

ROUTER PROJECTS AND TECHNIQUES



- 10 "Must-have" Router Bits
- Router Accessories Guide
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Tools & Supplies



In terms of tools and supplies, getting started in routing is a pretty straightforward proposition. You need a router and some router bits. But which size router — a palm-grip trimmer or a two-handed, 3hp beast? Will a half-dozen bits do, or is there a “proper” woodworker’s quota of cutters? This section will answer these questions, plus give you a tour of five unique dovetailing jigs.

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Routers are wonder tools for shaping the edges of boards into decorative profiles. However, they really deliver the goods on so many projects for their capacity to make nearly every conceivable woodworking joint. Three mainstays in that vast assortment are mortises, tongue-and-groove joints and dovetails. Learn more about all three options in this Techniques section.

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ROUTER PROJECTS & TECHNIQUES WINTER 2014

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Router Projects and Techniques

is published by Rockler Press Inc.,
 4365 Willow Dr., Medina, MN 55340.
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ROUTING

Tools & Supplies

Don't buy your first router until you learn your way around the options — as well as router tables — in our Buyer's Guide. Then, one of our experts shares his picks for the ten most useful router bits on pages 16-24. Maybe routing is already old hat, but you aren't happy with your current dovetail jig. Read about some lesser-known but enticing options here, too.

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Today's compact routers bridge the gap between the easy one-handed control of trim routers and ample power of the mid-size category. Most compacts now have plunge bases, too, bringing them even closer to their larger cousins, in terms of versatility.

A Buyer's Guide to Routing Products

THE ROUTER MARKET IS FLOODED WITH PRODUCT OPTIONS THAT CAN CONFUSE A “NEWBIE.” FEELING LOST? HERE ARE SOME TIPS FOR WHAT YOU REALLY NEED.

If woodworking has a wonder tool, I'll say it's the router. Pages and pages of bit catalogs are dedicated to the many lovely coves, chamfers, ogees and other decorative shapes it can make with the right bits. Need to whip up a bunch of identical parts? A router can follow a template of nearly any shape using a piloted bit or a guide collar attached to the base. It can cut intricate recesses for inlay one day, then muscle through raised panels the next. Want to make dovetails, rabbets, mortises, box joints or dados? Here's a tool that can produce them all.

But, how in the world do you get started with this wonder tool and unlock its treasure trove of potential? While no single article can cover all the bases of such a broad and extensive topic as routing, this overview should help get you off on the right foot.

Finding a Good Fit for You

First things first, of course, you'll need a router. Choosing the “best” machine can be bewildering, but it doesn't have to be. Before you get lost in the sea of router sizes, prices and features, step back and consider what you want your new router to do. If a router will basically be a means

for you to soften sharp edges or cut an occasional small profile, a trim router may be all the machine you need. For making joinery or heavier cuts, a mid-size router is the way go, and for the most demanding applications, such as raising panels, you'll want a full-size router. Let's work our way up the categories from smallest to largest.

Trim Routers: An Easy Grip

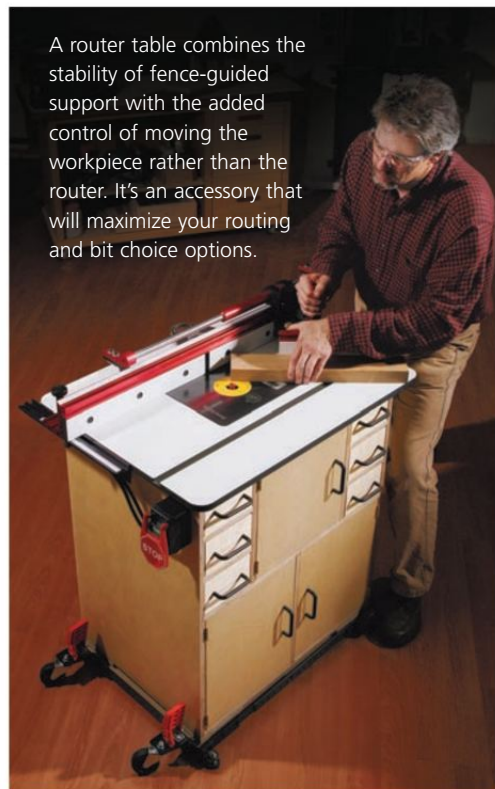
Originally designed for trimming countertop laminate, these tiny routers are simply appointed and affordable. They're small enough to stand on the edge of a board for trimming off edge banding, yet powerful enough to handle most smaller profiling bits. Trim routers are also ideal for cutting hinge mortises, small dados and fine joinery, where precision is really critical. You can hold a trim router easily in one hand, and the smallish size won't feel as intimidating to control as larger routers.

Compacts: The New Breed

In recent years, a new breed of small router — called the “compact” — has really bloomed. Sized in the 1- to 1½hp range, compact routers combine the convenience of trim routers'

small stature with more power. Most compacts also now have plunge bases for mortising. While they definitely aren't a one-to-one replacement for a machine in the 2+ horsepower range, which is more robust and handles larger bits, they're up to task for a broader range of template work and joinery than lighter-duty trim routers.

A router table combines the stability of fence-guided support with the added control of moving the workpiece rather than the router. It's an accessory that will maximize your routing and bit choice options.



Mid-size: Your Best Bet

A mid-sized router is the “Steady Eddie” of routing. Here, we’re talking about a 1.75- to 2.25hp machine with either a fixed- or plunge-style base. If you want just one router to do most every kind of routing task, including moderate to large profiling cuts, dovetailing and mortising, definitely set your sights on a mid-sized machine. For all-around woodworking, a mid-sized router is the workhorse of both serious hobbyists and professional shops.

Within this middle category of routers, you have two base style options from which to choose: fixed and plunge. A fixed-based router can be set to a full range of cutting depths, and the handles are positioned near the bottom of the base, so it has a pleasantly low center of gravity. However, a fixed base won’t allow you to



If one machine needs to cover the whole gamut of routing for your shop, choose a mid-size plunge router. While it may not be the ideal solution for every operation, you’ll find it to be amply powered and feature-packed.

plunge the bit into the wood. You’ll need to turn off the router and reset the motor in the base to change the cutting depth. Fixed-base routers can be used for general profiling or other cutting operations, provided you can feed the bit into the edge of the

wood. They’re also the usual choice for router tables.

Plunge bases are different animals. Here, the motor is mounted between two spring-loaded posts on the base. You can vary your cutting depth instantly and without turning the

SMALL, MEDIUM AND LARGE CATEGORIES SATISFY MANY DIFFERENT APPLICATIONS



Routers are made in three basic sizes to accomplish a wide range of purposes. Trim routers (left) are intended to trim laminate and veneer and perform light-duty template or profiling tasks. Mid-sized routers (center) are the “bread-and-butter” machines for template work, moderate profiling and joinery. Full-sized routers (right) are designed for heavy-duty operations and router table use.

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BEFORE YOU BUY, GET YOUR HANDS ON SOME ROUTERS

When shopping for your first router, try to at least handle a few before plunking down your cash. A home center or woodworking retailer is a good place to start the “test drive” process. Routers have a variety of handle styles, shapes and sizes. Switch and control layouts vary, too. Your router should fit your hands comfortably, and the On/Off switch and plunge controls should be easy to reach. Make sure the depth stop system on a plunge router is simple to understand. Some are, some aren’t. Combination kits are designed to be interchangeable. Try the motor removal mechanism. It should work smoothly and lock the motor securely in both bases. At least one of the subbases should accept rub collars. As you narrow down your options, what’s most important is to buy a powerful machine that feels right to you, even if it costs a little more. Shopping carefully now will help ensure that you’ll enjoy this much-used woodworking standby for years and years to come.



Bosch’s 2.3hp MRC23EVSK is one of many popular combination kits these days. Two bases makes these kits both affordable and extremely versatile — in or out of a router table.

tool off by simply unlocking a lever or knob and raising or lowering the motor housing. Plunge routers are equipped with a depth stop system so you can step off a series of cuts to create a deep mortise or cutout. The depth stop can also help you reset the tool to the same cutting depth without measuring — it’s ideal for repetitive cutting situations.

For all practical purposes, a plunge router can do everything a fixed-base router can do, but the handles and motor are mounted higher up on the base to facilitate the plunging motion. The higher center of gravity can feel a bit unstable, especially when you’re milling small or narrow stock. I tend to use my plunge router for mortising or hogging out waste on an inside cutout, but I reach for a fixed-base machine for nearly every other cutting situation.

Full-size: Save for Later

When it comes to routing, bigger isn’t always better, especially if you plan to use your router more as a handheld tool than under a table. Although a full-size router in the 3- to 3½hp range has its place, unless you plan to use really large profiling bits or raise

panels for cabinet doors, it’s more machine than you’ll need for ordinary profiling and joint-making. That extra weight, size and power can even work against you on smaller or delicate work. Still, if your budget will allow it, one of these big routers will give your router table the gumption that’s only exceeded by a dedicated shaper. And, once you step up to a big router, there are many good fixed-base or plunge models on the market.

Combination Router Kits: Two Bases Cover It All

If you just can’t decide between buying a fixed- or plunge-base router, you don’t have to. A combination kit can give you both. Here, you get a motor pack that installs in either a fixed or plunge base — both are included. The bases are full featured and capable of doing the same precise work as a dedicated fixed or plunge router. Horsepower wise, most combo kits are in the mid-size range.

The big advantage of a combo kit is that you can mount one base in a router table and use the other for handheld routing. Kits are an excellent way to maximize your initial investment, and they

cost less than buying two separate routers, with no appreciable compromise in quality. That's why combo kits are the clear favorite among woodworkers.

Router Tables: The Ultimate in Stability

While you'll probably do much of your routing holding the machine in hand, a router table can turn it into a stationary machine. Both mid- and full-size routers can be used in a router table. However, putting more horsepower under the table will expand your range of bit options. So, a full-size router provides maximum versatility.

With the router inverted and bolted underneath the tabletop, you can move the wood past the bit instead of balancing the tool on top. That can help you focus your attention better on the cutting operation and improve your control over the task.

Router tables provide a safe way to mill small workpieces or long, narrow edges. They're a necessity for raising panels or shaping parts with large bits. Attach a fence to the table to make straight cuts, or install a starter pin to rout curves.

There are dozens of router tables you can buy, ranging from simple benchtop units that cost around \$150 to industrial-quality models with floor-standing bases, dust-collection fences and

This full-sized router table from Bench Dog features a cast-iron top for optimal flatness and durability.



phenolic or cast-iron tops (see photo, left). Some styles include full cabinets to help control debris and noise, with a complement of drawers for bit and tool storage.

Which router table suits you best will probably come down to budget, how much floor space you can devote to it and whether or not you'll need to transport it out of your shop from time to time. While a full-size, floor-standing router table will give you a larger tabletop than a benchtop unit, a quality benchtop model can handle the weight of even a full-size router safely and do most every task that a floorstanding model can.

Another option is to build your router table rather than buy it. They're fairly easy projects to make from home-center supplies. If you're on a tight budget, your router table could literally amount to a piece of sheet material or countertop with a bit hole in it. Or, expand your router



Router tables can be as simple as a board and fence clamped to a workbench (above) or more elaborately designed, like the horizontal router table shown at right. Shop-made router table plans are plentiful in woodworking magazines and online.



table's conveniences and sophistication with a more complex design. You might even consider building the base and buying the tabletop and fence separately.

Bit-buying Tips

Sometimes too many choices leads to more frustration than convenience. Take router bits: if you already know the bit you need to get a specific job done, you're in the clear. But what happens if you're building your first collection? There are hundreds of bits to choose from. What bits do you really need?

Well, we're providing an excellent resource in this special issue for ten bits that should be part of any growing collection (see page 16). That will be a great place to start. From there, a print or online router bit catalog will help you better learn the lay of the land when it comes to bits.



Beyond the basic starter bit collections, manufacturers also offer specialized sets for building cabinet doors, millwork, paneling and various other unique applications where matched sets are necessary.

If budget is a big concern, consider buying a packaged variety set. It'll get you up and running fast with many of the most popular general-use bits. "Starter" bit sets are an excellent value for general routing and a convenient way to ramp up your collection in one purchase. Specific groupings will vary, but they usually come with two or three straight bits of different diameters, three or four edge profiling bits (cove, roundover, ogee, chamfer), a V-groove, dovetail bit and maybe a flush-trim or rabbeting bit. Be sure to buy from a reputable bit manufacturer.

From the standpoint of utility, a starter set will enable you to carry out a range of router operations, and the set's price is

lower than the aggregate cost of buying each bit separately. For many general routing jobs, you'll have all the bits you need.

Other Packaging Options

In addition to the "variety pack" of bits, manufacturers also sell sets of the same style but in multiple sizes, such as roundovers, chamfers or straight bits. For instance, a collection of straight bits in 1/4", 3/8", 1/2" and 3/4" cutting diameters are a smart subset to own, because you'll be able to handle a range of dadoing, mortising and other joint-cutting operations.

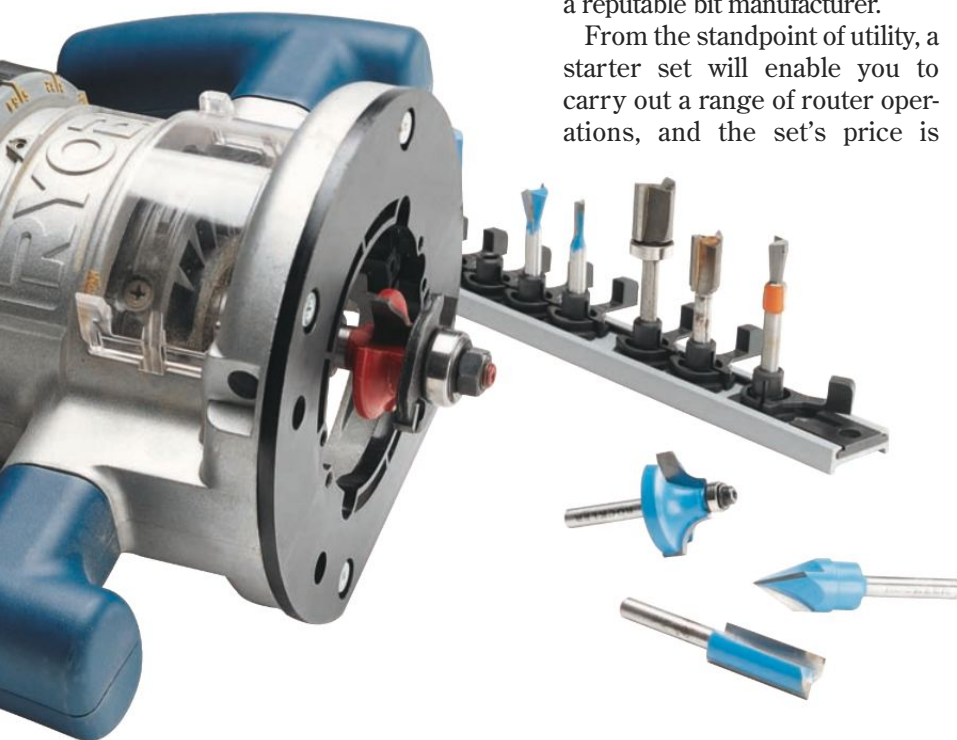
But bit sets don't stop there. There are specialized sets for making cabinet doors, window sashes, inlays, tabletop drop leaves, tongue-and-groove paneling, locking glue joints and even passage or entry doors. The market for custom bits continues to grow all the time.

Dive in, and Have Fun!

Sure, there's plenty to shop for to get started in routing. But, the most important thing is to get your feet wet! Routing will expand your skills while enhancing your projects. It's well worth the initial cost and effort.



Chris Marshall is a senior editor of Woodworker's Journal.



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10 Must-have Router Bits

EVERY BIT CHANGES A ROUTER INTO A DIFFERENT TOOL, MAKING IT THE MOST VERSATILE MACHINE IN TODAY'S SHOPS. HERE'S ONE WOODWORKER'S CHOICE OF 10 ESSENTIAL BITS.

It's a router bit jungle out there. The various profiles alone would account for several score, but considering that each router bit you'll find comes in a range of diameters, lengths, angles and other variations, the number of available bits increases exponentially — there are literally hundreds.

If your routing needs are decorative, you'll find numerous bits that

create attractive edge treatments, moldings, panels, fluting and millwork. Likewise, if you look at your router as an essential joinery tool, you'll find bits for dovetails, dadoses, rabbets, locking miters, finger joints and more. And if you have some other way to use this tool, consistently

There's a huge range of router bits out there: we take a look at the ones that should always be at the head of the line.



*Flush
Cutter*

*Straight
Bit*



Rabbeting Bit

Roundover Bit

Cove Bit

Chamfer Bit

Stile/Rail Bit

Slot-cutting Bit

cited as the most versatile in the shop, you'll undoubtedly find a router bit specifically for that purpose, too.

A router's not really a tool at all, just a spinning motor. It doesn't become a tool until you chuck a bit into it. But once you do add

that bit, it defines the kind of tool that router becomes. How you define it is up to you.

With that in mind, you could stock up on every bit there is. Or, you could buy 10 of the most useful bits and you'll be covered for 99 percent of what you'll need

in the workshop. But which bits make up the perfect top 10?

I'm glad you asked ...

Flush-trim/Pattern Bits

Would you like to be able to make identical curves or shaped details on more than one piece of



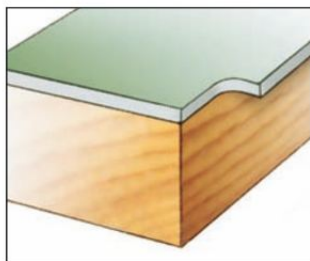
Roman Ogee

Dovetail Bit

Pattern Bit

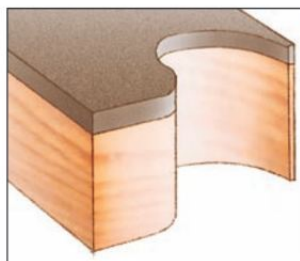


Flush Cutter



Flush cutters are the go-to bits for achieving a smooth, flush edge on laminate countertops.

When used with a template, the shank-mounted bearing on a pattern bit helps turn out multiple parts, all identical.



Pattern Bit



stock? Then you need a flush-trim or a pattern bit. With the bearing at the top (the end opposite the bit's shank), it's called a flush-trim bit and, as the name implies, trims one surface flush with another. The most obvious use is trimming applied laminates level with the edge of a countertop — that one function makes a flush-trim bit the most common bit used with laminate trimmers — but it can really make just about any two surfaces flush. The bit does this with cutting edges that are exactly even with the guide bearing. As the

bearing rides one surface, those cutting edges level the adjacent surface with the first.

Move that bearing to the bit's shank, and it becomes a pattern bit. It functions in the same way with cutting edges that are even with the bearing's rim, but in this case the bearing generally follows a removable template affixed to the top of a workpiece rather than a permanent surface. By rough-cutting the workpiece slightly larger than the template, the bit will turn out multiple finished pieces, each matching the template exactly. All you need to

do is temporarily attach the template, use it to guide the pattern bit, then remove the template and attach it to the next workpiece.

While they can be used in table-mounted applications, flush-trim and pattern bits are most typically used in a handheld router.

Straight Bits

If you could only have one bit, one that would still make your router the most versatile tool you own, it would be the jack-of-all-trades straight bit. Used with

A FEW MORE DESIRABLE BITS TO CONSIDER ...

There are lots of bit profiles out there beyond the 10 must-have bits. Here are a couple more you might find useful.

Round-nose bits (also called core-box bits) — Because they cut rounded grooves, they're ideal for sign making, fluting, decorative grooves, finger-pulls, moldings, millwork and more. Typically used with plunge routers, but in a router table with fence or handheld router with an edge guide, they'll also cut coves.

Raised-panel bits — Create the profiled edges on doors and other panels. Single-cutter bits shape only one face, but two-cutter bits form the front and back of a panel at the same time. These bits are among the most massive and must always be used in a table setup. They also take off lots of stock, so multiple passes are necessary.

Specialty molding bits — These are use-them-once-in-a-blue-moon cutters. They'll never see daily duty in your shop, but for a special project requiring an intricate edge, they're well worth their price. The one shown at far right makes a beautiful table edge.



Round-nose or core-box bit

Panel-raising bit

Specialty molding bit

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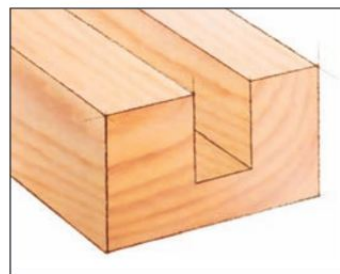
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Straight Bit

Because it has so many applications, the straight bit is easily the jack-of-all-trades of router bits.



a fence on your router table, a beefy straight bit can make rabbets and tenons, while a narrow-diameter straight bit cuts spline-slots, grooves and inlays like a champ. Paired with the right jig, it'll turn out perfect box joints. Need dadoses? A straight bit can make 'em fast on a router table or via a handheld router used with a guide. Routing handheld with the appropriate guide or jig, a straight bit can cut hinge, lock and joinery mortises, and can even level a tabletop. With a suitable fence arrangement, a straight bit turns your router table into an edge joiner. And that's just getting started — as you just read, if you add a bearing to a straight bit, it becomes a whole different kind of cutter.

Because they can do so much, straight bits come in probably the largest range of sizes — both diameter and length — of any standard router bit, meaning that you can more easily size the bit to the job. Straight bits are often sold in sets offering different

diameters and lengths. Specialized straight bits are also available, such as slightly undersized bits for creating perfectly snug dados to house plywood that generally is undersized of its nominal thickness.

Rabbeting Bits

Yet another adaptation of a straight bit, a rabbeting bit sports the same cutting edges but places them on a shorter, wider body. The top-mounted bearing rides the workpiece, while the cutting edges create the rabbet. The diameter of the bit combined with the depth of cut determines the size of the rabbet.

Rabbeting bits can be purchased in a variety of sizes depending on your joinery needs, but there is a one-size-fits-all version that uses a single bit with interchangeable bearings. Although the bit diameter doesn't change, the different-size bearings alter how much of the cutter length is exposed to the edge of the workpiece. Typically, these adjustable

rabbeting bits come in a set with bearings that will create rabbets from 1/8" in width using the largest bearing, to 1/2" wide with the smallest.

The number of bearings included varies by manufacturer, and some sets even include a

bearing that exactly matches the overall diameter of the cutting edges, which can effectively turn the rabbeting bit into, you guessed it, a flush-trim bit.

Roundover Bits

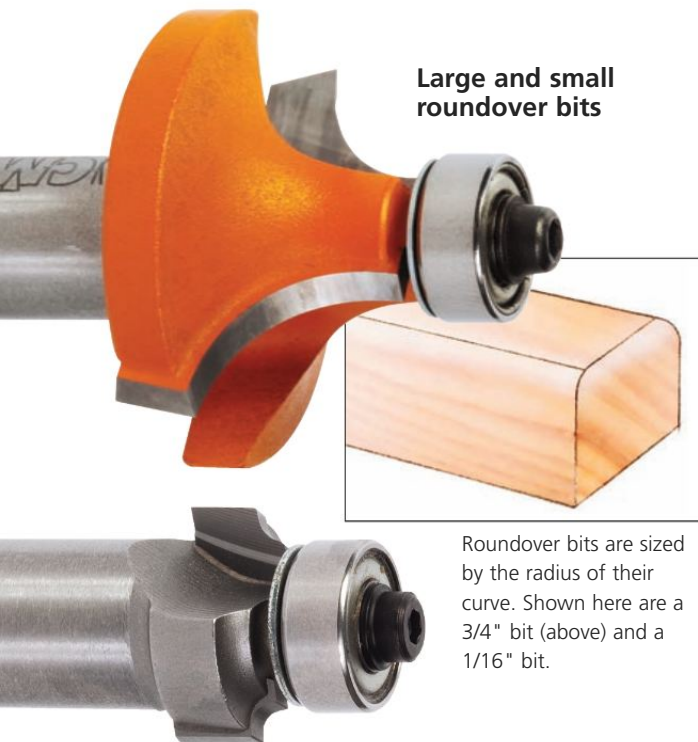
The perfect choice for easing sharply squared edges, roundover bits are sized by radius. (Imagine that curved edge as part of a circle — the bit size corresponds with the radius of that full circle.) Sizes start at 1/16" radius (middle photo, next page) that barely breaks a square edge — in fact, unless you have a lot of edges to do, you might be better off using a sanding block for that kind of roundover — on up to a 1½" radius bit that is probably far larger than most shops would need. (Even larger roundover cutters exist, but they're more suited to industrial applications.) You can buy a set with several bits, but if you're like me, you'll probably use the 1/4", 3/8" and 1/2" radius bits most often.

