Body Mortise.** Since the body mortise is shorter, I drew lines on the top of the jig to indicate where to stop the router. The exact position isn't critical.



▲ **Test Fit.** You have to rout both parts of the mortise before you can test the fit the hinge in the mortise. If necessary, you can adjust the jig or re-route the mortise.

into the slot on the jig before you power up the router.

Set the depth stop for the flange mortise. Lower the bit and rout from end to end on the jig, as shown in Step 4.

DUST DANGERS. The bit does a good job of pureeing the wood fibers. Unless your router has great dust control, you may find that chips and dust can build up between the bushing the slot in the jig. This results in a mortise that's too short.

Knowing is half the battle. After the first pass, I pull the router out and clear away debris and make

a second pass. Due to the design of the hinge, you can't do a test fit until the mortise is complete.

BODY MORTISE. The difference in routing the body mortise is controlling its length. Here, I found that drawing lines on the jig's plate worked best to indicate where to stop the router, as you can see in Step 5.

Since this mortise is shorter and deeper, you'll rout it in two passes, lowering the bit slightly for each pass. Here again, stop to clear away the chips to ease the routing. Once complete, you can test fit the hinge in the mortise.

You're looking for gentle press fit with no slop around the flange (Step 6). The body mortise is totally concealed.

INSTALLATION. A self-centering bit is my go-to on installing hinges. Here, too. It's just that the bit isn't long enough. So I start the pilot hole with a self-centering bit, then complete it with a longer twist bit.

SOSS hinges offer high strength with an invisible installation. Using a jig makes adding them to your projects a reliable process. Which means there's one less thing to worry about. **W**

PROBLEM-SOLVING SOSS HINGES



Knock-Down. SOSS hinges are ideal for shop projects like this assembly table that are designed to fold-up for easy, compact storage.



Flip Top. This desk features a flip-up top section to reveal a workspace. SOSS hinges allow for full 180° operation without getting in the way.



Doors. The SOSS hinges shown here are used to operate an inset door on a wall cabinet. Typical butt hinges would bind in this application.

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:

Woodsmith Store
800-444-7527
store.woodsmith.com

amazon.com

Amana Tools
631-752-1300
amanatool.com

Benjamin Moore
benjaminmoore.com

Brusso Hardware
212-337-8510
brusso.com

General Finishes
800-783-6050
generalfinishes.com

The Home Depot
800-466-3337
homedepot.com

Infinity Cutting Tools
877-872-2487
infinitytools.com

Lee Valley
800-871-8158
leevalley.com

McMaster-Carr
630-833-0300
mcmaster.com

Microjig
855-747-7233
microjig.com

MSC Industrial
800-645-7270
mscdirect.com

Rockler
800-279-4441
rockler.com

Woodpeckers
800-752-0725
woodpeck.com

GREAT GEAR (p.22)

Most products shown can be found on their manufacturer's websites, though the setup bars from Kreg and Bench Dog's Blade-Loc can be found on Rockler.

- **Woodpeckers**
Clamping Squares Plus CSP
Setup Blocks SUB13-22
- **Microjig**
Dovetail Nut DV-HL0.0K6
1" Dvttl. Screw DV-HL1.0K6
1½" Dvttl. Screw . . . DV-HL1.5K6
2" Dvttl. Screw DV-HL2.0K6
- **Infinity Cutting Tools**
Setup Blocks 100-075
- **Rockler**
Bench Dog Blade-Loc 24210
Kreg Setup Bars 42141

BALANCE BIKE (p.28)

The bike sports classic black and red spray paint. A couple coats of lacquer are warranted, considering the hard use the bike will face.

- **McMaster-Carr**
1½" Carriage Bolts 90185A587
5/16" Lock Nuts 95615A160
5/16" Washers 95229A460
5/16" Acorn Nuts 90507A240
Plastic Grips 97045K48

5/16" Threaded Rod . 90034A430

- **Amazon**
12" Bike Wheels . . B09NVTSS95

KITCHEN TABLE (p.34)

- **Home Depot**
Connector Screw 474762
- The cherry top was left unstained but protected with two coats of lacquer. Instructions for ebonizing the base are included in the article.

ENTRY BENCH (p.42)

The drawer fronts of the entry bench are painted with Benjamin Moore's Regal Select Exterior "Wolcott Navy." For some added protection, the rest of the bench was given a few coats of spray lacquer.

- **Rockler**
¼" Shelf Pins GRP946_1

TOOLBOX (p.50)

To make the thick washer for the drawer pulls, use the machinable brass rod from McMaster-Carr. To make the corrugated panel, I used a 90° V-groove bit (45722) from Amana Tools. The leather for the tabs can be found at a local hobby store.

You could put a deep stain on this vintage toolbox and it would be in keeping with its history. We chose to leave it unstained and sprayed it with two coats of lacquer, and it looks beautiful.

- **Brusso Hardware**
Butt Hinge CB-302
Lid Stay JB-250
Latch JB-828
- **McMaster-Carr**
Architectural Brass Bar . . 9122K25
Mach. Brass Rod 8953K174
Binding Barrel & Screw 93813A342
- **Lee Valley**
¼" Shelf Pin Sleeves 00S1060
¼" Shelf Pins 00S1045
- **MSC Industrial**
¼" Punch 60058013
1¼" Punch 60058179

SONGBIRD TOWER (p.56)

We painted the songbird tower with three colors from Benjamin Moore's Regal Select Exterior paint: the sides were in "Vermillion Red," the top was done in "Yosemite Blue," and the trays and base were painted with "Wolcott Navy."

- **McMaster-Carr**
¼" Plexiglass Sheet 8560K257

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