Roundover bits are normally used to create a smooth, even curve on a workpiece, but they also have one sharp cutting edge at the bottom of the radius that creates a 90-degree cut at the top of the roundover if the bit is fully extended. Used in this manner, a roundover bit makes a decorative thumbnail edge. A variation on the roundover bit has these 90-degree cutting edges both top and bottom, and it is often called a beading bit. The bit creates a curve bounded on each end with a 90-degree corner.

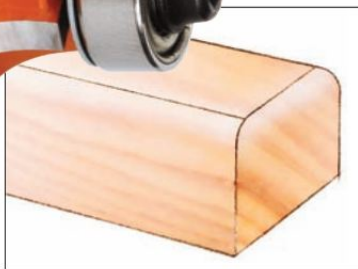
Rabbeting Bit



Interchangeable bearings allow rabbeting bits to be adjusted for cutting several rabbet sizes.



Large and small roundover bits



Roundover bits are sized by the radius of their curve. Shown here are a 3/4" bit (above) and a 1/16" bit.

Cove Bits

Cove bits are the mirror image of roundovers, creating a concave profile. Useful and attractive in their own right for decorative edges on tables, they are often used in combination with other bits to create intricate moldings (nearly every molding I've seen incorporates at least one cove). Paired with a matching roundover, you can create rule joints for drop-leaf tables.

Like roundovers, cove bits are sized by their radius and are often sold in sets. As with most sets, you'll likely find yourself not using the bits at each end of the size range; unless you regularly make a lot of molding or have other needs

Cove Bit



By themselves, cove bits are most useful for edge treatments; but combined with other profiles, they are frequently the basis for intricately shaped moldings.



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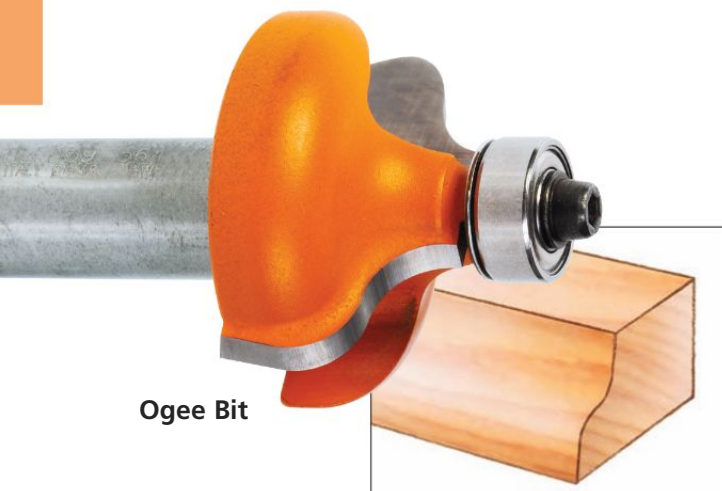
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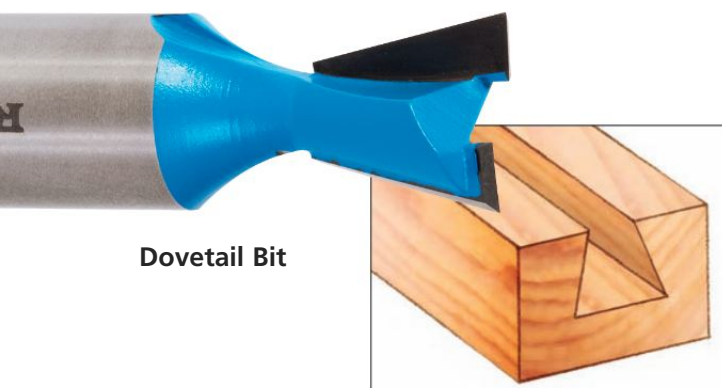
**WATCH
DEMO**





Ogee Bit

With a graceful S-curve at their heart, ogee bits lend themselves well to both decorative edge treatments and moldings.



Dovetail Bit

Dovetail bits, used in a router table or with a jig, are the fastest and most accurate way to cut perfect dovetails every time.



Chamfer Bit

The angled profile of chamfer bits makes them a good choice for creating miter joints, cooping and doing basic edge treatments.

for concave routing, you're probably better off getting multiples of the specific sizes you need. For creating coves on the edge of 3/4" stock, a 3/8" or 1/2" bit will prove the most useful.

Because they're round (looking at a cove bit edge-on, it's really a hemisphere mounted to the shank), there's a lot of metal there, making for a heavy bit. Larger radius cove bits should always be used in a router table.

Ogee Bits

When it comes to edge profiles, few are more attractive than the ogee. Ogee bits come in a huge range of shapes and sizes, but all are based on some form of the basic "S" shape. This S-curve can be shallow or deep, narrow or extremely wide. A plain ogee bit (top photo, left) is a simple S-curve, but it still lends an elegant profile to workpieces. A Roman ogee bit (see page 17) creates a profile that has a steeper curve to the S-shape, and adds a 90-degree cutting edge at the bottom of the curve that creates a bead at one end of the profile. The shape of the profile can get quite intricate, with any combination of notches and grooves as part of the curve.

As with cove bits, ogees are often combined with other bit profiles when creating molding. Ogee bits with extremely wide diameters are often used to create profiles on tables and, not surprisingly, are sometimes called table-edge bits. For safety, these large-diameter bits should always be used in a router table setup, and preferably with a variable-speed router so the rotational speed can be lowered a bit. The cutting edges of wide bits travel very, very fast; lowering the speed increases safety and reduces burning — multiple passes are recommended.

Dovetail Bits

For machining dovetails, there's really only one choice, but it's a perfect one. Dovetail bits make dead-on angled slots in a single pass, and they can be used with a number of jigs and templates. (For template use and for many commercial jigs, you'll want a dovetail bit with a shank-mounted guide bearing.) These bits excel at making traditional dovetails, of course, but used in a router table with a fence, they're also your best choice to create sliding dovetails useful for carcass joinery. These sliding dovetail joints are like dados on steroids: They have the strength of a regular dado, plus the locking power of a dovetail. Unlike traditional jig-made dovetail joints that are made with a combination of dovetail and straight bits, sliding dovetails use the

same bit for both the angled groove and the tongue — a single pass is all you need for the groove; one pass on each side makes the tongue.

Dovetail bits are available in a variety of angles, from 7 to 18 degrees, with 14 degrees being the most commonly used. For sizing your dovetails, you'll find bits in a range from about 1/4" to 1" in diameter.

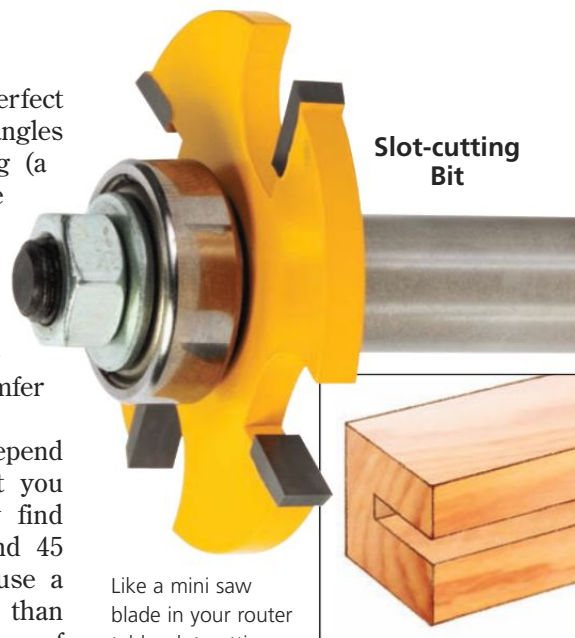
All router bits should be kept sharp, but this is especially the case for dovetail bits — a dull bit makes for truly ugly dovetails with lots of "furry" tearout.

Chamfer Bits

Chamfer bits make a single kind of cut — a straight angled edge — but, depending on the bit's cutter angle, you can make it do a number of tasks. A 45-degree

chamfer bit can create perfect miters for boxes. Other angles can be used for cooping (a 11.25-degree bit makes the correct edge angle for a 16-segment polygon). Like a roundover, a chamfered edge can ease sharp corners. Laminate installers often use a chamfer on countertop edges.

Available cutter angles depend on the manufacturer, but you should be able to easily find 11.25, 15, 22.5, 25, 30 and 45 degrees. You'll probably use a 45-degree chamfer more than any other. Since the size of a chamfer is controlled by how far the bit is extended from the router, it's not surprising that there are somewhat fewer sizes of chamfer bits available than other styles.



Slot-cutting Bit

Like a mini saw blade in your router table, slot-cutting bits create perfect thin grooves. Unlike a table saw, however, they can also cut short slots for biscuits.

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Slot-cutting Bits

You can cut slots on the table saw, but doing them on the router table with a slot cutter has some definite advantages. For one thing, you'll get perfect flat-bottomed cuts, something not all saw blades can do. And, because they cut horizontally, creating slots in the edges of extremely wide stock is far easier and safer than attempting to balance the same workpiece vertically against the fence on your table saw.

You can also buy slot cutters in a variety of thicknesses — usually 1/16" to 1/4" — and in versions with and without guide bearings. As with rabbeting bits, some slot cutters come with a set of different-sized bearings to adjust the slot depth. Slot cutters typically come with either three or four cutting edges or "wings." However, some newer slot cutters use a pair of two-wing cutters that stack atop one another on the

shank, using thin shims to adjust slot width the way a set of dado blades does.

A slot-cutting bit can also be used to turn your router table into a biscuit joiner. In fact, some manufacturers sell cutters specifically sized to commonly available biscuits.

Stile-and-Rail Bit Sets

Stile-and-rail bits — sometimes referred to as "cope-and-stick" bits — most commonly come as a set of two bits that facilitate the creation of truly accurate frame-and-panel joinery. Because cut profiles on stiles and rails must match perfectly, it's not surprising that the bits are mirror images of one another. Some "sets" are really single bits that stack one arrangement of cutting edges above the other, making for a fairly tall bit.

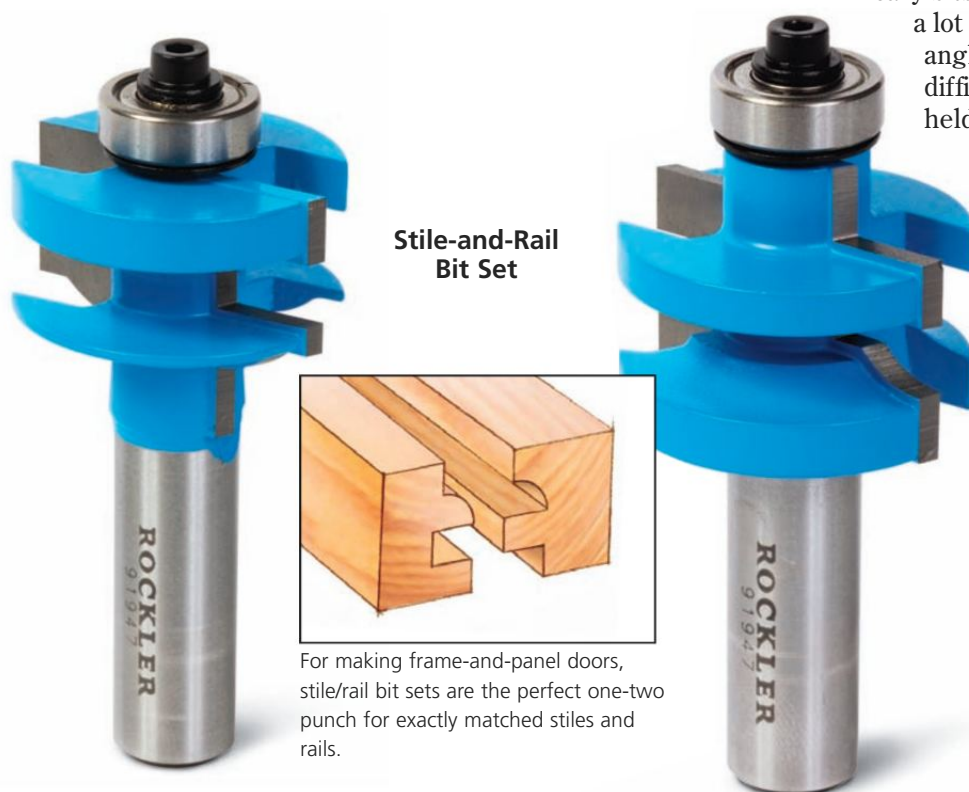
In use, you would first make all of your stiles (or rails). Then remove the bit and install its

mate in the table, using one of the finished workpieces as a guide to get the height set correctly for machining the mating rails (or stiles). Using a single-bit stile-and-rail cutter is the same process, but there's no need to remove the bit. When finished with your first set of parts, raise or lower the bit as appropriate so the new cutters come into contact with the workpieces, then cut the matching profiles.

Getting these bits set up accurately can be a trial-and-error process, so be sure to make some expendable practice workpieces to get the setup just right before routing your real workpieces. Once you have the bit set to your liking, cut off and save a short segment of that practice workpiece; it'll make setting up and repeating the cut that much faster in the future.

Stile-and-rail bits must always be used in a router table. These heavy bits have a lot of metal and a lot of cutting surfaces and angles, making them difficult to control in hand-held routing. Restricting their use to the router table is not only much safer, but the rigidity of the table-and-fence setup also makes for better control and more accurate routing.

A.J. Hamler is a regular contributor and the author of the book Civil War Woodworking.



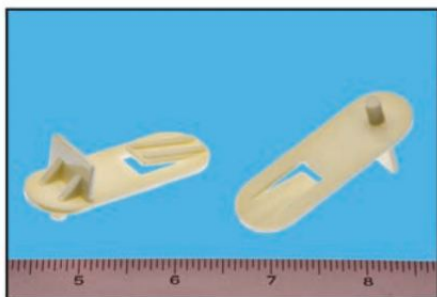


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Nontraditional Dovetail Jigs

ARE CLAMP-IN, TEMPLATE-STYLE JIGS THE ONLY WAY TO ROUT DOVETAILS? NO. HERE ARE FIVE UNIQUE ALTERNATIVES.

Generally, there are two approaches to making dovetails: using hand tools or a “clamp-in” style template jig and a router. The second approach has plenty of fans, and there’s a glut of router jig systems available on the market. Personally, I’ve had my struggles with some of them (readjusting bit depth, tweaking template offsets and fiddling around until finally arriving at the right combination for a satisfactory joint).

There are, however, other less typical styles of router dovetail jigs available. I’ve seen most of

them demonstrated at trade shows. Watching someone who’s made hundreds of dovetails with their jig move effortlessly through the routine, though, isn’t the same as setting one of these units up and making dovetails without an expert’s help.

So, in the hopes of finding a better mousetrap, I pushed the usual jigs aside and tried out these five lesser-known alternatives. I’m glad I did: there are some smart solutions here that make dovetailing easy and even fun! Sure, there’s a huge price spread, but I didn’t let that derail

this test. Repeatability, accuracy and ease of use were my main concerns. Turns out, there’s a good jig for most any budget. Here are my impressions — and my pick for best all-around jig.

Prazi Chestmate Dovetail Jig

For just \$99, Prazi’s Chestmate jig will enable you to cut through dovetail joints on stock of any width, in any spacing you choose. That’s because this jig employs a pair of interchangeable inserts — one for pins and another for tails — that follow a scrap template pattern you

create on, of all tools, a table saw! A tab under each insert fits into a series of shallow saw kerfs you cut in the template to create your own joint layout. It's an ingenious approach that guarantees the pins and tails will register properly while giving you plenty of creative control.

Chestmate clamps over the workpiece, and you provide a 3/4" dovetailing bit, 5/8" guide collar and a straight bit to carry out the milling steps with your handheld router. The system is very easy to warm up to. After making one adjustment to the pin insert to alter my pin thickness, I was cutting glue-up-ready through dovetails on the second try. Bit depth doesn't impact the joint fit, just the amount you want the pins and tails to stand proud for final sanding. So, that reduces the possible variables that affect how the joint fits to just one: pin thickness. It's a huge timesaver.

Downsides to the Chestmate? There aren't many. It's designed to cut 3/4", 7° or 14° dovetails. If you want other dovetail sizes, you'll need to experiment with it. The jig also won't do half-blinds. But, Prazi also provides several more inserts as standard items, so you can use the same jig for cutting box joints, hybrid box/dovetail joints, mortises and even dowel joints. If variable-spaced dovetails are what you're after, Chestmate's versatility, sturdy construction and ease of use make it an excellent value.

General Tools E•Z Pro Dovetailer II

I was introduced to General's original E•Z Pro jig a few years ago by its inventor, and the unique design made it attractive then and now. So is its sub-\$80



Changing over the Chestmate between pin and tail cuts is easy: loosen the jig wings and slip in the appropriate pin or tail insert.

price. The aluminum framework clamps to a workpiece with four integral three-point knobs. Fingers on the right half of the jig guide half-blind pin-cutting with an included, piloted dovetail bit. You rout the corresponding tails on the jig's left side with the same bit. The Dovetailer will make half-blinds or box joints on stock up to about 1" thick or even a modified version of a through dovetail on 1/2" or thinner stock.

Aside from its almost pocket-change price, there are several more things I really like about this jig. Since it doesn't capture stock left to right, it will accept workpieces of any width, from drawers to big chests. A little plastic aligning tool clips into the fingers to reset it for each series of cuts.

The jig is outfitted with an adjustable depth-of-cut scale, and the bottom of the scale doubles as a toothed adjuster plate. It enables you to register the tail board correctly on the jig's tail fingers using the pin board as a reference. Quite slick.

Since I originally reviewed this E•Z Pro, General has updated it to the Dovetailer II. Now it is anodized gold (it originally was



A tab under the pin and tail inserts locks positively into saw kerfs you cut in your custom template. They index the router cuts.

PRAZI'S CHESTMATE \$99



Versatile and modestly priced, this jig makes variable-spaced through dovetails and much more.

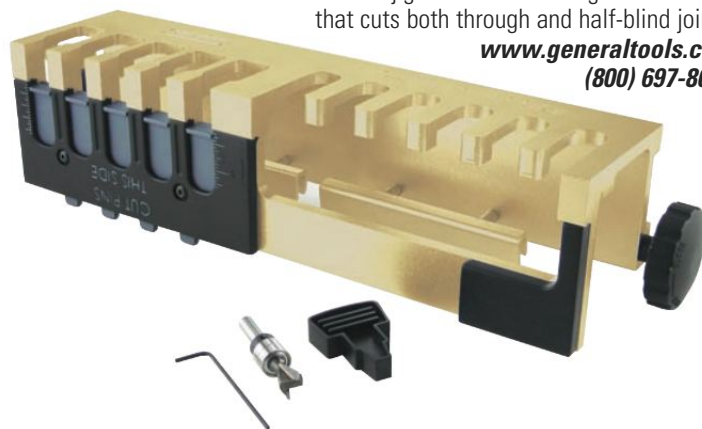
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silver as you can see in the photos on the next page). They have added a stabilizer bar, plus knobs on the ends of the jig for more comfort and control when guiding it inverted on the router table — that's a second option to clamping it in a vise and moving a router over the top as I did. New plastic guides also improve accuracy. If you rout dovetails often or just now and then, the Dovetailer II will be easy on both your patience and pocketbook.

GENERAL TOOLS DOVETAILER II \$79.96

Economical jig with a built-in alignment feature that cuts both through and half-blind joints.

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Teeth on the Dovetailer's aluminum adjuster plate help you register the tailboard for routing using the pin board as a guide. This ensures that the board edges will line up on the finished joint.

Gifkins A10 Dovetail Jig

The Gifkins A10 Jig hails from Australia, which explains why I had never heard of it before researching this article. I sure wish it were on my radar years ago. It makes through dovetailing exceptionally easy to do on the router table. The system is designed around a thick, one-piece phenolic bottom template that cuts pins on one side and tails on the other. An aluminum spine and a pair of replaceable MDF backup boards provide good support over the template to hold workpieces vertically.

The template is engineered with the necessary pin/tail offset already calibrated. Two wrap-around stops on top of the jig set

your pin and tail board locations automatically. Once the stops are tightened, it's ready to mill both joint parts. The jig is even helpfully labeled to clarify which side of the template does what and with which bit — a piloted straight and dovetail bit are supplied. Gifkins sells clamps and brackets to secure the boards, or use your own clamps.

The only fine-tuning required — a one-time job on this jig — adjusts the pin thickness. It's a simple matter of adding shims behind the pin backup board. Six dovetail templates are available to rout various pin sizes and spacings. The jig can also make box joints but not half-blinds. A standard kit includes the jig, bits



Long runs of dovetails are possible with this jig by snapping in an aligning tool to index the jig for each new set of cuts. Blanket chests or deep drawers are fair game.

and an "A10" template that routs 10mm pins in stock up to 1/2" thick. Other templates and cutters, available as upgrades, to mill larger dovetails in stock up to 7/8" thick. The jig is limited to boards around 12" wide or less.

After I added a few of the

GIFKINS A10 JIG \$399.99



One-piece phenolic template and wraparound stops make through dovetailing easy on the router table.

www.japanwoodworker.com
(800) 537-7820



Gifkins's one-piece pin/tail template and wraparound stops (right photo) form a solid platform for routing perfect through dovetails. The author's first test cuts created the box shown above.



included paper shims, this jig cut flawless dovetails. The clearly written manual made my learning curve easy. While \$399.99 is a lot to pay for one size and style of dovetails, this well-made jig will have you cutting them almost effortlessly...and liking it!

Keller Model 1601 Pro Series

Keller aluminum dovetail templates have been around since 1976, and now I know why. They're practically bulletproof and are wonderfully straightforward to use. I was sent the Model 1601 template kit, which routs 7°, 7/16" dovetails, spaced 1½" on-center, with a pair of Keller piloted dovetail and straight bits. Two hefty 1/2"-thick templates get that job done — one for pins and one for tails — on any width stock.

Getting the system up and running is quick: you mount each template to a block of wood that becomes a workpiece clamping surface. Only the pin template requires initial adjustment, and that happens by sliding it back and forth on two slotted screw holes, making a few test cuts and

fastening it permanently with more stout screws.

I followed the manual's recommendations for dialing in the initial template setback on the blocks. To my surprise, the pin size was spot-on: my first test joint was a pleasing slip fit, ready for glue and clamps.

The process for making a joint involves routing the tail board first on either your router table or with a handheld machine. Then you use the tail board as a pattern to knife a single tail location onto the pin board, similar to laying out handcut dovetails. There are no calculations or difficulty to it. Clamp the pin template to these lines, and rout the pins. Carefully knifed layout lines will ensure dead-even pin and tail board edges when the joint fits together.

Keller Pro templates come in three sizes. While they're meant for fixed-space joints, you can vary the pattern by shifting the template during routing. A \$269 price tag may seem high for a jig that only cuts through dovetails. (A lower-priced "Journeyman" series is also available.) Still, these Pro templates carry

20-year warranties. And their beefy thickness should easily surpass that warranty period for a lifetime of hard use.

MLCS Fast Joint System

Want to add some flair to your half-blinds? Here's a jig that will make the conventional wedges, as well as key- and heart-shaped joints, just by switching between interchangeable templates. Fast Joint will do through dovetails, too. The company also sells a



Registering the pin board for accurate joint alignment is as easy as holding the boards together and knifing a pair of tail lines onto it.



Keller jigs have proven themselves in pro shops for nearly 40 years. Once they're set, you'll rout crisp dovetails with little fuss.

KELLER 1601 PRO SERIES \$269

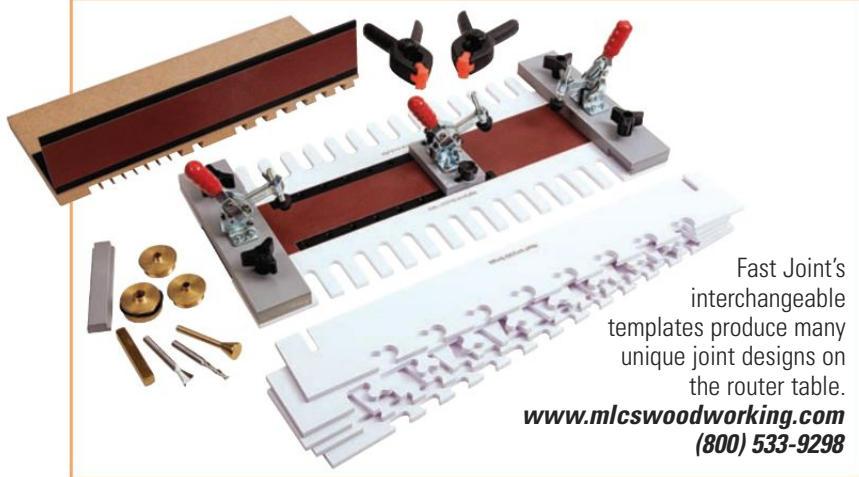


Heavy-duty templates create through dovetails on any part width, quickly and accurately.

www.kellerdovetail.com
(800) 995-2456



MLCS FAST JOINT \$169.95



Fast Joint's interchangeable templates produce many unique joint designs on the router table.

www.mlcswoodworking.com
(800) 533-9298



A wide jig base faced with sandpaper and three supplied toggle clamps hold workpieces securely for router table use. A right-angle fence mounts on the jig to rout pin boards vertically.



Fast Joint's interchangeable templates come in several decorative styles. They will add a whole new dimension to your corner joinery.

variety of other templates as accessories to expand the options even further.

Here's how it all works: the jig consists of an "H"-shaped platform with stops and toggle clamps on each end. Pin and tail templates bolt in place on opposite sides, which also registers their offset. For half-blinds, you cut the joint pins by standing the workpiece against a right-angle fence that clamps to the jig base. The tail slots are milled with the board lying down and clamped. Both pins and tails are cut vertically for through dovetails. All the milling happens on the router table, using guide collars and bits that MLCS supplies with the system. In fact, MLCS provides everything you need — even spring clamps! — for a convenient, all-in-one package.

Fast Joint will rout boards up to 14" wide in stock from 1/4" to 3/4" thick; through dovetails are limited to 3/8" or thinner material.

This jig took me longer to set up and learn than some others. But, its manual is well written and clearly photographed to explain the step-by-step process. Keep it in a safe place for a refresher course if you don't rout dovetails very often.

Fast Joint worked well for me, because the guide collar and templates minimize the setup variable that could complicate the process. You'll need to set bit heights carefully, and you may need to make spacer blocks to position workpieces on the jig in order to create a centered pattern.

I wish the templates were made of a more durable material than PVC; they will flex slightly when pressed hard against a guide collar. But that really didn't impact accuracy or joint fit. All in all, \$170 seems a good bargain for a jig that makes four joint styles right out of the box, with a nice bunch of extras.

"Best Bet" Honors

Often, choosing a winner is an easy job, but not this time. There are several standout jigs here. General Tool's Dovetailer II is priced for anyone and works well. Chestmate is also a steal for its multipurpose capabilities. But my "Best Bet" goes to Keller. It's more spendy than some, but the sheer simplicity of this system makes dovetailing both accurate and fun. I'm confident that with these templates, I could lose the manual and still be cutting perfect joints in minutes.



Chris Marshall is a senior editor of Woodworker's Journal.



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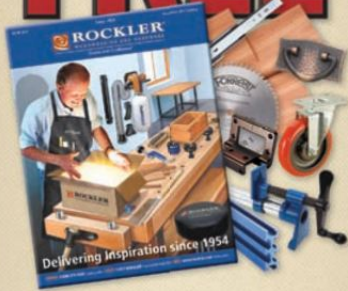
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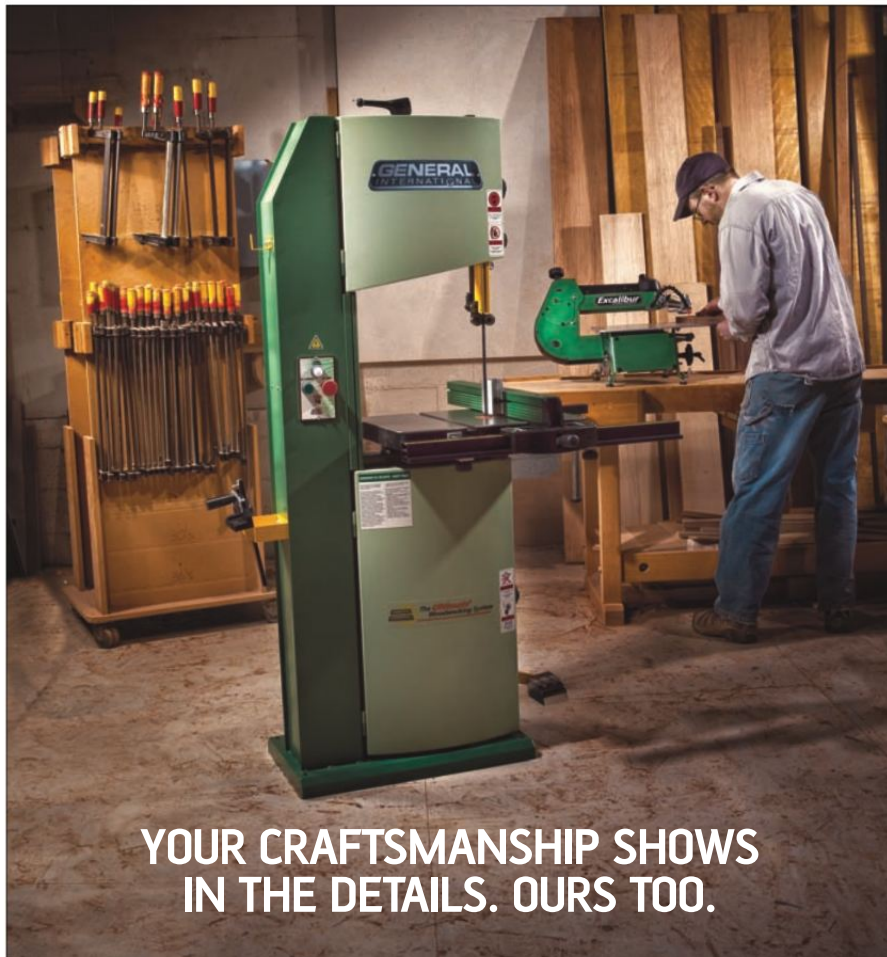
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ROUTING

Techniques

This Techniques section not only teaches some important fundamentals for mortising and dovetailing, but also gives you practical alternatives for milling tongue-and-groove joints with three different bit combinations. In routing, there's a lot to be said for having a solid understanding of joinery basics and knowing what your "back pocket" options can be.

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Mortising with a Simple Jig

YOU CAN CUT MORTISES ACCURATELY WITH A TEMPLATE GUIDE, STRAIGHT BIT AND A SIMPLE SHOP-MADE JIG.

There are many ways to make mortises — and just about as many tool options. A plunge router is one of the best choices, because you can accurately control the depth of cut, and the machine delivers clean and precise results. Here's a simple, dedicated jig you can make quickly for cutting mortises of a specific dimension with your plunge router.

Step 1

This mortising jig is dedicated to a specific-size mortise, so laying out your mortised workpiece is the first step in building the jig. Everything follows from the mortise proportions. Mark the length and width of your intended mortise with a square, and extend layout lines a short distance onto the adjacent (un-mortised) faces of the workpiece to serve as reference lines later (see Photo 1).

Step 2

A second important piece of information you'll need is the outside diameter (O.D.) of the screw-in template guide you'll use in your router with this jig, as well as the diameter of the appropriate router bit. Here we're going to use a 5/8" O.D. template guide around a 1/4"-diameter carbide spiral upcut bit. (Note: A conventional two-flute straight bit would also work fine.) The difference between the template guide's O.D. and the router bit diameter is called the offset. You can measure it (see Photo 2), but a more accurate method to find offset is to simply subtract the bit diameter from the template guide O.D. — in our case, 5/8" minus 1/4" equals 3/8" of total offset. Divide this number in half to find the offset on either side of the bit; in this example, it is 3/16".

Step 3

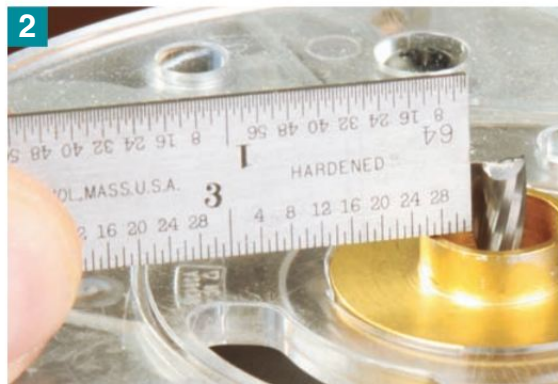
For the top plate of your jig, choose a piece of 1/2"-thick scrap that measures 4 to 6 in. wide and about 10 to 12 in. long. Rip a strip from one edge that is exactly as wide as your template guide's O.D. (see Photo 3). The strip won't work for the jig if it is any narrower than the template guide — it establishes the width of the jig's slot.

Step 4

Now rip the top plate of your jig in half, and crosscut the spacer strip in two. Measure the length of your mortise layout from Step 1, and add to its length the total amount of offset (in our case, 3/8"). This number



1 Lay out the mortise you want to make with this jig on your workpieces. Draw reference lines on both the faces and edges.



2 Calculate the offset between the bit's cutting edge and the outside rim of the template guide. The most accurate method is to simply subtract the two diameters and divide by 2.



3 Rip a spacer from scrap that exactly matches the outside diameter of the template guide you'll use for this jig.



4 Glue and clamp two pieces of spacer strip between the halves of the jig's top plate, which are marked to the overall size of the mortise opening plus the combined offset. This creates the mortise slot.



Draw reference lines across the top plate and along its length to indicate the cutting limits of the bit. You'll refer to these lines when positioning the jig on your workpieces for mortising.



Mark fence locations on the jig's top plate, using the actual workpiece, clamped in a bench vise, as a reference aid.



Flip the top plate over so the reference marks face down, and align the line you just drew for the fence with the edge of the fence piece. Attach the top plate to the fence with countersunk wood screws.

determines the total length of the jig slot. Mark the slot locations on your top plate workpieces; centering the slot on the top plate is a good idea. Form a “sandwich” of top plate pieces and spacer strips — spread open to the overall slot length — to create the jig slot. Glue and clamp the top plate assembly together (see Photo 4, previous page). When the glue dries, trim off the excess spacer strips from the ends of the plate.

Step 5

With the template guide and router bit installed in your plunge router, turn the router bottom-side up and fit the template guide's bushing inside the jig's slot. Plunge the router base until the bit passes through the plate so you can access it as a reference for measuring. Now use a combination square to mark long layout lines on the plate that indicate the width of the mortise. Then slide the bushing from one end of the slot to the other to mark the length of the mortise. When marking the plate, always reference from the outside edge of the router bit (see Photo 5).

Step 6

At this point, it's time to install a fence under the jig plate that will reference the edge of the workpiece to be mortised. To locate the fence's position on the top plate, align the mortise “width” layout lines on your workpiece with the corresponding lines you just drew on the top plate. Draw a short layout mark on each end of the plate that's even with the edge of your workpiece to set the fence location. You can draw these layout marks either to the left or the right of the jig slot; it doesn't matter. A bench vise can be helpful for holding the mortised workpiece steady as you align it with the plate for marking (see Photo 6).

Step 7

Select a piece of scrap several inches longer than your jig's top plate to use for a fence. Clamp it beneath the top plate, aligned with the layout marks you drew in Step 6. Fasten the parts together with countersunk wood screws (see Photo 7).

Step 8

The short reference lines you drew onto the un-mortised sides of your workpiece will now come in handy for positioning it in the jig to prepare for routing (see Photo 8). Clamp the workpiece and jig together securely.

Step 9

Use the stepped turret on the router base to set up the first and subsequent depth cuts to excavate the mortise depth you need (see Photo 9). With each pass, you



Prepare for routing by lining up the mortise reference marks on your workpiece with the layout lines on the jig. Clamp the workpiece and jig together.

can either push or pull the router along the slot to clear the waste — the feed direction doesn't matter because the template guide traps the bit in the jig slot. Make sure to remove no more than about 1/8" of material with each pass, especially when routing hardwood (see Photo 10).

Step 10

Square up your mortise with a sharp chisel, and it's all set for a matching tenon on the mating workpiece.

Chris Marshall is a senior editor of Woodworker's Journal.



Set the depth turret of your router to make the first shallow plunge cut, and feed the router along the slot. Remove about 1/8" of material with the first pass.



Continue with more routing passes, removing another 1/8" of material each time, until you reach the full mortise depth you want.

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Routers, and an increasing variety of jigs, have transformed dovetail making into a machining operation. The jig shown above allows the user to work on both the pin and tail boards in the same machining operation by clamping the parts horizontally and vertically in the jig. A template guides the bit.

Dovetailing with a Router and Jig

OUR AUTHOR TAKES YOU STEP-BY-STEP THROUGH THE PROCESS OF ROUTING THROUGH AND HALF-BLIND DOVETAILS.

Among the many different joint variations you can cut with your router, dovetails are certainly fair game. Cutting either half-blind or through dovetails will require a jig outfitted with a pair of rigid

templates or a set of moveable guide fingers. There are dozens of these commercial jigs from which to choose. Some jigs will cut both styles of dovetails by switching from templates to guide fingers. Other jigs are

dedicated to one style of dovetail only. Regardless, you can usually buy a variety of templates or guide fingers to cut dovetails of different sizes and spacings, to suit everything from small drawers and boxes to large chests.

Dovetail jigs vary considerably in their features and operation, and you'll need to study the manual carefully to set up and use your dovetail jig accurately. However, in this article I'll attempt to give you a general idea of how typical half-blind and through dovetail jigs work and the steps required to carry out the machining processes.

Half-blind Dovetails

Although they're time-consuming to cut by hand, half-blind dovetails are relatively easy to cut using a template-style router jig and a router fitted with a dovetail bit and a guide bushing. While it does take quite a bit of fussing and adjustment to get the joints fitting just right, both pins and tails are cut at the same time in mating parts (see photo at left), making this a very fast process once the jig and router are set up and fine-tuned.

When making either dovetail style, it's paramount to mill your stock flat and to precise dimensions, with nice square ends on all parts. You'll need to mill at least a couple of extra boards the same size as the stock for your project to test your jig setup. Label the parts to keep their orientation clear.

For this example, I'll cut half-blind dovetails in 1/2"-thick drawer sides using the Rockler dovetail jig; other jigs may require different setup steps, so refer to your jig's manual for more specific directions.

First, attach a 7/16" guide bushing to the sub-base of your router, making sure that the guide is concentric with the collet. Install a 1/2"-diameter, 14° dovetail bit in the router's chuck and set the bit's cutting depth to 9/16" below the base of the router.

After securing the dovetail jig in a bench vise, install the straight finger template and set the template and the stop bar to the jig's 1/2" scale settings (see Photo 1). [Note: if your router's sub-base isn't 5 3/4" diameter, see the jig's manual for directions on setting the stop bar correctly.]

Place a board vertically into the left side of the jig and adjust the side stops so that the stock is centered relative to the template fingers (see Photo 2). Make sure the board is square to the jig, then

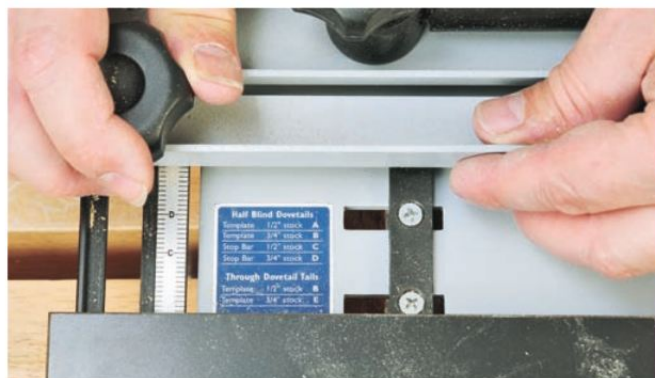


Photo 1: Set the jig's template and stop bar to match the thickness of the stock you'll be dovetailing. An on-board scale makes this process easy.



Photo 2: Square and clamp the vertical test board in the jig, and adjust the jig's stop flush against the edge of the workpiece. Make sure the board end is snug against the template bottom.



Photo 3: Install and clamp the mating board horizontally in the jig. Use spacer blocks to ensure even clamping pressure.

tighten the screws that secure the stop. Repeat this on the right side of the jig. Now slip boards into both horizontal and vertical positions in the jig, with their sides flush against the left-hand stops. Butt the stock ends against each other. Set small scraps of the same thickness as your boards at the other end of the jig, so that the jig's built-in clamps will hold the stock securely (see Photo 3).

Photo 4: When standing in front of the jig, you'll move the router from left to right across the template to make the deep cuts. However, depending on your jig, you may need to make a light skimming pass from right to left first to help reduce tearout.

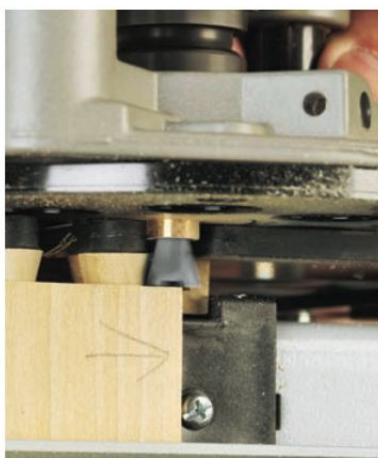


Photo 5: Feed the router in and out of the template fingers to cut the pins and tails to shape. Work slowly and methodically, keeping the router's base planted firmly on the template.

Route along the full length of each template finger, working in a clockwise direction (see Photo 4) while keeping the guide bushing in firm contact with the template's edge (see Photo 5). It's very important to never, ever lift the router until the bit is clear of the template, lest you ruin it. Once all the dovetails are routed, check to make sure all of the waste material has been removed before unclamping the boards (see Photo 6). Remove the test parts and trial-fit them (see Photo 7). If the fit is loose, set the bit to cut a smidgen deeper; if the fit is tight, make the depth of cut

shallower. If the tails are proud of the joint surface, reposition the jig's stop bar slightly farther from the template; if the tails are sunken, move it closer. Repeat with more test cuts until you're getting perfect joints.

When cutting your project parts, always route boards marked as pairs at the same time, with the top edge of both parts set against the stop, and with the inside faces of both parts pointing up and out (see Photo 8). Hence, half of the joint board pairs will be cut using the left-hand stop, half using the right-hand stop.



Photo 6: Before unclamping the boards from the jig, check to make sure you've routed away every bit of waste material in and around the template fingers.



Photo 7: Assemble the test joint and evaluate the part fit. Likely, you'll need to make a few more adjustments to your setup.



Photo 8: When routing half-blind dovetails, orient the matching pairs of workpieces with their inside faces pointing out.



Photo 9: On through dovetails, the ends of both the pins and tails are visible in the finished joint, forming a pleasing pattern.



Photo 10: Some through-dovetail jigs, like the Leigh D4 Jig shown here, have adjustable fingers that enable you to vary the pattern and spacing to customize your joinery.

Through Dovetails

You can also use a template-style jig for cutting through dovetails (see Photo 9), but the process requires switching templates when cutting the tail portion of the joint.

Further, such jigs only produce evenly spaced dovetails of fixed proportions. A more flexible type of joinery jig, such as the Leigh D4, has adjustable template fingers that let you set the size and spacing of dovetails to suit your

needs and tastes (see Photo 10), and cut them in a simple two-step process. Instead of having a single fixed template, this style of jig has adjustable fingers that work with a router guide bushing to control the bit's cut.

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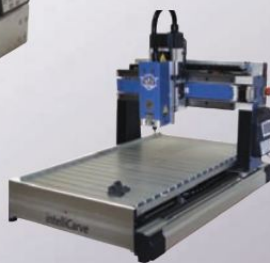


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Photo 11: Clamp the pin board vertically in the jig, and adjust the guide fingers to create an attractive pattern of pins.

Here's a brief description of how to cut through dovetails with the Leigh jig. (Of course, see your jig manual for complete details if the procedure deviates from what's shown here.)

The assembly that holds the template fingers slides onto a pair of bars. Scales on the assembly are positioned on the bar to accommodate different stock thicknesses. To set up the jig, first clamp a pin board vertically into the jig, then arrange two outer guide fingers to form half pins at the edges of the board (see Photo 11). Then, arrange the desired number of finger pairs in between, to form the full pins.

To rout the pins, set up your router with a 7/16" guide bushing and a 5/16"-diameter straight bit

Photo 13: To make the tail cuts on the mating workpiece, you'll need to flip over the jig template to expose the tail portions of the guide fingers. Re-mount the template on the jig and switch to a dovetail bit. Feed the router from left to right to cut the tails.



Photo 12: Cut the pins with a guide collar outfitted in your router base and a 5/16"-diameter straight bit. Feed the router from left to right to cut away the waste.

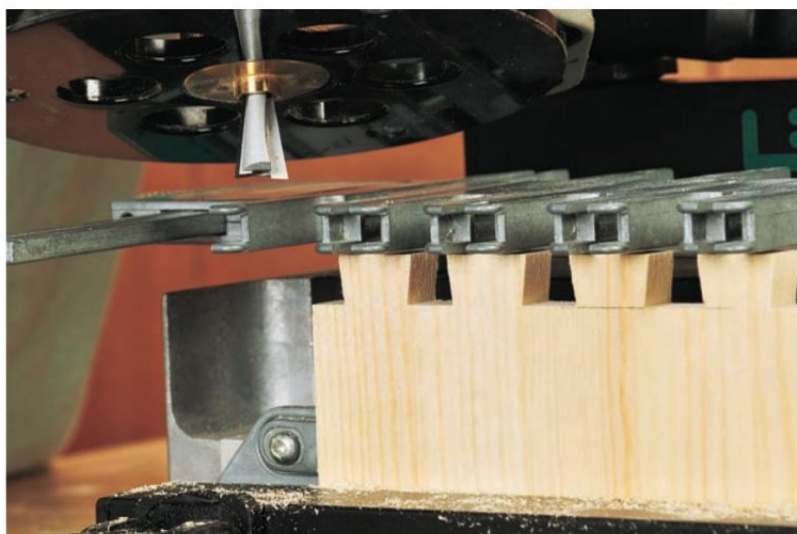
(see Photo 12). As when routing half-blind dovetails, carefully rout around each guide finger, working the router from left to right, and never lift the router until you've turned it off and are clear of the template.

To prepare the jig for routing the tail portion of the joint, remove the entire finger assembly, flip it over and remount it on the jig's bars. This puts the tail-cutting end of each finger over the tail board, which also clamps vertically in the jig. Tails are routed with an 8° dovetail bit using the same router guide bushing (see Photo 13). The

bit's angle matches the angle of the pins, and the fingers mirror the layout you set for cutting the pins. As with any router-cut dovetails, it's best to cut sample joints on scrap boards to check the fit of the pins and tails. Readjusting the position of the finger assembly on the jig's bars allows you to fine-tune the final joint fit.

With either jig style, be patient with your test cuts and adjustments. It can be fussy work, but the results are impressive!

Sandor Nagyszalanczy is a regular contributor to Woodworker's Journal.



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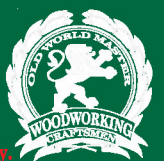
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Three Tongue-and-Groove Routing Options

YOU DON'T NEED A DADO BLADE TO MAKE TONGUE-AND-GROOVE JOINTS ... JUST A ROUTER TABLE AND A FEW COMMON BITS.

Tongue-and-groove (T&G) joints form sturdy, interlocking connections with lots of glue surface area for all sorts of woodworking applications: cabinet door joints, self-aligning shelf edging, web or face frames and even carcass assembly. There are DIY applications for this joint

too, such as V-groove wainscot or wood flooring. Cutting the narrow centered groove and the corresponding tongue to fit into it doesn't take a dado blade and table saw. You can do it all at the router table quite easily with three different cutter approaches. Here's how.

STRAIGHT BIT AND RABBETING BIT

Step 1: Generally speaking, it's easier to cut the groove of a T&G joint first, then mill the tongue to fit the groove. A 1/4" straight bit or spiral upcut bit makes an ideal groove-cutter into the edge of a workpiece. Mark your workpiece with a couple short reference lines for centering the bit on the thickness of the wood. Install the straight bit in your router table, and raise it about 1/4-in. Adjust and lock the fence so the bit is centered between its reference marks with the workpiece held in place. Clamp a featherboard to the table to press the wood firmly against the fence.

Step 2: Push the stock through the bit using moderate feed speed. Once you've completed the first pass, clear out any debris from the groove, then flip the workpiece end-for-end and make a second pass (see Photo 1). Two passes will ensure that the groove is perfectly centered. Now raise the bit about 1/8- to 1/4-in. at a time and repeat the process until you reach the groove depth you want. Note: It's a good idea to make the groove about 1/32-in. deeper than the tongue will be long; the open space at the bottom of the assembled joint will give the glue some room to migrate so the parts fit fully together.

Step 3: You're done with the straight bit, so switch to the rabbeting bit. But first, install the appropriate-sized bearing on the bit. You want the distance from the bearing's rim to the edge of the cutters to match the tongue length you want to make. Install the bit, and adjust the router table's fence so its faces are flush with the bearing rim (see Photo 2).

Step 4: The cleanest, safest way to mill the tongue is to rout away the waste a little at a time and not with a couple of heavy passes. Lower the bit so just 1/8-in. or so of the cutters are above the table. Again, install a featherboard to keep the workpiece on track while you slide it along the fence. Make two passes over the bit — one into each face of the workpiece — to form the rough tongue shape (see Photo 3). Then, repeat, raising the bit about 1/8-in. with each round of passes to remove more waste.

Step 5: When the tongue nearly fits the slot, use the grooved workpiece as a reference for raising the rabbeting bit until it just intersects the bottom wall of the groove (see Photo 4), and make two more passes to shave the tongue to final thickness.



1 Make two passes with a straight or spiral bit, flipping the workpiece end-for-end between passes, to cut a centered groove.



2 Adjust the faces of your router table's fence so they are flush with the bearing's rim on the rabbeting bit. Close up the fence facings, if possible, to reduce the gap around the bit.



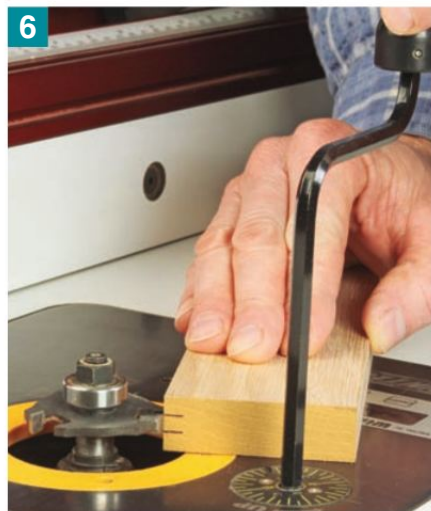
3 Rout away the bulk of the waste for the tongue in a series of shallow passes, flipping the workpiece from one face to the other after each pass. Continue to raise the bit about 1/8-in. for each pair of passes until the thickness of the tongue is close to fitting the groove.



4 Use the grooved workpiece as a reference for raising the rabbeting bit carefully to its final height. The top of the cutters should be flush with the inside wall of the groove.



Make the final two passes to the tongue workpiece. If your last bit height adjustment was accurate, the parts should slip together with just a bit of friction — not too loose or too tight.



With the appropriate bearing installed on your slot cutter for the groove depth you want to make, raise the bit until the top and bottom edges of the cutters intersect your workpiece layout marks for the groove location.



Route away the waste in a series of passes to form the groove. Start with the router table fence adjusted so only about 1/8 in. of the cutters protrude past it. After routing the workpiece and flipping it to center the slot with a second pass, move the fence back to expose more cutters for subsequent passes.

Step 6: Test-fit the joint (see Photo 5). The parts should slide together with a bit of friction, but it shouldn't take force. If the tongue is still too snug, try running the tongue workpiece over the cutters one more time without changing the bit height at all. Press down harder when feeding the wood along. Often this is all it takes to whisk off the last bit of waste and improve the fit.

SLOT-CUTTING BIT

Step 1: A slot-cutting bit can mill both parts of a T&G joint. Install a bearing on your bit so the amount of cutter projection from the rim to the edge matches the depth of the groove you want to make. Mark a workpiece that centers the groove location, as in Step 1 of the first technique. Install the slot cutter, and adjust the bit height to meet the layout marks (see Photo 6).

Step 2: If the fence facings are adjustable, close up the fence around the bit to eliminate gaps around the cutter. Now shift the fence so only about 1/4-in. or so of the bit projects beyond the fence; a deeper pass would tax the bit and router unsafely. Make the first set of passes, flipping the workpiece over between cuts to center the groove. Make more passes, shifting the fence back about 1/8-in. or so each time to expose more cutter; do not change the bit height. Make your final two passes with the fence adjusted flush to the bearing's rim (see Photo 7).

Step 3: Now loosen the fence just enough to shift it, and tap it lightly from the back to withdraw the bit about 1/32-in. deeper into the fence — this will create the slightly shorter tongue and the open space at the bottom of the groove. Re-tighten the fence. Lower the bit to about 1/8-in. above the table. Follow the same cutting process as you would with a rabbeting bit to form the tongue, raising the bit with each set of passes until you shave away all of the waste (see Photo 8 and steps 4 and 5 of the first technique, previous page).

TWO STRAIGHT BITS

Step 1: A 3/4"-diameter straight bit can take the place of a rabbeting bit or a slot cutter to form the tongue of a T&G joint, too. But, to start with this method, use a 1/4"-diameter straight or spiral bit to mill the groove first (see steps 1 and 2 of the first technique and Photo 1, previous page).

Step 2: To cut the tongue portion of the joint, install the wider straight bit (it should have a larger diameter than the tongue's length), and adjust the fence until the bit's cutters project out from the fence the length of the tongue you want to make. With the router unplugged, hold a ruler over the bit and rotate the cutter by hand to check your fence setting carefully (see Photo 9). Close up the fence facings around the bit, if possible, to support the wood.



Make the tongue with the same slot-cutting bit as you used for the groove. Here, adjust the router table's fence so it's flush with the bearing's rim. Raise it above the table a little at a time to cut away the waste. Make two passes per height setting — one into each face of the workpiece, to form the tongue.

Step 3: Lower the bit as you would when using a rabbeting bit or slot-cutter, and follow that same cutting process, raising the cutting height a little at a time until the tongue is just a bit thicker than its groove (see Photo 10). Use the grooved workpiece shown in photo 4 to adjust the bit for the last passes that bring the tongue to final size.



A large-diameter straight bit can also be used to cut the tongue of a tongue-and-groove joint. Extend it out from the router table fence to match the length of the tongue you want to make.



Mill the tongue with the straight bit the same way you would with a rabbeting or slot-cutting bit: raise it to cut away material and make a pass on each face of the workpiece. Continue to raise the bit and make more passes until the tongue is the correct thickness for its slot.

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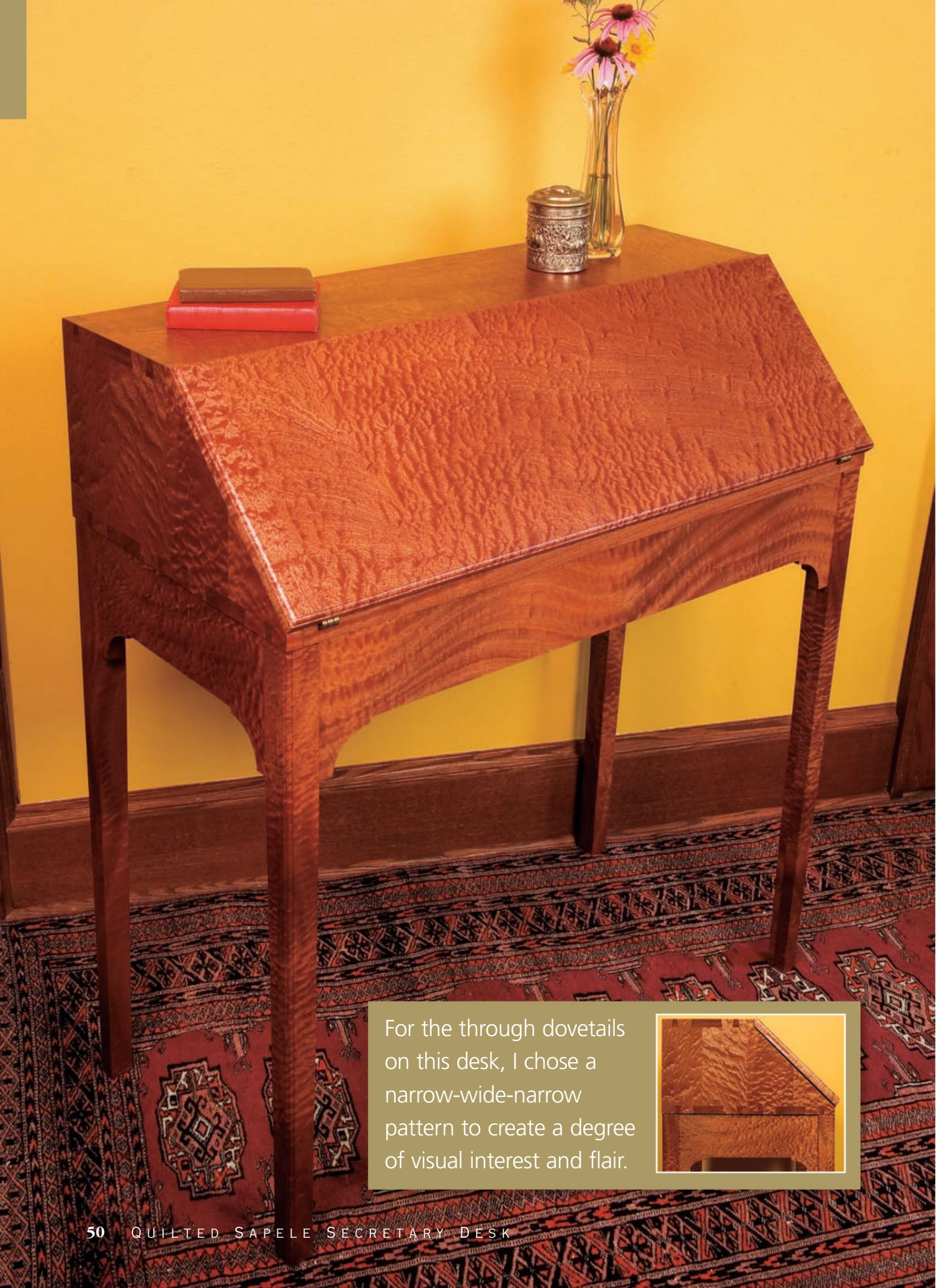
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For the through dovetails on this desk, I chose a narrow-wide-narrow pattern to create a degree of visual interest and flair.



Quilted Sapele Secretary Desk

THIS STUNNING HEIRLOOM PROJECT IS SURE TO GET RAVE REVIEWS FROM WOODWORKERS AND NON-WOODWORKERS ALIKE.

In any woodworker's short list of heirloom projects, a secretary desk ranks right up there with grandfather clocks, hope chests and cradles. I've been itching to build one for years, and this design, derived loosely from a *Journal* project featured way back in the 1980s, includes the classic features you'd expect: a flip-down lid with breadboard ends, divided upper case and graceful, tapered legs. For added flair, I built mine from some really striking pommelle sapele lumber, and I joined the desk case pieces with variable-spaced through dovetails.

This definitely isn't a one-weekend project, but it wasn't too difficult to build — and you can space the dovetails conventionally if you prefer. Just make sure your dovetail jig will handle 16"-wide panels.

A Bit More About Sapele

Sapele is a central African hardwood, golden-brown in color with a grain pattern similar to mahogany. In fact, it's commonly known as African mahogany. Pommelle sapele is the quilted variety, with a deeply convoluted grain pattern. I paid about \$35 per board foot for 4/4 quilted stock, and it's also available in 8/4 and 10/4 thicknesses in widths up to about a foot. I got some really great looking wood for this

desk from West Penn Hardwoods (www.westpennhardwoods.com).

If you can, buy wide stock for the desk bottom and lid so you don't have to glue up panels from more than a couple of strips of stock. The quilted pattern will blend together much better this way. Most of the desk case parts are made from 3/4" lumber, but you'll need a few small pieces of 1/4"-thick stock for the cubby-hole parts. Because you only need a little, it won't feel too wasteful to plane down some scraps. You could buy 8/4 stock for the 1½"-thick tapered legs, but I glued up 3/4" stock and was happy with the result. Be sure to apply mineral spirits as you go, to provide a sneak preview of how the grain matches.

I used sapele for the 3/8"-thick drawer parts, but it's perfectly acceptable to use a secondary wood like poplar, maple or pine.

Finally, you'll need 1/4"-thick

plywood for the back and drawer bottoms. I used mahogany veneer plywood for these pieces and would suggest a dark stain, perhaps cherry or walnut, so they don't stand out too much.

Getting Started

The secretary is made in two separate pieces: the upper desk case and the base. For the purposes of this discussion, I'll treat them separately. Since the desk case construction is more involved than the base's, I suggest building it first — but it really doesn't matter, so begin with whatever section you're in the mood for. Before you begin, spend some time gluing up panels

When working with expensive stock like sapele, it's important not to waste material. Forming the angled side pieces is easily done on a band saw or a top quality scroll saw.





The breadboard mortises stop short of the part ends. Use a long 1/4" straight bit in the router table to cut them. Mark the fence to start and stop these cuts accurately.



Mill tenons in the desk lid using a wider straight bit. Set the fence so the bit cuts the shoulders first, then make a second pass to remove the rest of the waste.

for the wide desk parts while all your quilted stock is available. Try to blend the wood grain as best you can, and do a careful job of jointing the panel parts so seams will disappear. Make sure the desk lid and other case parts



Slip the breadboard ends onto the lid and drill three stopped holes through the bottom to connect the parts. The dowels shouldn't show through from the top, so drill carefully.

are flat and true after glue-up. Otherwise, the lid won't lay flat, and the dovetails won't fit properly.

Making the Desk Case

Follow the *Material List* dimensions on page 55 to cut the first 12 parts to rough size. The desk back (piece 1) fits into 1/4"-deep by 3/8"-wide rabbets in the top, sides and bottom (pieces 2, 3 and 4). Cut those now on your router table or table saw. (Note: They are stopped rabbets on the sides.) Use the *Elevation Drawings* on page 55 to lay out and cut the sloping angle on the fronts of the desk sides at the band saw.

Next, set up your dovetail jig for cutting the through dovetail joints that connect the case top, bottom and sides. I used a Leigh jig that allows you to cut both the pins and tails at the same time with any spacing you like (see the *sidebar* on page 54). Once you've cut the dovetails, dry fit the case to make sure the parts go together without brute force — you'll need to achieve a slip fit here in order to install the other desk parts in one major glue-up. Clamp the case together.

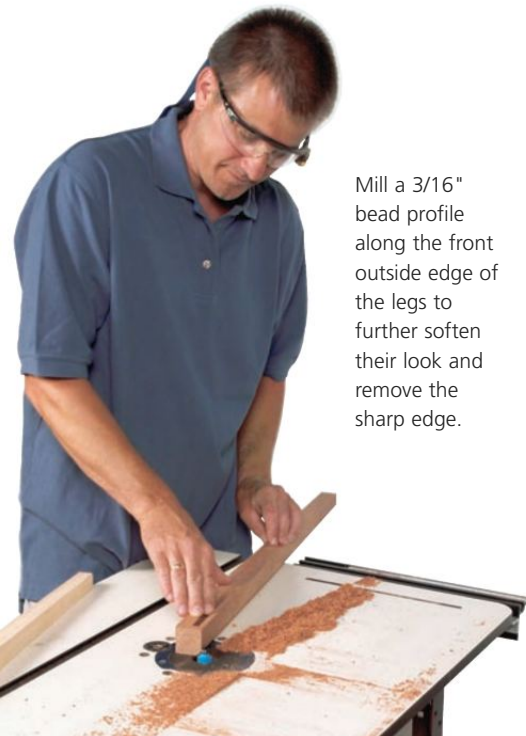
Making the Desk Lid

Start working on the lid (piece 5) by cutting the breadboard ends (pieces 6) to length, and setting up a 1/4" straight bit in your router table to mill 1"-deep centered mortises in the ends (see top left photo on this page). Cut the mortises in a

series of shallow passes, stopping the cuts 3/4" from the part ends.

Trim the lid to final length, and switch to a wider straight bit in the router table to cut the end tenons (see middle left photo). The ends connect to the lid with three dowel pins (pieces 7) fitted from below (or inside of) the lid. Assemble the lid and drill these holes with your bit marked for a 5/8" depth so you don't drill all the way through. Widen the outer two holes in the tenons so the lid can expand and contract across its width. Then glue the dowels in place to assemble the lid — there's no glue on the tenons and mortises.

Check the fit of the lid on the desk case, then cut a bevel along the lid's front edge to match the "step" formed by the desk top and sides. Now add a 3/16"-radius bead along the lid's front edge. Do this on the router table using the fence as a guide; the bevel won't provide a flat surface for the bit's bearing to ride on. Switch to a 3/8"-diameter core box cutter to cut a 1/8"-deep finger recess in the sides of the breadboard ends. You'll have to stand the lid on end to make these cuts on the router table, so add some stability for the lid by attaching a taller fence to your existing router table fence. Wrap up the lid by cutting mortises for the hinges (pieces 13). Mark and rout these mortises into the lid back and desk bottom according to the manufacturer's instructions. You are going to have to chop small mortises to



Mill a 3/16" bead profile along the front outside edge of the legs to further soften their look and remove the sharp edge.

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LEIGH'S D4 JIG: CUSTOM SPACING

I wanted to space the dovetails in a narrow-wide-narrow pattern, but my trusty old dovetail jig only cut evenly spaced pins and tails. I was lucky enough to get my hands on a Leigh D4 dovetail jig, and then it was easy as pie ... almost. I did run into a bit of trouble with the angled front, so I needed to place an auxillary stop to accommodate the wide bottom and narrow top aspects of the sides. But once I noodled that out, it was smooth sailing. I have to say that I am really pleased with the variable spacing of the dovetails. It gives this project's joinery a handmade look.



"split the knuckle" of the hinge (see the *Elevation Drawings*).

Completing the Desk Details

Unclamp the desk case, and continue with the cubbyhole details. Cut the internal components (pieces 8 through 12) to final size. The vertical dividers (pieces 8) are notched and dadoed into the top and bottom of the case. The horizontal shelves (pieces 9) also have blind dadoes where they fit into the dividers and the desk sides. Follow the

Elevations on the next page to cut mortises for these parts with a router guided by a straightedge.

Sand all the desk case components thoroughly now, and dry-fit the dividers and shelves into place. Once everything fits, spread glue on the dovetails and in the shelf and divider dadoes, then clamp up the dovetails, dividers and shelves to assemble the case. When the assembly dries, glue and brad-nail on the decorative valance (piece 10). Fasten the drawer guides (pieces 11) to the desk sides with short countersunk screws, and glue the drawer stops (pieces 12) to the shelves 3/4" in from the front edge. Complete the desk case by testing the fit of the back panel into its rabbets. I suggest waiting until you've completed finishing the piece until you actually install it.

Building the Base

The base is a straightforward tapered leg construction. First, cut the leg blanks (pieces 14) to size and rout mortises for the aprons. There are two tapers on

adjacent faces of the legs. Follow the *Drawings* to lay out starting points for the tapers, and cut them with a tapering jig on the table saw. Then use a block plane to form small, secondary tapers along the inside edges of each leg. Ease the outside leg edges with a 3/16"-radius bead.

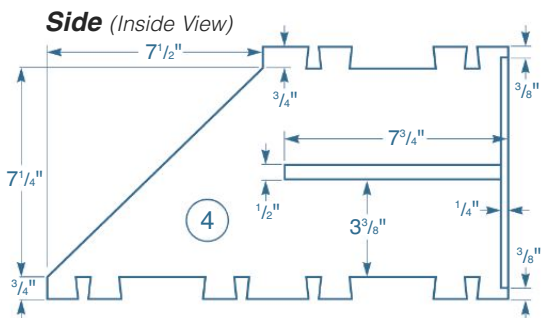
Now turn to the aprons. Cut blanks for the aprons (pieces 15, 16 and 17) and mill tenons on the ends of these parts to fit the leg mortises. To shape the lower profiles of the aprons, make full-size paper patterns using the shapes shown in the *Drawings*, and secure the patterns temporarily to the blanks with double-sided tape. Cut out the aprons on a scroll saw or band saw and sand smooth.

Next, make the corner blocks (pieces 18) and form the 3/8" x 3/8" rabbets on the angled ends using a table saw or router table (as shown in the bottom left photo). These fit into matching stopped grooves in the aprons, so rout those grooves, too.

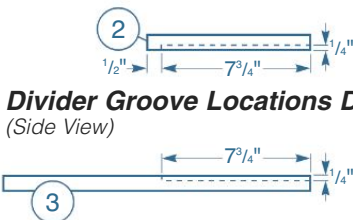
Give all the base parts a thorough sanding before getting out the glue bottle, and be sure to carry out a full dry-assembly. If you're satisfied with your work, glue and clamp up the legs and aprons, checking the assembly for square. When the glue dries, add the corner blocks.



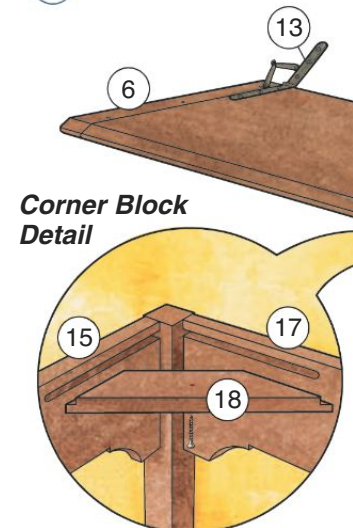
Miter-cut the ends of the corner blocks, then make a pair of shallow cuts to form tongues that will fit into the base aprons. Or, cut these rabbets on the router table, if you prefer.



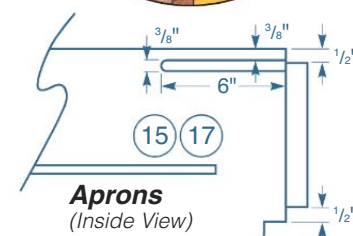
The author chose a varied but repeated pattern for his dovetails. If your dovetail jig will not accommodate these cuts, any regular pattern will serve.



Divider Groove Locations Detail
(Side View)

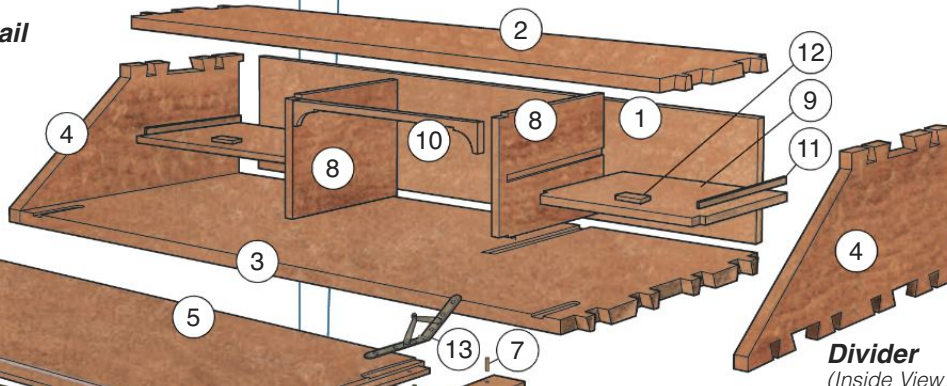
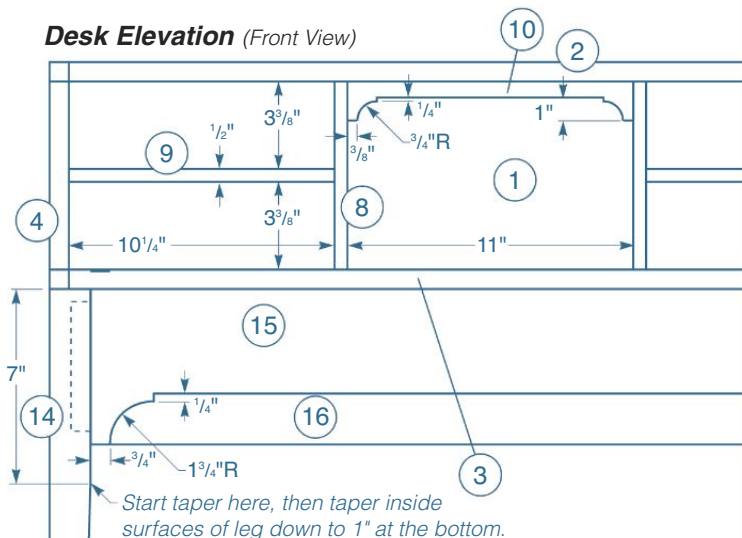


Corner Block Detail

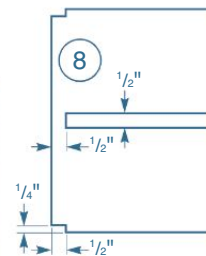


Aprons
(Inside View)

Desk Elevation (Front View)

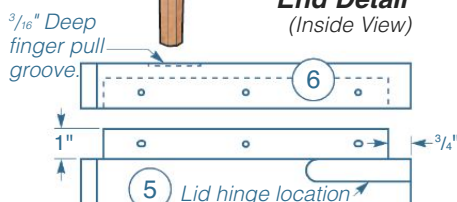


Divider
(Inside View)



Shelf
(Top View)

Lid and Breadboard End Detail
(Inside View)



MATERIAL LIST - DESK

	T x W x L		T x W x L
1 Desk Back (1)	1/4" x 8" x 33 1/4"	10 Valance (1)	1/2" x 1 1/2" x 11"
2 Desk Top (1)	3/4" x 8 1/2" x 34"	11 Drawer Guides (2)	1/4" x 1/2" x 7 5/8"
3 Desk Bottom (1)	3/4" x 16" x 34"	12 Drawer Stops (2)	1/4" x 3/4" x 2"
4 Desk Sides (2)	3/4" x 8 3/4" x 16"	13 Lid Hinges (2)	3/4" x 7"
5 Desk Lid (1)	3/4" x 11" x 33"	14 Legs (4)	1 1/2" x 1 1/2" x 29 1/4"
6 Breadboard Ends (2)	3/4" x 1 1/2" x 11"	15 Front Apron (1)	3/4" x 6" x 32 1/2"
7 Dowel Pins (6)	1/4" Dia. x 5/8"	16 Back Apron (1)	3/4" x 6" x 32 1/2"
8 Dividers (2)	1/2" x 8" x 7 3/4"	17 Side Aprons (2)	3/4" x 6" x 14 1/2"
9 Shelves (2)	1/2" x 8 x 10 3/4"	18 Corner Blocks (4)	3/4" x 3" x 9"

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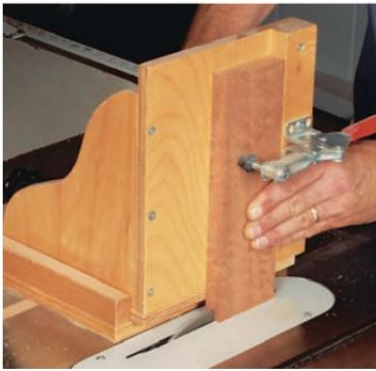
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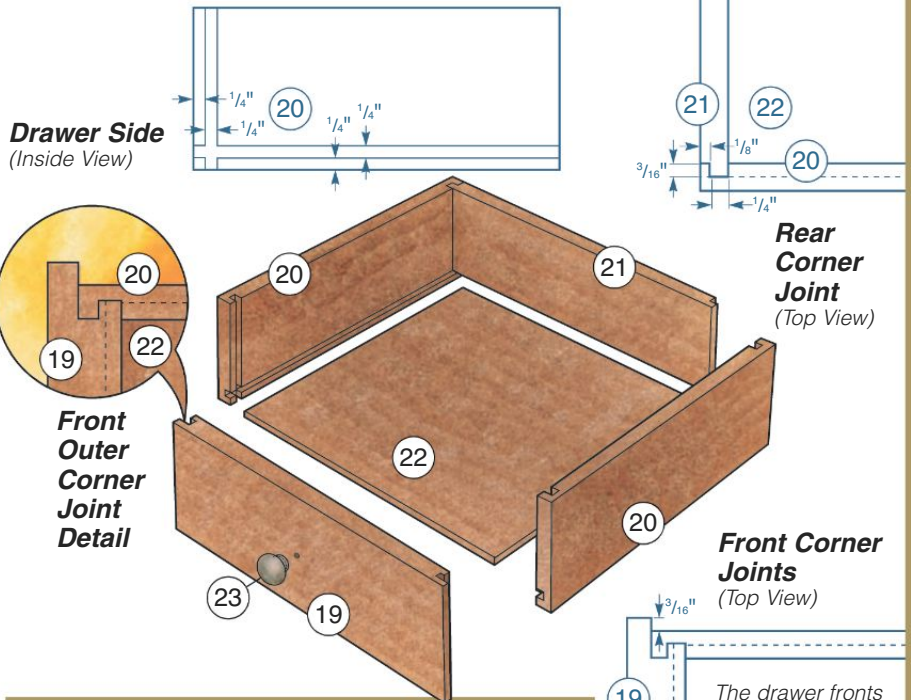
The drawers are joined together with a very slick and simple dado cut notch system. Test the cuts on scrap wood first.

Constructing the Drawers

Get rolling on the drawers by cutting the fronts, backs and sides (pieces 19, 20 and 21) to size. The drawers employ simple dado-and-rabbet joints to hold the boxes together. Follow the *Elevation Drawing*, above, to cut the drawer side dados and back rabbets to shape with a dado blade.

To make the drawer front joints, Raise a 1/4"-wide dado to 3/8", set the fence to 1/4", and cut grooves into the ends of the fronts, running the pieces on-end through the blade. Then raise the dado to 9/16" and cut the deeper grooves (on the outside ends, see *Drawings*) that give the fronts their overhangs. Remove the dado head, replace it with the saw blade, and with the fronts flat on the saw, trim the inner tongues back until they fit the side dados.

Use a dado blade or router table to cut the 1/4"-wide by 3/16"-deep grooves in the front and sides for the drawer bottoms (pieces 22). Dry-fit the drawer boxes, and measure the openings before cutting the drawer bottoms to final size. Finish-sand the drawer parts now, then glue the corner joints together. Slip the bottoms into their grooves



MATERIAL LIST - DRAWERS

	T x W x L
19 Drawer Fronts (2)	3/4" x 3 3/8" x 10 3/16"
20 Drawer Sides (4)	3/8" x 3 3/8" x 7 5/8"
21 Drawer Backs (2)	3/8" x 2 7/8" x 9 5/8"
22 Drawer Bottoms (2)	1/4" x 7 5/16" x 9 5/8"
23 Drawer Knobs (2)	1" Dia. brass

dry, and fasten them with three small brads driven up into the bottom edge of the backs. Now you can measure, mark and drill holes for the knobs.

Finishing Up

After all this construction, it's time to make that wonderful sapele grain really "pop." I wiped on three coats of boiled linseed oil to bring out the grain's depth and figure, then topcoated with wipe-on satin polyurethane.

To attach the desk and base, drill pilot holes for a screw in each corner block and fasten the two components with four screws. Mount the lid hinge hardware and add the drawer knobs. Nail the back panel in place and you're done.

I don't know about you, but I've never liked paying bills. Still, I have to

say that sitting at this desk sure makes that annoying task seem a lot more bearable these days. Well, at least tolerable.

Brad Becker is a professional woodworker and a regular contributor to the Woodworker's Journal.



Dovetailed Puzzle Box

THIS DOVETAILED
PUZZLE BOX IS
CHALLENGING TO
MAKE AND FUN
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This small puzzle box doesn't eat up a lot of material, it's fun and a little challenging to make but won't keep you in the shop for weeks, and it will appeal to anyone who tries to open it.

It's symmetrical, with interlocking dovetail slides and keys. The sides are alike, as are the ends and the top and bottom. Which is really the top? How do you get it open? The answer may not be immediately obvious. For now, don't try to solve it. Think about getting it made.

You'll only need a couple feet of stock, depending on board width. So rummage through your stashes of scraps too good to toss. Joint and plane all the stock for the box to a 1/2" thickness. Rip the sides and ends to width, and crosscut these four parts to length. Make sure you have some decent sized scraps, thickened along with the good stuff, to use for dialing in setups. Set the rest aside for now.

Making Rabbeted Miter Joints

I elected to use rabbeted miter joints to assemble the sides and ends. The joint's benefits are its clean appearance, its improved stress resistance over a plain miter joint, and particularly its ease of assembly. You can cut mitered rabbets on the table saw, but it's less intimidating to make them on the router table. You'll need a bit to cut rabbets and a chamfering bit to add the mitered ends.

The sequence, as shown in the photos (above right), is as follows: First, you rabbet the parts. Then you bevel the ends of those rab-



Confirm the accuracy of your setups with test cuts: Start the corner joints by adjusting the rabbet bit height as you would for cutting a shiplap. For half of each joint, cut a rabbet as wide as the mating piece is thick. The other half of each joint requires the width of the rabbet to match its depth (left photo). Bevel the ends of both the narrow and wide rabbets with the same setup using a chamfer bit (center and top right photos). The result is a miter with the registration benefits of a rabbet (right).

bets — in effect, mitering them.

The depth for all the rabbets is half the stock thickness, in this case 1/4". Put a straight bit in the router and carefully adjust the depth of cut to 1/4". Make a test cut on a piece of the setup scrap; rip the scrap in two and put the pieces together in a shiplap. The faces must be flush with the bottoms of the rabbets tight together. If you've got a gap between the rabbets or if the faces aren't flush, tweak the bit height and cut a new test. Then set the fence for the first round of rabbets.

The rabbets cut across the ends of the box sides are half the stock thickness in width, or 1/4". Slide the fence into position, and use the final depth-of-cut test piece as a gauge in setting it. You want only enough of the bit exposed to cut as wide as the depth. Again, confirm the accuracy of the setup with test cuts.

Rabbet the ends of both side pieces, backed up with a good-sized pusher to guide the workpieces through the cuts.

Now alter the setup for rabbeting the box end pieces. These rabbet widths match the stock thickness exactly. Using an end piece as a gauge, shift the fence to expose more bit. Once again, confirm the accuracy of the setup with test cuts. That done, cut rabbets across the box ends.

Beveling the Rabbets

The bevels (or miters) are routed with a chamfering bit. When you fit the bit in the router, be sure to extend it far enough out of the collet. The bottom of the cutters must be 1/4" above the tabletop to mill the bevels (see center and top right photos). As you adjust the height of the bit, use a workpiece to gauge the precise elevation. The terminus of the angled cutting edge must align with the rabbet bottom. Similarly, adjust the fence so only enough of the bit is exposed to cut the thickness of the rabbet projection.

Confirm your setup using the final rabbet test-cut scraps. Make any necessary adjustments before cutting the good parts. Back up the cuts to prevent blowouts.

After sanding the parts and checking the fit, I assembled the box with glue, clamping it with a band clamp and four shop-made corner blocks. To make such blocks, cut a rabbet in a 1 3/4"-square strip, then chop it into four pieces, each about 2" long. Wax the faces of the rabbets so the blocks don't get glued to the box. As you tighten the band, measure the diagonals to ensure the box is square — you may need to coax it.



Rabbeted Tops/Bottoms

When the glue cures, pop off the band and corner blocks, clean up the edges of the box, and rip and crosscut the top and bottom to fit the box. I cut the two parts using a cutoff sled on the table saw, and I used the box assembly to set a stop for ripping, then crosscutting the parts accurately. Cut 1/8"-deep, 1/2"-wide rabbets around the top and bottom (see *Drawings*), so these parts will set slightly into the box. Glue the bottom onto the box (but not the top).



The author used shop-made corner blocks and a band clamp to glue the box together. Don't let appearances fool you: check the assembly's squareness carefully and adjust it before the glue sets.



Clamp backup boards to the top (unglued) and bottom before making the first slot cuts in the box ends. Three or four passes, flipping the box and moving the fence away from the bit each time, completes each wide slot.

Rout Slots, Slides and Keys

I routed all the dovetail slots, grooves, slides, and keys with a 3/4" 14° dovetail bit. I cut the wide slots in the box ends first, then routed and fitted slides to them. Put the bit in the router and adjust the cut depth to 3/8". Plan to make the slots about 1 1/2" wide (precision here is irrelevant). Set the fence 1 1/8" from the tip of the cutter for the initial cut. Using its rabbet, position the top

on the box. To prevent blowout damage, cut two pieces of scrap to cover the top and bottom. A clamp holds the package together and ensures you slide the same side of the box along the fence on each cut.

Make a first pass, routing a dovetail groove through one end of the box. Then roll the box end-for-end and make a duplicate groove through the other end. Adjust the fence about 5/8" fur-

ther away from the bit and make second passes though both ends, widening the slots. A second fence adjustment and third cuts should be sufficient to complete the slots.

To make the slides, cut a strip of 1/2"-thick stock about 2" wide and 7" long. Leave the depth-of-cut setting unchanged, but move the fence to house the bit almost completely. A shallow first pass along each edge of the blank establishes the dovetail angle but leaves a shoulder above the bit to bear against the fence. A multi-pass cut-and-fit process, shifting the fence, whittles down the dovetail section without affecting the overall (fence-bearing) width of the blank.

Once the blank fits easily into either slot, cut it into two slightly overlong slides. Clamp the box in your bench vise, with a scrap tucked in to hold the slide in place, as shown in the photo below. Plane down the slide flush with the box end's face. Turn the box over and repeat the operation to finally fit the second slide. Sand the ends of the wide slides flush with the top and bottom of the box. Glue the slides to the box top (and only to the top, not to the box itself).

With them in place, you can now rout the key grooves across the box top and bottom. Milling them repeats the earlier process for routing the wide slots. Clamp scrap against the wide slides to prevent exit damage. Lower the bit to cut only 1/4" deep, and set the fence to locate the groove in the center of the box. Plow grooves across the box top and bottom.

Make the keys the way you did the wide slides. Resaw or plane a 1"-wide strip of stock to 3/8" thick. Rout the edges and fit the keys into the grooves. Plane them flush and trim them to exact length.



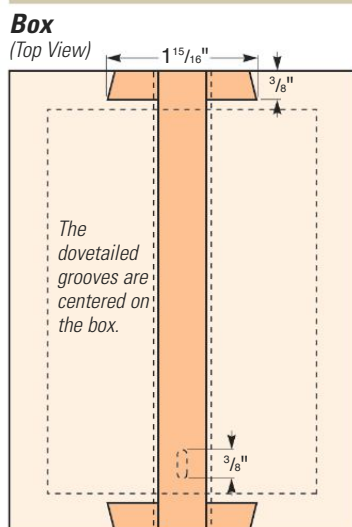
Make the slides with the bit setting unchanged from routing the slots. If you use 1/2" stock, a shoulder is formed that rides along the fence, allowing you to progressively adjust the fence and cuts while narrowing the slides (top left). Eventually, the dovetail portion of the blank will be narrow enough to fit into the slots (bottom left). Plane the fitted slides to final thickness by hand (right), clamping the box — slide in place — in a bench vise with a scrap against the slide to immobilize it.

MATERIAL LIST

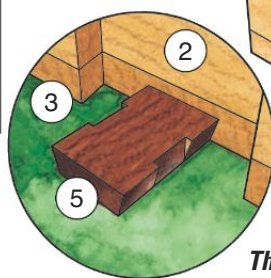
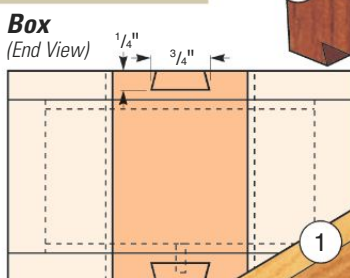
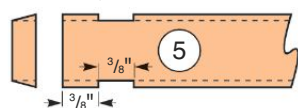
	T x W x L
1 Sides (2)	1/2" x 2" x 6"
2 Ends (2)	1/2" x 2" x 4 1/2"
3 Top and Bottom (2)	1/2" x 4 1/2" x 6"
4 End Slides (2)*	3/8" x 1 5/16" x 2 3/4"
5 Top and Bottom Keys (2)*	1/4" x 3/4" x 6"
6 Locking Dowel (1)	1/8" x 1/8" x 3/8"

* Fit to the dovetailed grooves

Note: The dovetail cuts are made with a 14° bit.

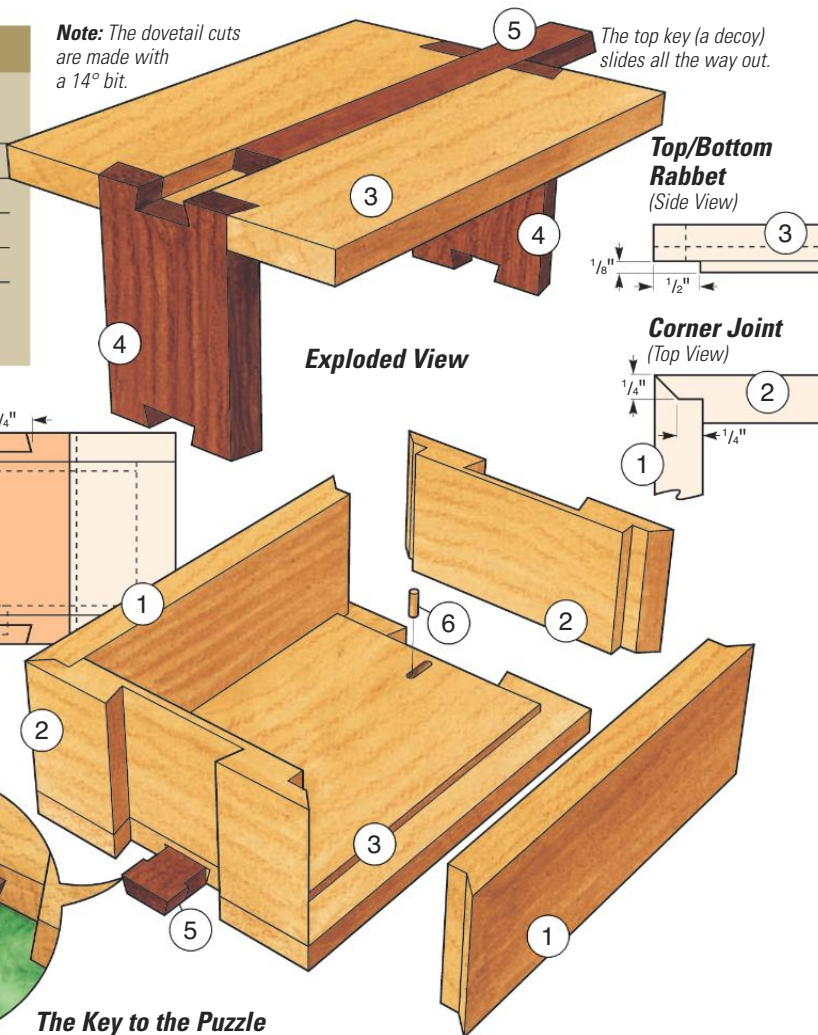


Bottom Key Notch Detail
(End and Top Views)



The Key to the Puzzle

Pare a notch in the bottom key's dovetailed edge. This allows the end slide to clear the bottom key. The locking dowel stops the key in the proper position.



I applied Waterlox for finish, allowing it to dry for several days before rubbing it out with wax and #0000 steel wool.

Solution Step of Construction

The solution to the box's puzzle — how to open the thing? — is in the limited movement of the bottom key. It moves clear of one slide, but then stops with its far end sticking out. That movement aligns tiny

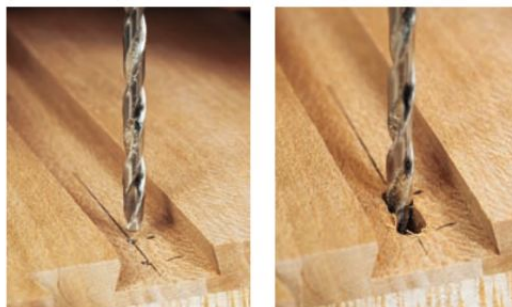
notches in the key's edges with the dovetail notch in the adjacent slide. Pull the top up, and the slides (they're glued to the top, remember) pull up and off with it.

The key's movement is governed by a 1/8"-dia. dowel pin projecting into a short slot in the box bottom. Fit it by pulling the key out of the bottom and laying out the ends of the slot on the centerline of the dovetail groove.

Drill the ends of the slot with a 3/16" bit and then waste the material between them. Reinsert the key, aligning its ends flush with the box ends, then transfer the near slot end location to the key with a transfer punch or drill bit. Move the key to what will be the limit of its travel and score its edges to mark the two notches that must be pared. Pull out the key and drill a stopped 1/8"-dia. hole at the mark, then pare off the dovetailed edges. Reinsert the key, glue the pin into its hole, and fit the top and slides in place.

I left the key in the top unglued, as a kind of diversion. The key comes out, but the box just doesn't open!

Lay out the slot for the locking dowel in the bottom dovetail groove (left). Mark the ends with an awl, then drill two holes through the bottom. Drill holes between the first two, and slide the box along the fence to "rout" it smooth (right).



Bill Hylton is a woodworker and author of *Woodworking with the Router*.

A Tambour-topped Box

TALK ABOUT COOL — WHEN YOU PULL THE DRAWER OPEN ON THIS LITTLE BOX, THE TAMBOUR TOP ROLLS BACK — A DEFINITE ATTENTION-GETTER!



This box has a little surprise that gives it “wow” factor: When you open the drawer, the top of the box retracts like a mini roll-top desk. The top is a tambour, with a series of narrow slats glued to a flexible canvas backing. The tambour slides in a curving track in the sides of the box. When you pull the drawer open, the tambour automatically opens, revealing a shelf inside. The box is sized to be useful as a jewelry box, a case for storing watches, sunglasses, etc., or as a desktop caddy to keep pens, erasers and other office supplies organized.

Forming the Sides and Tambour Track

To start this project, cut out the two sides of the box from any nice hardwood stock planed down to a final thickness of 5/8". Cut out two partial discs that are

exactly 7½" diameter by putting the point of a compass exactly 1½" from the square edge of the stock. After rough cutting the discs out with a band saw or jigsaw, stick them together using double-stick tape or adhesive transfer tape, then use a stationary disc or belt sander to sand them to final size (Figure 1). Separate the parts, remove the tape and mark the inside face and front-facing edge of each part.

Next, rout the tambour tracks on the inside faces of the sides (I've made a video of the entire tambour making process, which can be viewed here: www.woodworkersjournal.com/TambourBox). To create the track, use a small plunge router fitted with a 1/4" spiral-fluted straight bit and a 3/8" O.D. guide bushing attached to the router's subbase. A template, made from a 7" by 4¾" piece of 1/4"-thick

Masonite or hardboard, guides the bushing during track routing. Print out a paper copy of the template shown on page 65, and glue it to the template stock with craft spray glue. After drilling two 3/8" holes in the locations shown, cut the outer edge of the template to shape, as well as the waste in the channel section of the template. Use a 3/8" bit in a router table to rout the channel to final size, using the table's fence to guide the cut (Figure 2). Sand the edges of the template square and smooth with a stationary disc or strip sander.

Now use double-stick tape to secure the template in place on the inside face of one of the box sides, carefully positioning the template's bottom edge flush with the bottom of the side and its front edge flush with the front of the side. With the plunge router set to take a 1/4"-deep cut, rout the track starting at the top of the template. As you move the router around the template, take care to keep the guide bushing tight against the template's edge (Figure 3). When you reach the end of the channel, stop routing.

Before removing the template, mark its angled end (just below where the channel starts) onto the side with a fine pencil line. Now remove the template, peel or rub off the tape, and attach the template to the inside face of the other box side, reversing it front-to-back so that you'll rout a mirror image of the track. Rout and mark as before.

There's one more bit of track routing you'll need to do, to allow the tambour to be installed or removed from the assembled box. Make the second 1/4"-thick template following the pattern shown in the *Drawings*. Line up the template's angled notch with the pencil mark you made earlier and set its lower edge so that it overhangs the bottom of the box side by 3/8". Clamp the template and side down to a bench top, taking care to locate the clamps so they don't interfere with the router's base. Then rout the short exit track, starting the router at the bottom edge of the template (Figure 4, next page).

Making the Bottom and Shelf

The box's bottom and shelf are made out of 3/8"-thick stock. Cut out both of these parts from the same hardwood as the sides, so they'll match. Bevel-cut the front edge of the box bottom to 15°, so that it'll match the slope of the sides.

To keep small items from rolling off the back of the shelf and interfering with the tambour, the shelf's back edge receives a raised cap strip with a cove cut into its upper, front-facing edge. Cut the cove into the strip using a 3/8"-diameter core box bit in your router table, then glue it to the back edge of the shelf. The shelf also receives a small bead strip, to keep small items from rolling off its front edge. Cut the 5/16"-diameter half-round bead using an edge-beading bit in the router



Figure 1: The author sands the two sides to their final shape. While they are being sanded, the sides are held together with double-sided tape. This technique virtually assures that the sides are identically shaped.



Figure 2: Making a template to guide the router while cutting the tambour track is an essential step. Once again, the template is used to provide dependable uniformity in the machining process.



Figure 3: While routing the tambour track, keep constant pressure on the edge of the guide template. Loss of control during this operation will likely result in a ruined side piece. A plunge router works best here.

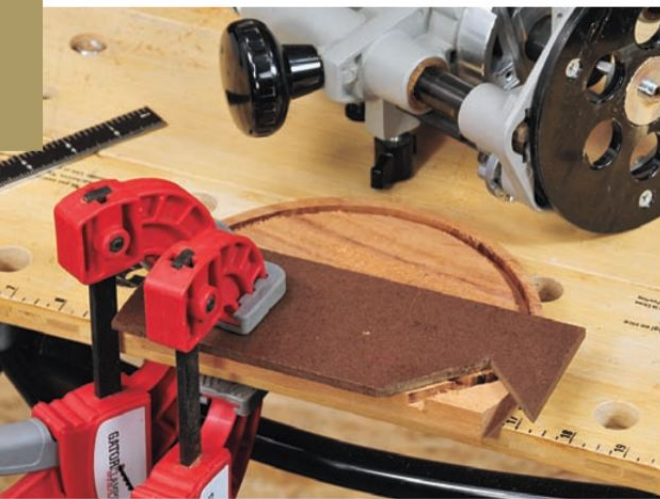


Figure 4: An additional bit of track routing is required to allow access for the tambour during assembly. The small template is clamped securely to the workpiece — it will work for both sides of the box.



Figure 5: The author used biscuits to join the shelf and the bottom to the sides of the box. Note the stop block clamped to the work surface. It is cut square and holds the side 90° to the table and biscuit joiner.



Figure 6: Once the small clearance miter has been cut onto the lower rear corners of the drawer sides, a small triangle of stock must be removed using a sharp chisel.

table. Set this strip aside for now.

The shelf and bottom are secured to the sides using #10 biscuits (Figure 5). Set up the biscuit joiner to center the slots thickness-wise in the ends of the shelf and bottom, locating them as shown in the *Drawings* on the opposite page. Cut the biscuit slots in the box sides so that the bottom and shelf will be positioned as shown in the *Drawing*.

Sand the parts smooth, leaving the edges of the ends crisp where they'll join the sides. Also sand the inside faces of the sides, paying special attention to smoothing the inside surfaces of the routed track. Don't round over the edges of the sides just yet.

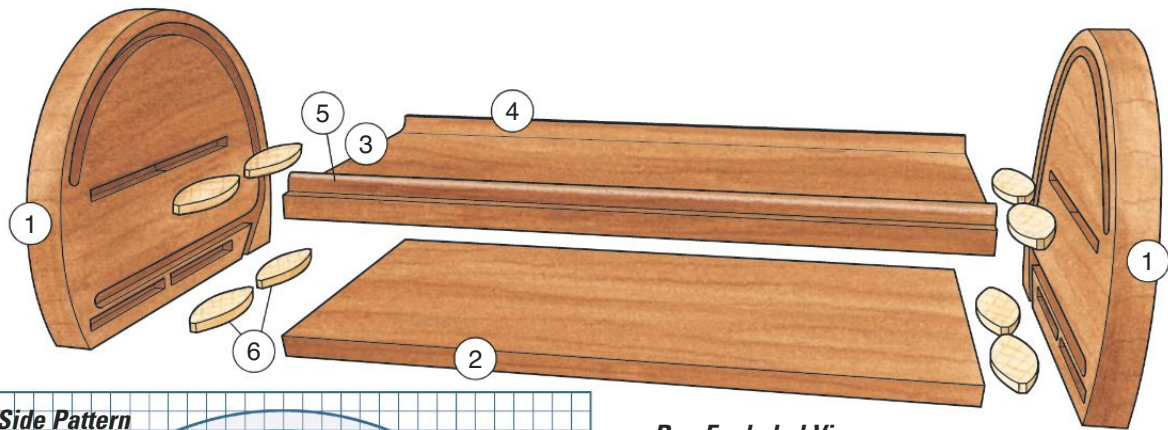
Building the Drawer

The space formed by the sides, shelf and bottom of the box serve as a housing for the box's drawer. The drawer is sized to fit snugly in this space, yet slide smoothly in and out of it. Cut out the parts for the drawer following the *Material List*. You can use just about any wood for the drawer box parts, but for the drawer front and pull cap, use the same hardwood that matches the rest of the box. You can cut the drawer bottom either from solid stock or 1/4" hardwood plywood (which is typically about 3/16" thick).

Cut a 3/16"-wide, 3/16"-deep groove on the inside face of both sides and the drawer front, using either a table saw or a router table. Space the lower edge of the groove 1/4" up from the bottom edge of each part. Cut or rout a 1/8"-wide, 5/32"-deep dado into the inside face of the two sides. Space these grooves 1/2" from the back ends of the sides. Next, cut the joints on the ends of the drawer back. Using a 1/4" straight bit in the router table, rout a rabbet to form a 1/8"-wide, 5/32"-long tenon on each end of the back.

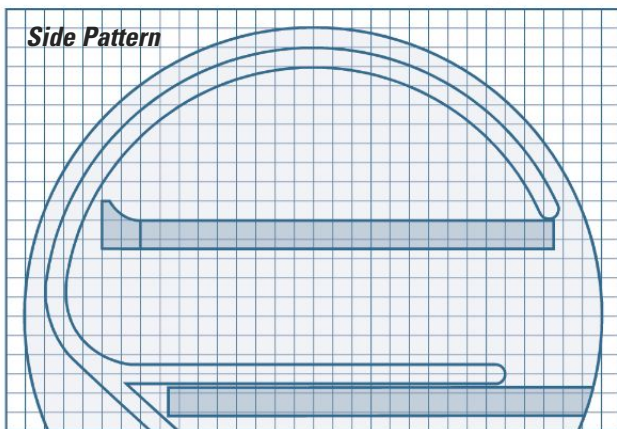
To create clearance where the tambour attaches to the drawer, cut off the back lower corner of each side at a 45° angle. Then, using a sharp chisel, trim the small triangular piece above the miter cut flush with the depth of the drawer bottom groove as shown in Figure 6, at left.

To shape the drawer pull strip, first use a 3/8"-diameter core box bit to take a 3/8"-deep cut into the lower edge of the strip (Figure 7, page 66). Set the table's fence so that the cove is spaced 1/4" back from the strip's front edge. Trim the strip on the table saw, to form the 1/4"-thick section that will be glued atop the drawer. Use a 1/2"-radius roundover bit in the router table to shape the top edge of the pull, then set the strip aside. To join the



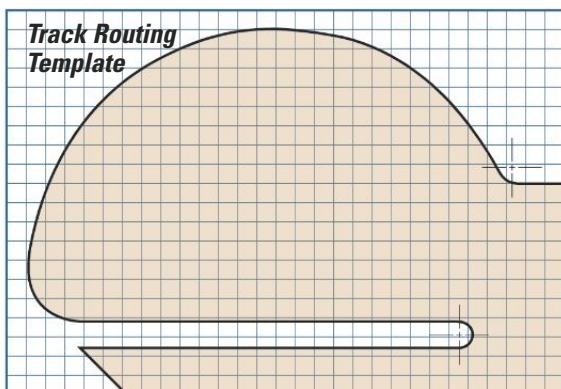
Box Exploded View

Side Pattern



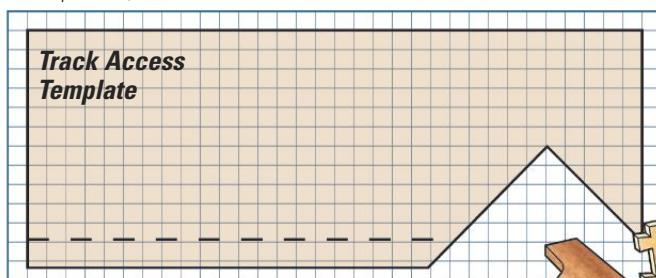
Each square = 1/4"

Track Routing Template



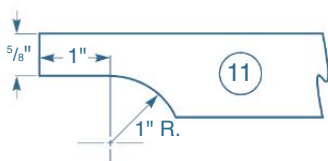
Each square = 1/4"

Track Access Template

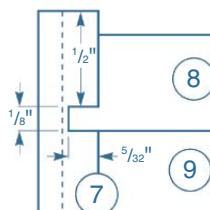


Each square = 1/4"

Drawer Handle Cutout
(Top View)



Drawer Corner
(Top View)



MATERIAL LIST

Box:

	T x W x L
1 Sides (2)	5/8" x 5 1/4" x 7 1/2"
2 Bottom (1)	3/8" x 5 5/8" x 10 13/16"
3 Shelf (1)	3/8" x 5 5/16" x 10 13/16"
4 Rear Cap for Shelf (1)	5/8" x 1 1/2" x 10 13/16"
5 Front Bead Strip (1)	5/16" x 5 1/16" x 10 13/16"
6 Joinery Biscuits (8)	#10 plate joinery biscuits

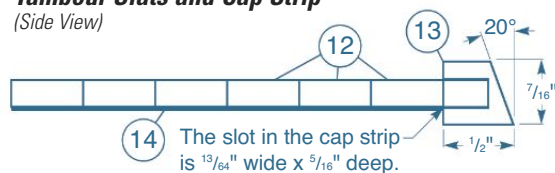
Drawer:

7 Sides (2)	5/16" x 1 3/4" x 6 5/16"
8 Back (1)	1/2" x 1 5/16" x 10 7/16"
9 Bottom (1)	3/16" x 5 7/8" x 10 3/8"
10 Front (1)	5/8" x 1 7/8" x 10 3/4"
11 Pull Strip (1)	5/8" x 1 5/16" x 10 3/4"

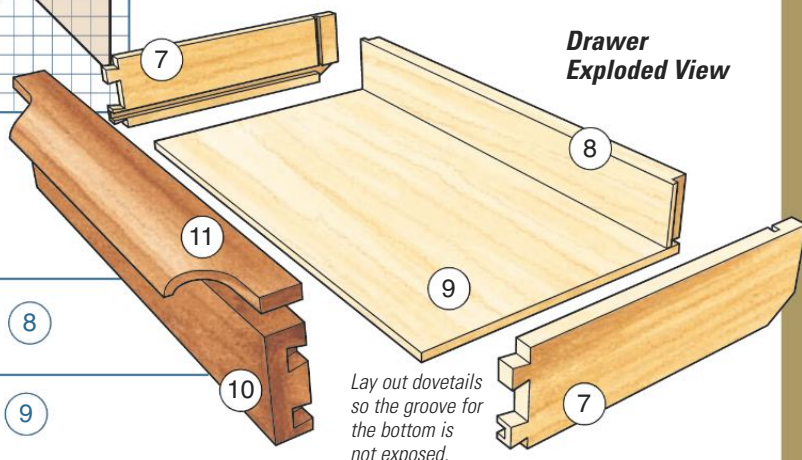
Tambour:

12 Slats (21)	3/16" x 1/2" x 11 13/16"
13 Cap Strip (1)	7/16" x 9/16" x 10 3/4"
14 Lightweight Canvas Duck Fabric (1)	11 1/8" x 11"
15 Screws (2)	#6 x 1 1/2" long

Tambour Slats and Cap Strip
(Side View)



Drawer Exploded View



Lay out dovetails so the groove for the bottom is not exposed.

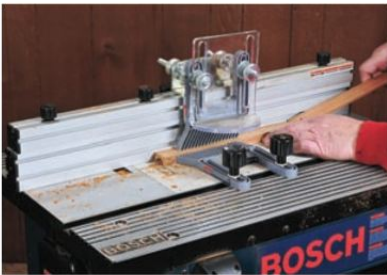


Figure 7: Start the drawer pull.



Figure 8: Curve the drawer front.



Figure 9: Shape the drawer pull.



Figure 10: Resaw stock for the tambour slats.



Figure 11: Gang cut the slats to width.



Figure 12: Wedge the slats into the jig.

drawer sides to the drawer front, I hand cut half-blind dovetails with 5/16"-long tails and 5/16"-deep pins. Although there aren't many dovetails, it takes a lot of fussing and patience to get tight, clean joints, so you may opt to join these parts using a simple rabbet joint instead.

After sanding the inside surfaces of the drawer parts, do a quick dry-assembly to make sure everything fits together correctly. Now glue up the basic drawer box, sliding the drawer bottom in place and tacking it to the lower edge of the back side. Check to make certain that the assembly is square before leaving it clamped up to dry for an hour or so. When the glue dries rubbery hard, scrape off the squeeze-out.

After clamping up the dry-assembled box, slip the drawer into its housing to check the fit. There should be about 1/32" of side-to-side play between the drawer and the sides. If the fit is a little too snug, use a block plane to trim the sides slightly. Now set the drawer front flush with the edge of the sides and mark the sides' curve on each end of the front. Use a hand plane to shave the drawer front until its curve matches the sides (Figure 8). After sanding the front smooth, glue the pull strip to the top edge of the front. When the glue dries, cut away the outer parts of the pull strip on the band saw (Figure 9), following the curve shown in the *Drawings* on page 65. Use a spoke-shave or cabinet scraper and sandpaper to fair in this curved cut with the drawer front, then finish-sand the rest of the drawer. Round the top edge of the pull with a block plane and sandpaper, to increase the radius of its curve to about 3/4" (which presents a more elegant look). Also, ease the bottom inside edge of the pull strip, to make it more "finger friendly."

Gluing Up the Tambour

I've saved the most interesting task for last: making the tambour that forms the box's retracting top. To make stock for the tambour's slats, resaw enough 11½"-long 4/4 boards to make twenty-four 1/2"-wide slats as shown in Figure 10. Plane each of the resawn boards down to 3/16" thick, then crosscut the boards exactly 11⅝" long, making sure all ends are cut square. Rip the slats to 1/2" width on the table saw, using a quality blade that leaves nice, clean-cut edges. To save time, I adhesive transfer tape the boards together, and gang-cut four slats at a time (Figure 11).

Create a frame for assembling the tambour by nailing or screwing 1/2"-thick scrap strips to a flat piece of 1/2" or 3/4" plywood. Make the inside dimensions of the frame 11⅝" wide by 12" long. Now set the best 21 of the slats you cut into this frame, with their "good" sides facing down. Add an extra slat, covered with masking tape after the last good slat. Press the tambour tightly together by driving three pairs of small wedges against each other between the last taped slat and the frame (Figure 12).

An 11⅝" x 11" piece of lightweight (9 to 11 oz.) canvas duck fabric makes the flexible back of the tambour. Carefully spread a light, even coating of yellow or white PVA glue onto the slat assembly and press the canvas down onto the slats. Align it with the frame and wipe off any excess glue from around the edges. To set the glue quickly (to keep it from seeping down between the slats), use a household iron on a medium setting (no steam) to heat the canvas (Figure 13, next page). Work the iron over



Figure 13: An iron sets the glue.



Figure 14: Trim the canvas back from the ends.



Figure 15: Glue the cap strip in place.



Figure 16: Dry-clamp the box together.



Figure 17: Test-fit the tambour sheet.



Figure 18: Attach the tambour to the drawer.

the surface for a minute or so, applying only light pressure and keeping the iron moving at all times. Let the tambour cool for about 10 minutes, then remove the tambour from the frame and bend the joints between all the slats open, to assure they're not stuck together. Set it aside to dry overnight.

The next day, trim back the canvas at the sides of the tambour 3/16" from the ends of the slats (Figure 14). On the band saw, trim 7/16" off of both ends of the last slat (at the rear of the tambour), so it can be attached to the drawer. Also reduce the width of the first slat (at the front) to 5/16" wide using a table saw or jointer. To finish off the tambour, the front slat receives a cap strip, cut to the size and profile shown on page 65. Glue this strip in place, centering it on the length of the slat (Figure 15). Now sand the entire tambour surface smooth, easing the edges between slats and rounding their ends slightly. Wax the slat ends a little, so that the tambour will slide more easily within the track.

To attach the tambour to the drawer, dry-assemble the box and clamp the sides, bottom and shelf together (Figure 16). Slide the drawer into place and turn the whole thing upside down on the bench. Slip the tambour into its track with the capped end first (Figure 17). With the drawer held fully closed and the tambour cap tight against the pull strip, press the last trimmed slat against the drawer bottom and drill a pair of small diameter countersunk holes into

the edge of the drawer back, spaced about an inch from the ends (Figure 18). Drive 3/4"-long #6 screws into the countersunk holes, then flip the assembly over and make sure the tambour retracts smoothly when you pull the drawer open.

Assembly and Finishing

Disassemble the parts, and glue the bead strip to the shelf, locating it parallel to and 5/16" back from the shelf's front edge. Glue the shelf, bottom and sides together, applying just enough glue to coat the biscuits and slots thoroughly. After the glue dries, sand the entire box, rounding over all edges slightly with sandpaper. You can apply any finish to the box, but an oil finish makes it much easier to finish the tambour slats, so that is my recommendation. Reconnect the tambour and drawer, and your box is ready for use. With any luck, you'll hear a little "wow" the first time somebody opens it.

Sandor Nagyszalanczy is a regular contributor to Woodworker's Journal. His books are available at www.sandorsworkshop.com.



This clever box has a tambour top that retracts as the drawer is pulled open. This is a great small project that will provide a true woodworking workout.

A Basic Ladderback Chair

THIS LADDERBACK IS A CLASSIC PROJECT THAT WILL TEACH YOU SOME GREAT SKILLS AND GIVE YOU A PLACE TO PONDER THEM.



The construction process that you choose as a builder is often constrained not only by the size of your workplace, but also by the tools that you have at your disposal. For this project, we decided to use a 14" band saw in place of a table saw, for those who may not own one yet. Even so, the critical path of woodworking remains the same: harvesting the stock, marking and making the joints and so on.

To make this chair, we used solid cherry lumber surfaced to 1 $\frac{3}{4}$ ". There are no metal fasteners used here ... just dowel joints and a form of mortise-and-tenon joinery.

The primary machining on this chair was done with a router guided by shop-made templates. The back legs, back slats and the seat (pieces 2, 5 and 6) were all template-routed to their final shape. The front legs and the stretchers (pieces 1, 3 and 4) were rough cut on the band saw, then planed square and smooth by hand.

Chairs have a reputation of being difficult to build, and with good reason. As our late contributing editor Mike McGlynn used to say, "when you make a chair, the joinery has to be bomb-proof." That may have been a slight overstatement, but probably not by much!

Getting Started

Begin the process by getting sufficient 1¾" stock into your shop to make the chair (or chairs), and keep it there for a while to let it get used to the environment. With your lumber in hand, the first task on the agenda is to make the template for the back legs, pieces 2 (top two photos at right). Because the template will end up long and skinny, Baltic birch plywood (1/2" thick) is the perfect material to use here. The voidless plywood provides strength and dimensional stability that are essential for this task. Lay out the shape of the leg on the plywood with a sharp pencil, using the *Drawings* on the following page as a guide. Then step to your band saw and cut the shape, staying just outside the pencil lines. When you've cut it out, sand and plane the excess away until you have an accurately formed template. Remember, any dips, bumps or other distortions will be clearly telegraphed to your leg stock as you rout, so refining the shape of the template is very important.

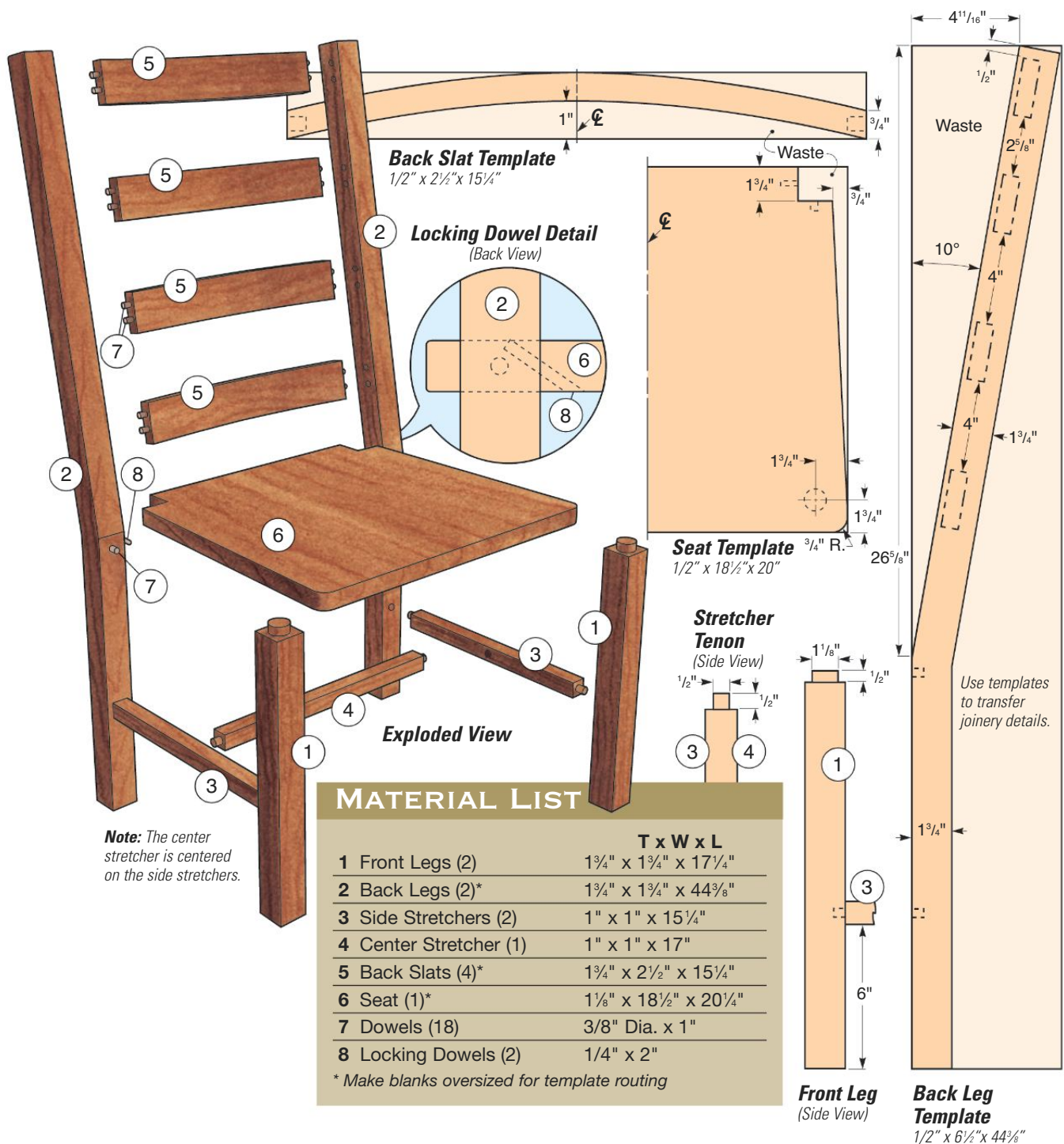
Now use the template to trace the shape of the legs onto your cherry lumber. Even though it might seem a bit odd, a full-thickness black Sharpie® is the perfect marker to use for this task. Its ultra-dark lines are easy to see, and it is thick enough that you can cut exactly to the outside of the line and have just the right amount of wood to trim away with the template-routing bit. Which brings up a couple of other important points: If you have not done much template routing, you need to be aware that routing across end grain in situations like these legs can lead to disaster. You must be very careful to avoid fracturing the grain at the corners. It is better to avoid the corners and just rout up to them but stop short, leaving small nibs of wood to be sanded off later. Also, pay attention to how the grain runs (by looking at it visually and listening while you are cutting) in the leg as you are routing. If the grain is as curly and troublesome as was the cherry we used here, you will need to stop and do some climb cutting in places to avoid tearout.

The legs were routed in a two-step process because the router bit was not long enough to machine the thickness of the leg in a single pass. After securing the template to the leg blank with carpet tape, take the first routing pass. Then remove the template and lower the bit in the router. This way you can complete the cut by guiding the bit's bearing along the surface of the wood you've already machined. With that done, sand the nibs at the ends of the legs and set them aside for now.



Lay out the back leg template and cut it to shape on the band saw (top photo, above). Then refine the shape of the template (center photo, above). Shaping the legs is a two-step routing process. First, with the template secured with carpet tape, rout the waste material away. Then remove the template and lower the bearing-guided bit to complete the shaping (bottom photos, above).

Next, it's time to make the front legs and the stretchers (pieces 1, 3 and 4). We ripped them from the cherry lumber using the band saw, and then used a hand plane to square and smooth them. Even with this unruly cherry, that process only took a short while. As long as you are at it, now is a good time to make the seat blank (piece 6) from 1¾"-thick stock. Here we resawed the thicker cherry lumber to about 1¼" thick, glued up the blank, then planed it flat (across the grain) with a bench plane. Make the blank slightly oversized as, once again, you will template-route it to its exact final dimensions a bit later on here.



It's Jig Time

We used a shop-made jig (see *sidebar*, page 72) to raise round tenons on the ends of the front legs and stretchers. It is not complicated to make or use, and one of its best features is that it can handle stock of differing thicknesses, using interchangeable tenon guides. As with any machining task, it only makes sense to use scrap lumber cut to the same dimension as the actual leg and stretcher stock to set up the cuts and test the fit of the tenons in pre-drilled holes. The stretcher tenons were formed to be 1/2" in diameter and 1/2" long. The leg tenons were also 1/2" long but 1 1/8" in diameter. One tip to keep in

mind: make the tenons just oversized in diameter and then hand-sand them from there. This ensures a tight fit, which is crucial for chair joints.

When you've cut the stretchers and legs to length and raised the tenons, go ahead and drill the holes for the stretchers in the legs and the side stretchers. Then, clamp the parts together to test the fit, and so that you can measure for the back slats (see top left photo, next page). It's important to keep the legs parallel to each other, so using squared-up pieces of sheetstock, cut to the proper size and clamped between the legs, is a great way to do that.



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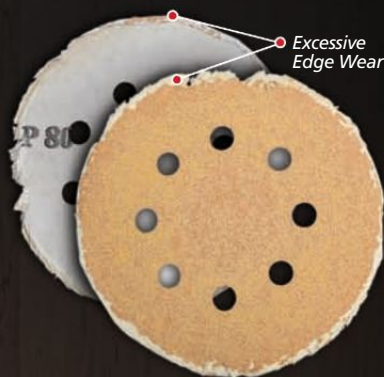
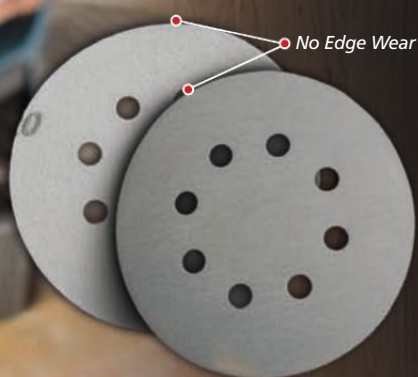
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Rout the shape of the back slat, keeping your hands clear of the cutter. When those cuts have been done, chuck a 3/4" flush-trim bit with the guide bearing on the end of the bit (photo with the red bit, at left). Set it so that it will clean up the rest of the waste on the slats, and repeat the process. Sand the back slats smooth and then use dowel points to help locate the dowel holes in the back legs. Drill the dowel holes and then dry-assemble the parts. When everything fits properly, disassemble and finish-sand them.

It's time for your final template-routing process to complete the seat. Make a 3/4" plywood template, shaped as shown in the *Drawings* but fit precisely to the chair as it is in clamps. Secure it to the seat blank with carpet tape. Step back to your router table and use the flush-trim bit to shape the blank. Take care at the end-grain corners. Square up the notches at the back of the seat with chisels. Mark the locations of the front leg mortises on the seat, and drill them. Test their fit, then final-sand the seat. Then drill 3/8" dowel holes in the notches of the seat as shown in the *Drawings*, and use dowel points to locate matching dowel holes in the back legs. Drill those holes and test-fit the seat one more time. When you are satisfied, glue and clamp the chair together. We added 1/4" locking dowels from underneath the seat as shown in the *Drawings*. Drive them in and sand them smooth.

After the clamps came off, we broke the edges of the chair parts with sandpaper, rounding them over to make a pleasing shape. Apply your choice of finish, and you'll have a fine hallway chair or, if you make a few of them, a dining room set.



Dry fit the chair parts and make your slats:

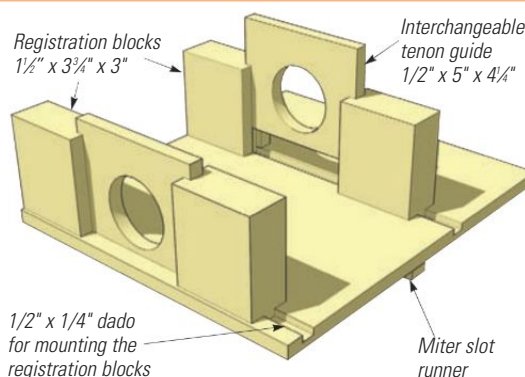
The back slats are machined from 1 3/4" stock (use your template, flush-trim and pattern bits and two passes on the router table) and are secured with dowels as is traditional in ladderback chairs.

Making the Back Slats and Seat

The cross slats that make up the ladderback need to be perfectly fitted between the legs. With the chair parts clamped together, determine the slat length and create a plywood template using the *Drawings* as your guide. The back slats end up being 3/4" thick, but they are shaped from 1 3/4" stock. Once again, you will use a two-step template routing sequence, this time on the router table. Cut the slat blanks to length, use the template to trace their shape onto the blank, and then drill their ends for pairs of 3/8"-diameter dowels. Use the band saw to rough cut them to shape. Then step to your router table and chuck a 3/4" "pattern" bit — it has the bearing at the "chuck end" of the bit — into your router (photo with the blue bit, above).



ROUND TENONS ON SQUARE STOCK



This sliding jig, easily made from scrap, allows you to use a router table to safely raise round tenons on the ends of square stock by rotating it in the tenon guides. Tenon diameters are adjusted by raising and lowering the router bit. To see it in use, visit woodworkersjournal.com and click on the "More on the Web" content for the April 2013 print issue.

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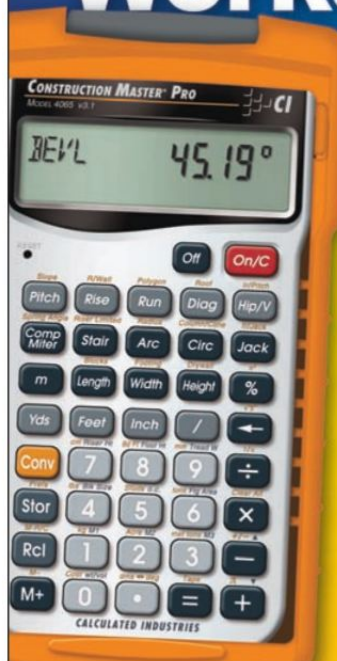
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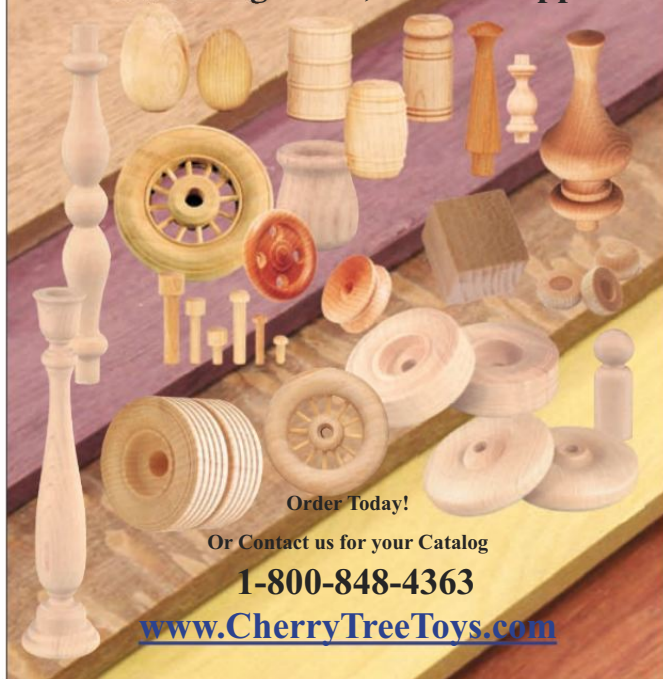
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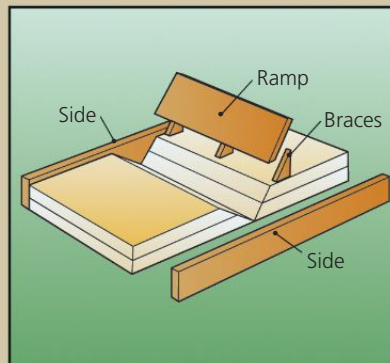
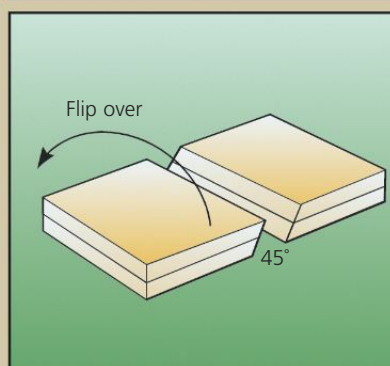
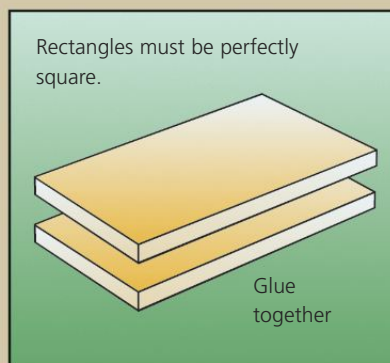
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A Simple Dovetail Key Jig

DOVETAIL KEYS ARE EASY TO MAKE WITH THIS SCRAP-MADE JIG.

Dovetail keys add strength and beauty to an otherwise ordinary mitered corner. To make this handy jig, simply follow the three-step process shown at right. After the jig is constructed, determine where to set the fence on your router table in order to put the keyways exactly where you want them. But before you chuck your dovetail bit in the router, use a 1/4" straight bit to plow a groove in the jig (to remove waste material). Switch to your dovetail bit and remove the remaining material. Slide the jig along your router table fence to form perfect dovetail keyways.

A 45° beveled pocket in this jig, and a ramp behind, hold parts securely for cutting attractive dovetail keys across corner joints.



Form two identical rectangles from 1/2" plywood or MDF. The blanks must be perfectly square. Glue and clamp the blanks together. Tilt the blade of your table saw to exactly 45° and cut the glued-up blanks in two. Flip one piece over as shown above, and check their intersection with a square to make sure the "pocket" formed is exactly 90°. Cut the jig sides, ramp and support braces from 1/2" scrap. Position the pieces as shown in the bottom illustration, above, and secure them with glue. It's better to use only glue for attaching the sides to the base, but if you use screws or nails, position them high enough so they won't make contact with router bits during use.

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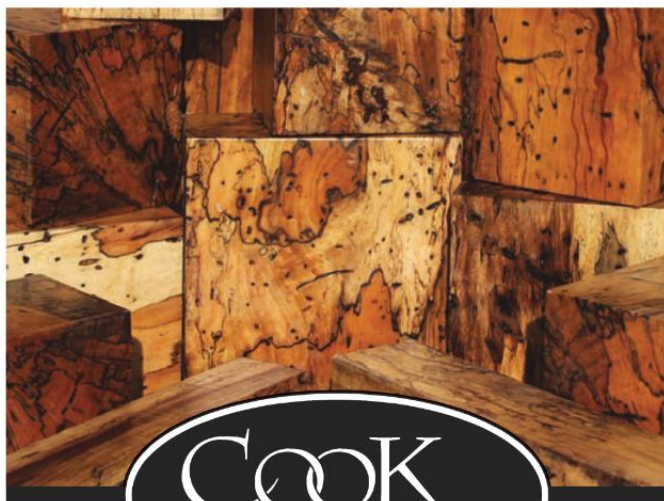


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Butler Tray And Stand

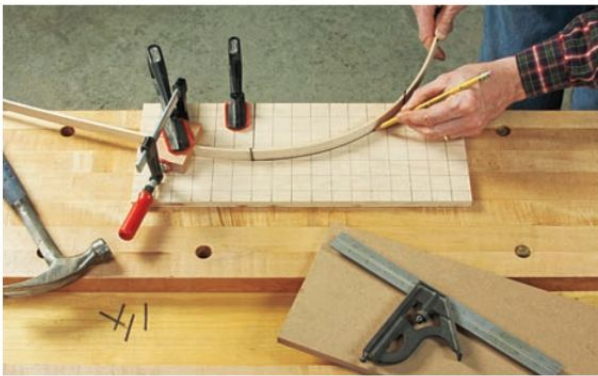
THIS CLASSIC MAHOGANY AND BRASS TRAY AND FOLDING STAND WILL COME IN HANDY THE NEXT TIME GUESTS COME CALLING.



Last year, Rob Johnstone cut the tray portion of this project out on a CNC Shark machine. But, I don't have that technology, so he asked me to build the same tray and a folding stand to go with it using standard woodworking machines. And, as you'll see, that is quite easily done with several templates and a router table. The matching aspects, hinge mortises and many curves of this project are much easier to manage with guided router bits than lots of exacting band sawing and drum sanding. So, gather up some nice clear mahogany, and let's get started.

Making Wing Templates

There are two approaches to creating full-size templates for the butler tray's short and long wings: you could head to a photocopier and enlarge the gridded drawings we show on page 80, or draw a grid on some scrap plywood and plot several points of the curves, then join them with a strip of thin wood or hardboard bent to shape as I



The author formed half-curve patterns for the short and long wings by bending a flexible batten between nails on a plywood grid and tracing the shape (left). Once cut and smoothed, this half curve could be traced to form full templates on 1/2" MDF. Hinge leaf patterns (right) were found on a downloadable PDF first released for the CNC Shark version of this project. Those were then affixed to the wing template and cut to shape (right).

did (see top left photo). A few casing nails hammered into my half pattern registered the batten ends as I drew a half curve for both a short wing and a long wing. Then, I cut out the half patterns, faired them on my spindle sander and used them to draw full templates on some 1/2" MDF. Now lay out the handle shape on your short wing template. Cut it out and refine its curved shape on a spindle sander or with sanding drums. (You can use the same cutout for template-routing all four handles, so you need just one handle cutout.)

Mortising the tray's curved brass hinges would be tough to do by hand, so I printed out a PDF that ran with Rob's original CNC Shark article, and I used spray glue to affix two of the PDF's hinge patterns to my short wing template. Cut these mortise shapes out with a jigsaw or scroll saw (top right photo), and smooth them carefully to complete the short wing template.

Template-routing the Wings

Glue up a panel for your tray, and cut oversized blanks for the four short and long wings. Try to make all of the tray parts from one piece of stock so the grain and color are consistent. Trace

the wing shapes onto their blanks, and step to the band saw to cut them slightly larger than their layout lines. Transfer the handle outline from your template to all four wings, and cut these to rough shape, too.

Shaving off the extra stock so your wings match their templates exactly is standard template-routing work, but with one caveat: you're routing both end grain and long grain on these curves. Routing against end grain on the bias can lead to tearout if you feed into the curved ends, so here's what I did instead: with the template located on top of my blank and affixed with double-sided tape, I used a large-diameter flush-trim bit — bearing at the tip — and started my cut where the long grain begins, at about the handle position, trimming off the waste and feeding left to right (right top photo). Then, I flipped the workpiece over so the template was on the bottom, switched to a pattern bit — bearing on the shank — and finished trimming off the remaining overhang (center right photo). With this two-bit method, you'll always rout the end grain "with" the grain and "downhill," so to speak, instead of against it. Use a starter pin in



Routing "with the grain" to avoid tearout on the curves started with a flush-trim bit and the template on top (top), followed by a pattern bit and the template below (center). Handle cutouts were also template-routed (bottom).



Chiseling and routing the wing hinge mortises (top) was quick and easy. The tray-side hinge mortising process (center) was a more involved affair in order to create room for the hinge barrel, spring and hinge leaf thickness. Before final finishing and assembly of the tray (bottom), make sure the wings tip up fully as intended. Trim their ends a bit, if needed, to provide clearance for more hinge travel.

your router table as a fulcrum to begin each cut.

Once the outer curves of all four wings are done, double back to the flush-trim bit and rout the handles to final shape. Just use your short wing template, taped to either a short or long wing, to template-route all four handles (bottom photo, previous page). Remember to feed the work counterclockwise around to avoid climb-cutting.

Hinge Mortising Next

Grab your short-wing template, and trace pairs of hinge leaves onto the four wings. I positioned them $2\frac{1}{4}$ " in from the ends. The hinge barrels will require that you cut a $1/8$ "-deep rectangular mortise into the edges of the wings. Make these shallow mortises $1/4$ " wide, and chisel them out by hand. Then clamp your short wing template into place and rout the curved hinge leaf mortises $1/8$ " deep into the faces of the wings (top left photo). I used a short piloted mortising bit in a trim router for this job.

Set the wings aside and cut your tray's center panel to final size. It requires its own set of longer hinge leaf mortises that must be carefully laid out and milled in three steps. To start this process, I made a "tray side" mortise template using Rob's PDF pattern once again (it includes full-size layouts for both wing and tray hinge mortises), spray-mounted to a piece of scrap MDF. Cut out the curved leaf shape to make this template. Now set the wings into place against the tray and transfer the exact locations of the wing hinge leaves over to the tray side. Use your new tray leaf template to mark the hinge

shapes onto the tray.

With that done, take a close look at the center photo. The underside of these hinges have both a recessed barrel and a steel flap that serves as a spring. I mortised for the spring first, excavating a $5/8$ "-wide, $3/8$ "-deep channel in the center of the hinge leaf area to give the spring and its adjacent brass stop full clearance. A $1/4$ " carbide upcut spiral bit in my trim router was all it took, guiding the router freehand — it's very controllable on soft mahogany if you work carefully. Then I raised the bit to $1/4$ " depth to rout a $1/4$ "-wide slot along the wing edge for the hinge barrel; square up the inside corners of these cuts with a chisel. Last, clamp your tray-side hinge mortise template into place and zip through the eight curved leaf mortises at $1/8$ " deep.

Completing the Tray

Chuck a $1/8$ " roundover bit in your router, and ease the inside edges of the handle cutouts and outside curves of the wings on both their top and bottom faces. Give the tray parts a thorough sanding up through the grits to 180, and you're ready for some "test" assembly. You'll understand why I say "test" as soon as the hinges are screwed in place.

Fit the hinges into their mortises, and drill pilot holes for the tiny screws with a self-centering Vix-Bit. Now, attach the hinges, and tip the wings up gently. Do they raise to 90° and just touch at the ends? If not and the tips intersect, you'll need to nibble a bit of material off to improve the clearance — for me, this was about $1/4$ " from all eight ends of the wings. When the wings fold

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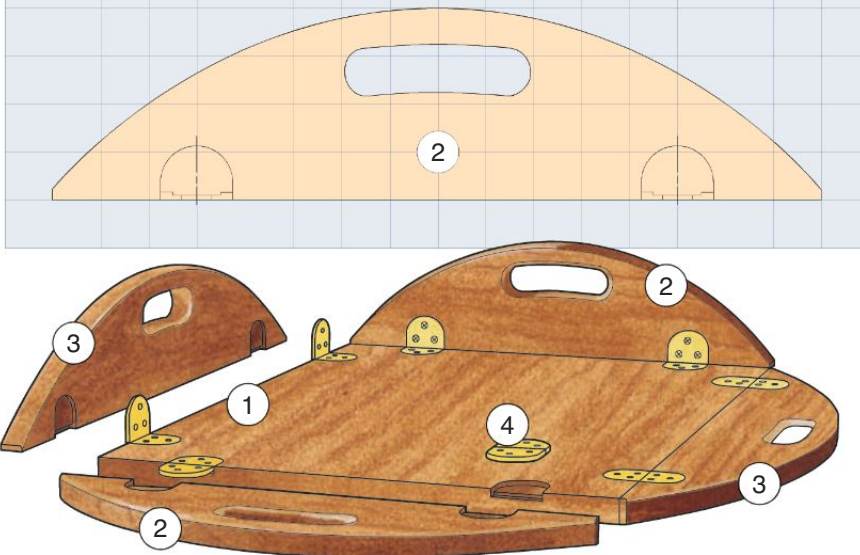
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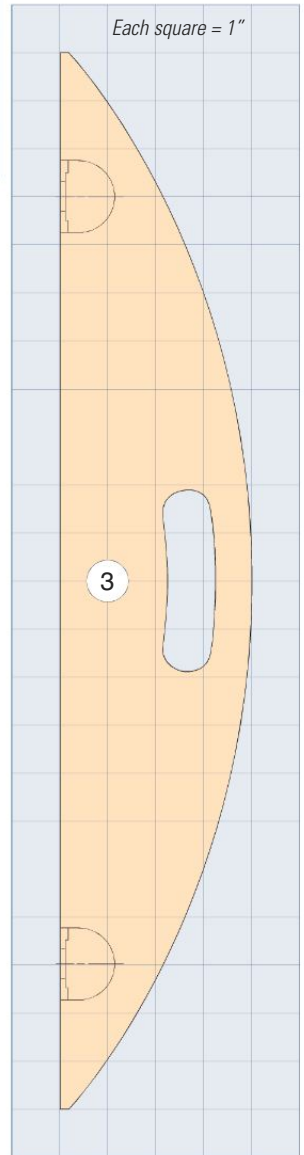
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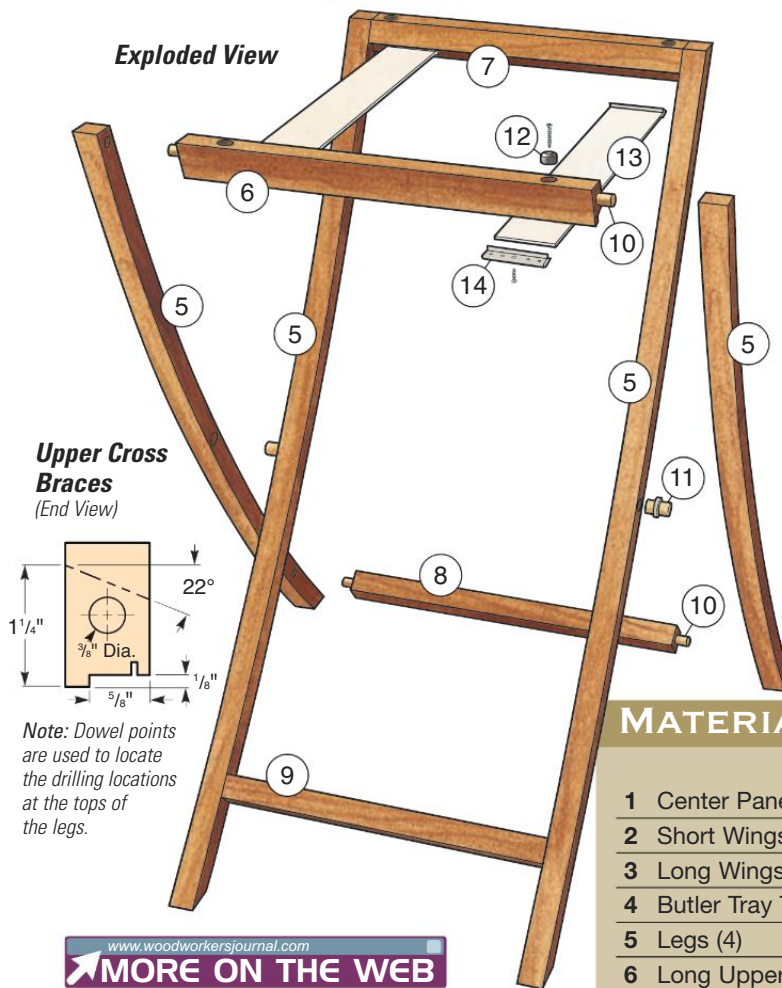
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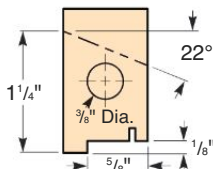
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Exploded View



Upper Cross Braces
(End View)



Note: Dowel points are used to locate the drilling locations at the tops of the legs.

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MORE ON THE WEB

To see a video of Rob Johnstone making this tray on a CNC Shark machine — and download the hinge layout PDF pattern — visit woodworkersjournal.com and click on the "More on the Web" tab for the August 2013 issue. Or receive these full-size patterns by sending a SASE to Woodworker's Journal-TRAY, 4365 Willow Dr., Medina, MN 55340.

MATERIAL LIST

	T x W x L
1 Center Panel (1)	3/4" x 16" x 22"
2 Short Wings (2)	3/4" x 4" x 16"
3 Long Wings (2)	3/4" x 4" x 22"
4 Butler Tray Table Hinges (8)	Brass
5 Legs (4)	7/8" x 3" x 34"
6 Long Upper Cross Brace (1)	7/8" x 1 1/2" x 13 7/8"
7 Short Upper Cross Brace (1)	7/8" x 1 1/2" x 12"
8 Long Lower Cross Brace (1)	7/8" x 7/8" x 13 7/8"
9 Short Lower Cross Brace (1)	7/8" x 7/8" x 12"
10 Dowels (4)	3/8" x 1"
11 Roto Hinges (2)	1/2" Dia.
12 Rubber Bumpers (4)	1/2" Dia.
13 Chair Webbing (4 ft.)	2" Wide
14 Webbing Metal Clips (4)	2" Wide



A quick mock-up, using the MDF leg tracing pattern and a second sample leg (above), confirmed the correct leg angles and spread for the stand. The author created wide inside and outside plywood templates for routing the slender leg blanks to final size and shape (below). This routing would be unsafe to do with the skinny MDF tracing pattern alone.



up properly, take the tray apart and apply your choice of finish. After the finish dries, wax the tray parts and put it all together again.

Preparing Leg Templates

Now that you are thoroughly entrenched in a templating state of mind, there are more to make for building this project's stand. Templates make the slender legs safer to rout and ensure that the leg shapes are consistent. Any undulations or irregularities along the long curved edges of the legs are very easy to see, so uniformity and smoothness are paramount here. I enlarged the

gridded leg pattern on the facing page to full size, spray-mounted it to a piece of 3/4" MDF and cut out the shape. Primarily, this will serve as a rigid tracing pattern for your routing templates. But it also helped me make a quick mock-up with a second scrap leg to determine whether the end angles of the legs would give the stand the proper spread it needed beneath the tray (top left photo).

Prepare two blanks from 6"-wide void-free plywood or MDF, about 38" long. Trace the inside curve of your leg pattern as close as possible to the edge of one workpiece to form an "inside" leg template, and trace the outside shape of the leg pattern onto the other workpiece, close to its edge, for the corresponding "outside" leg template. Band saw these to rough shape just outside the traced lines. Now tape your MDF leg pattern securely to each template, and bring them to exact curvature at the router table with a flush-trim bit. Finish your leg templates by tacking a long strip of 7/8"-thick, 1 1/2"-wide scrap wood along the bottom face of each template and flush with its back edge to complete them. (These backers will stabilize the templates during routing.)

Shaping the Legs

Choose a piece of straight-grained mahogany for your leg stock, and trace the pattern four times to form leg blanks. Head to the band saw to cut these to oversized blanks. Be prepared for possible slight springback once the parts are cut free; you may want to make them as much as 1/8" overly wide all around just to be safe. Use the leg pattern to mark centerpoints of the legs around their faces and

edges, and mark your inside and outside leg templates to reference the same centerpoints.

I chose to rout each leg to completion before moving on to the next: I routed the inside curve first, with the leg blank firmly fixed beneath the template carpet tape. Then I lined up my center line on the workpiece with the outside template's centerline, taped it and flush-trimmed the leg's other broad edge. (Keeping the center lines aligned will ensure that all the legs will be routed in the same relative positions on the two templates, in case there are any slight deviations in curvature.)

Once the template-routing is done, use your leg pattern to carefully mark the angled ends of the legs. I cut these by taping the legs down to my table saw's crosscut sled, aligning each cut to the sled's blade kerf line.



Once the ends of the cross braces were drilled for dowels (top), metal dowel points registered accurate centerpoints for drilling corresponding holes in the legs (bottom).



Stand assembly in brief: Glue up the short cross braces, dowels and inner legs (top left), then add the Roto hinges, long cross braces and remaining outer legs (top right). Cut the chair webbing to length and fit metal clips to the ends by clamping the parts in a vise (center). Fasten the straps to the bottoms of the upper cross braces with screws (bottom right).



Forming the Cross Braces

Rip and crosscut stock for pairs of long and short cross braces, but don't bevel-rip the top ends of the top cross braces yet. Before doing that, you need to cut a 1/8" x 5/8" shallow rabbet into the bottom edges of the top cross braces to recess the metal clips that will hold the stand's straps in place, plus a shallow kerf near the inside edge of these braces to fit the flared edge on each clip (see *Upper Cross Braces Drawing* on page 80 for this detail). Then lay out and drill centered holes in the ends of all four braces for the 3/8"-diameter dowels that will connect the braces and legs. Use metal dowel points inserted in these cross brace holes to find the corresponding centerpoints on the inside faces of the legs for their holes.

With this prep work behind you, tilt your table saw blade to 22° and bevel-rip the top edges of the top cross braces to match the top angles of the legs.

Assembling the Stand

One final order of important business before putting this stand together: choose the two

legs that will form the inside pair of your stand, and mark center points for the pivoting Roto hinges that will allow the stand to scissor open and closed. Drill 1/2"-diameter holes, 5/8" deep for this hardware in the outside faces of these two legs.

If you want to soften the long edges of the legs with roundovers, do that now too, but stop the profiles where the cross braces go.

It's finally time to bring the inside legset together with the short braces, dowels and glue to form the first leg subassembly. Once that dries and comes out of the clamps, press the Roto hinges into their holes. Add the remaining legs, longer braces and dowels to create the outer leg subassembly. Before you glue these parts together, though, double-check that the leg angles and curves face opposite the first subassembly — an obvious thing but a complete frustration if you get it wrong and realize it too late!

The end of this elegant little project is close, but there are still a few more steps. Drill 1/8"-deep, 1/2"-diameter holes in the

angled edges of the top cross braces in order to partially recess four rubber bumpers. Screw them in place.

Now invert the stand on your bench and hold it open so the bumpered cross braces rest flat on the bench (the spread should be about 18"). Cut two strips of chair webbing 1" longer than the inside span between the legs. Then, fit the webbing fully inside the metal clips, and close the clips by squeezing them in a vise. Make sure the flared edges of the clips face the same direction on each of the straps before pinching the second clip closed.

Fit the clip flares into their kerfs in the top angled cross braces, and secure the clips with short screws to complete the stand. I then removed the straps but used a length of string tied to the clip screws to keep the stand upright and open. It was convenient as I applied a spray lacquer finish.



Chris Marshall is a senior editor of *Woodworker's Journal*.

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Cribbage Board

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During those long, cold winters I spent growing up along the shores of Lake Vermilion in the far north of Minnesota, one of the ways that we wiled away the long dark evenings was playing cribbage. Young or old, it made no difference. It is such a popular pastime “up North,” that I would not be surprised if it was the primary way most of my friends learned to count and to add. (One of the ways you earn points in cribbage is by combining cards that add up to 15 or 31.) I can still hear

someone counting out “that’s 15 for two and a pair is four!” Which is why when editor in chief Rob Johnstone asked if I was interested in making a cribbage board project, I said, “Oh, you betcha!”

But before that could happen, I had to figure out how to build it.

Starting with the Middle

This cribbage board design started from a set of plans provided by a fellow reader (see *sidebar*, next page), but

I quickly did what all woodworkers do when working from a plan supplied by someone else: I changed it! After a couple of test cuts in 3/4" stock, I was worried that the recess that stores the cards could become a problem. When I routed the recess, the amount of material remaining seemed a little too thin for my liking. I could, of course, make that

Author Frank Grant and editor in chief Rob Johnstone are pictured here hard at work — testing the cribbage board’s durability — in Rob’s shop.



READER-INSPIRED DESIGN

Bruce Beatty, a reader who hails from Orangeville, Ontario, created this project using Google SketchUp. Bruce constructs games every year for holiday gifts — and several years ago, it was cribbage. We selected Bruce's board as the winner of a SketchUp contest we held that year. Thanks again, Bruce!



After tracing the core's shape onto a piece of cherry lumber, the author uses a band saw to cut it out. Note that the position of the roto hinge and other important details are marked as well.

piece from 7/8"-thick stock, but it looked a bit bulky. So, after a bit of noodling, I decided to rout the card recess completely through the 3/4" stock and glue a 1/4"-thick piece of black walnut to the bottom as a base. To my eyes, that dark base visually anchored the cribbage board to the table and provided a nice three-layered look to the project. (You can choose either solution.) I also decided to use a pivot hinge and included a small magnet to keep the board closed.

With those choices made, I went ahead and cut blanks from which to form the three pieces that make up the cribbage board: the core, base and playing surface (pieces 1, 2 and 3). You can find the sizes for the blanks in the *Material List* on the following page. While the choice is up to you, I made the base from walnut, the core from cherry lumber and the playing surface from maple.

You have another choice to make now: if you are going to make several cribbage boards (say, perhaps to give away as presents ...) I recommend that you make two separate templates — one sized for the core and base, and one for the playing surface. If you are only going to make one or two cribbage boards, simply make the template for the core. (You can lay out and make the playing surface easily enough without resorting to pattern routing if you are only making a few of these cribbage boards.)

The core template needs to locate the positions of the rotating hinge, the peg storage hole, magnet hole and the card storage recess I talked about earlier. And the best way to make the card recess hole includes pattern routing as one of the steps. Look to the *Drawings* on the following page to give you all the dimensions and locations for these details. Consider this as a tip: I made

my templates from 1/2" MDF because it is easy to work with and inexpensive. But more than that, 1/2" thickness, in my opinion, is better than 1/4" for pattern routing with a bearing-guided router bit because the bearing can be shielded within the thickness of the MDF (see the top photo on page 88). Take your time and make the template (or templates) accurately ... any mistakes here will show up on your finished project.

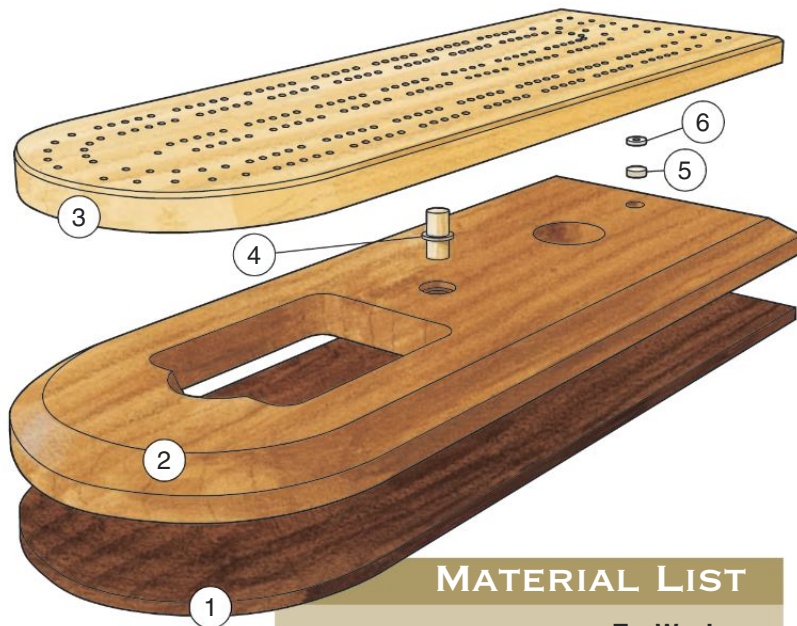
Making Some Sawdust

Grab the core blank you cut earlier and the core template and trace the shape onto your blank. As shown in the photo above, if your blank is a bit oversized, align the template with two edges of the blank when you trace the shape, so it will reduce your cutting on the band saw.

When you've completed the band saw cut, step over to your drill press to bore a 1/2"-deep hole for peg storage and a two-step hole for the pivot hinge. When forming this two-step hole with Forstner bits, make the shallowest hole (5/8" diameter by 1/16" deep) first. Then you can easily align the deeper hole (3/8" diameter by 3/8" deep) by using the spur

This cribbage board's design requires three pieces of wood, a rotating hinge, a magnet and, of course, some pegs to keep score.





Exploded View

T x W x L	
1 Base* (1)	1/4" x 6" x 15 7/8"
2 Core* (1)	3/4" x 6" x 14 7/8"
3 Playing Surface* (1)	5/8" x 5" x 15 1/8"
4 Roto Hinge (1)	3/8" Dia.
5 Magnet (1)	3/8" Dia.
6 Magnet Washer (1)	3/8" Dia.

**Cut the blanks to make these pieces slightly oversized.*



Next, drill out the four corners of the card recess as shown in the left photo. I used a handheld jigsaw to remove most of the waste from the card recess. When that is done, use a couple of pieces of two-sided carpet tape (not too much!) to secure the core template onto the core. Then chuck a 1/2" bearing-guided pattern routing bit into your router table. Trim the card recess opening as shown in the top left photo, next page. Then you can shape the outside of the core in the same manner. Cutting the curved shape at the end of the board with a router bit can be a little tricky. You may be better off just sanding it smooth to your marked line, although I did OK by climb-cutting around the radius. Pop the template off of the core and set it aside for now.

Grab the base blank that you made earlier. Use the core (or, if you wish, the core template) to trace its shape onto the base blank. Band-saw the base to shape, but stay outside of the lines by a strong

The core gets several holes bored into it and even through the piece. Here, the four corners of the card recess are drilled out.

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With the template aligned (and attached with double-sided tape) to the dark lines marked earlier — which guided the rough cut on the band saw — it was time to start template routing. A flush-trim bit is used to refine the card recess opening and then to shape the exterior profile.

1/16" and set it aside with the core.

It's now time to move on to the playing surface. If you made a template for this piece, grab it and the blank you cut earlier and go through the same shaping process you did with the core. (But don't drill the peg holes yet; just make the outside shape.) If you did not make a template, you have a bit more layout to do, but it shouldn't take long. Once the piece is shaped, grab the drilling jig you ordered and the self-centering drill bit and head over to the drill press. (What's that? You didn't order the drilling jig and bit? What are you, crazy? Let me strongly affirm, here and now, that you should not try to make this project without the jig ... sorry. It is simply too hard to get all those holes placed properly without it. There are 260 or so holes to drill — that's a lot of alignment!)

Again, reach for the double-sided tape and secure the drilling jig to the playing surface. Chuck the bit in the drill press and start drilling. But go slow! Even with the jig as a guide, I found that I had to take my time and be very deliberate about this process. It was also useful to free any tiny wood chips that clog the centering sleeve on the drill bit. When that was done, I bored the pivot hinge hole on the back of the playing surface and the magnet washer hole and set it aside. Grabbing the core one more time, I chucked a 3/4" cove-cutting bit into a handheld router and shaped the finger opening on the edge of the card recess as shown in the photo, center right. Then I glued the base onto the core and let the glue cure. Once that was dry, I used the pattern-routing bit to trim the base to perfectly match the core.

You are almost done. Changing out the pattern-routing bit in the router table for a large chamfer bit

in the router table, I shaped the top edge of the core so that the inside of the chamfered profile matched the size of the playing surface. (See the lead photo on page 84.) With that cut completed, lower the chamfer bit and shape the top edge of the playing surface with a slight bevel. Now it's time for sanding. Work up through the grits to at least 180, but I recommend 220-grit. With this done, take a moment to secure the magnet and washer in their holes with five-minute epoxy.

For finish on this project, I used a natural Watco oil. Try not to get too much into the peg holes — even though that is hard to avoid. Three coats of oil and a rubdown with some paste wax, and you'll have a proper finish on your gameboard.

The last thing you need to do is assemble the two pieces by driving the pivot hinge into the core and tapping the playing surface down onto the hinge. You'll notice that the magnet pulls the two pieces into alignment when you get them close to the right spot. Nifty, huh?

Now all you need to do is find a partner and a deck of cards, and you'll have yourself a game going in no time! Fifteen for two, anyone?



Frank Grant is a professional woodworker from Minneapolis, Minnesota.



The final bit of shaping on the card recess is made with a large bearing-guided cove bit. The author cut this finger opening "freehand."



Even with the aid of a hole-drilling jig and a self-centering bit, you should still go slowly and clear the bit often to help keep the holes aligned.



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Q&A and Readers' Tricks

Questions certainly arise when using routers, and our team of experts come to the rescue of our inquiring readers. Here's a selection of router-related questions from past issues. Want to learn some clever routing tricks? Flip over to page 98.

Questions & Answers94-96

Tricks of the Trade98

Questions & Answers



Q When I try to cut a mortise at 3/8" or 1/2" x 1/2" or more deep, I burn and ruin my bit. I have tried different speeds but no luck. I am using a Bosch router with a Kreg lift. What is my problem? I would appreciate any help that you can give me.

Earl Purcell
Uniontown,
Pennsylvania

maneuvering your workpiece, or if you're trying to expedite the process by cutting full-depth in one pass, the bit may dwell too long in the cut.

It's better — safer and faster — to rout mortises with a plunge router. Begin with the router at one end of the mortise, jab the bit about 1/8" into the work, feed quickly to the opposite end, then retract the bit from the cut as you return the router to your starting position. Repeat the action several times, cutting a little deeper on each pass.

— **Bill Hylton**

Q It seems, no matter how careful my technique or sharp my bit, that any time I rout a decorative edge or create a molding, somewhere along the edge I will get router burn. I hate to completely redo an entire piece for just a small area. Is there some way to remove this discoloration?

Phil Gilstrap
Hodgen, Oklahoma

A A bit dulls prematurely when it overheats, often because the cut is too heavy, the feed rate is too slow, or the bit "dwells" in an enclosed cut (like a mortise). Reducing the bit rpm is a good tactic, but it isn't enough to offset a hesitant feed or a demanding cut.

I'm inclined to think that doing the job on the router table is problematic. In my experience, you have to tip the workpiece up above the spinning bit, plunge it onto the bit, feed just an inch or so, then tip it up off the bit. A mortise is deeper than you should cut in a single pass, so you ought to be repeating the action, raising the bit another 1/8" to 1/4" between passes.

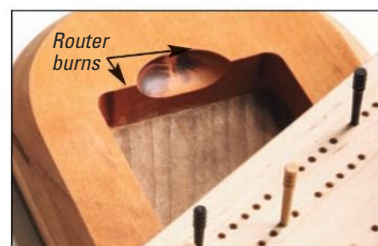
If you're tentative or halting in

A Burn marks on wood result from excessive heat generated by the router bit, and the best strategy for dealing with them is avoidance. Keeping your bits both clean and sharp is important. Using good technique is also important. When profiling an edge, you must feed the router (or, on the router table, the workpiece) briskly and continuously. Every hesitation or pause can result in a burn, especially if you're working a susceptible wood like cherry or maple. Planing, scraping, filing, and sanding will remove burn marks.



Use a sharp router bit and make several passes when making a mortise on a router table.

But you must work carefully. The hazard is that you'll distort the profile or contour. Take your time. Use a crisp-edged sanding block or a detail block matched to a contour's proportion. Begin your work some distance from the burn so you don't produce an



Cherry is a species of wood that burns quite easily. The best strategy for removing router burn is to not get it in the first place.

obvious hollow in place of it.

Depending upon the location and extent of the burn, a redo actually may be the best option. You often can, for example, joint the edge that guides the router, then re-rout the profile, removing the burn. The operation can be faster than a lot of persnickety hand-sanding and yield a crisp, unblemished profile.

— **Bill Hylton**

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Questions & Answers (continued...)

Tilt Base

(Trimming hard to reach areas)



Offset Base (Trimming)



Offset Base (Scribing)



Our expert from Bosch explains the use of the offset and tilt bases that are provided with some of the Colt Palm Grip routers. These bases have been bedeviling one of our readers for several years!

Q I bought the PR20EVSNK compact router from Bosch three years ago, and I'm confused. It came with several accessory bases — the offset base and the tilt base — that are useless for me since I do not understand what they're intended to do. Can you help?

Simon Lamothe
St. Celestin, Quebec

A The offset and tilt bases are used primarily for trimming countertop laminates. The tilt base trims the far end of a piece of laminate on a countertop near the "backsplash," which is the vertical part of the countertop that butts up against the wall. This area cannot be reached using the standard fixed base, because the edge of the fixed base will reach the backsplash before the router bit can reach the section of laminate closest to the backsplash. When the router is equipped with its tilt base and a long bearing bit, it can reach and trim the complete length of the laminate.

The offset base is typically used in retrofitting laminate on already-installed countertops. This application involves trimming laminate placed on the top of the backsplash so that the laminate doesn't project out over the front of the backsplash. In such retrofit situations, the wall prevents the fixed base from

being positioned such that the bit can reach the front edge of the backsplash. The offset base, however, allows the bit to reach the front of the backsplash.

The offset base can also be used to properly fit new countertops against an uneven wall. The countertop is placed close to the wall, and the tip of the router's offset base is moved along the wall such that the backside of the offset is perfectly scribed to fit against the wall. See the photos, above.

— **Jim Stevens**
Bosch Power Tools

Q Does my new 3hp router, which I love, truly achieve 3hp, or did I actually get cheated when I bought it?

Bobby Joe Fayne
Gadsden, Alabama

A Horsepower in electric motors is a tricky topic. First, to clarify, we are talking about two different types of motors here. Your router is powered by what is known as a universal motor. They are commonly used in routers, corded drills, circular saws, jigsaws and such, and they can generate really high speed in various configurations — as much as 20,000 to 30,000 rpm at the upper end.

While horsepower is a math formula based on the definition

that there are 745.7 watts of electrical energy in one horsepower of mechanical energy, you can also come to a horsepower rating by multiplying torque x speed (in this case, rpm). Universal motor makers depend on this concept to get their horsepower ratings.

The other motor type — induction — turns at much slower rpm, and the makers of those motors use a formula where they use volts (in this case, the 120-volt household standard), multiplied by amps (the power of the current, in many cases a 15- or 20-amp circuit), multiplied by the efficiency of the motor (a fraction of 100%: .6, for example) and then divide that number by 745.7 watts, which is the definition of one horsepower.

So, here's my best answer: Did you get cheated? Nope, you really like your router and it works great. Is your router really 3hp? I don't know; you'll have to check the label and do some math to figure that out for sure.

— **Rob Johnstone**



Figuring out a router's true horsepower requires a little arithmetic.

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27 LED PORTABLE WORKLIGHT/FLASHLIGHT
HFT

SAVE 56%

Requires three AAA batteries (included).

LOT NO. 67227/69567/60566

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REG. PRICE \$149.99

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FORGE

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WITH ANY PURCHASE

PITTSBURGH 6 PIECE SCREWDRIVER SET
ITEM 47770/61313

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SUPER COUPON!

PITTSBURGH 12" RATCHET BAR CLAMP/SPREADER

LOT NO. 46807/68975/69221/69222

\$1⁹⁹
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CHICAGO ELECTRIC POWER TOOLS

FREE
60 Tooth Carbide Blade A \$19.99 Value Included

SAVE \$120

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SUPER COUPON!

5" RANDOM ORBITAL PALM SANDER
CHICAGO ELECTRIC POWER TOOLS

SAVE 33%

LOT NO. 93431/69857/69917

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REG. PRICE \$29.99

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4000 PEAK/3200 RUNNING WATTS 6.5 HP (212 CC) GAS GENERATORS
PREDATOR GENERATORS

70 dB Noise Level

SAVE \$200

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WINDSOR DESIGN

SAVE \$40

LOT NO. 94538

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11 PIECE WOOD CARVING SET

SAVE 40%

LOT NO. 4855/60655

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REG. PRICE \$4.99

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CENTRAL PNEUMATIC 2.5 HP, 21 GALLON, 125 PSI VERTICAL AIR COMPRESSOR

SAVE \$70

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HIGH VOLUME, LOW PRESSURE SPRAY GUN KIT
CHICAGO ELECTRIC POWER TOOLS

SAVE \$30

LOT NO. 44677

\$99⁹⁹
REG. PRICE \$129.99

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Tricks of the Trade

ROUTING IS SUCH A WOODWORKING MAINSTAY THAT WE RECEIVE CLEVER TRICKS ABOUT IT EVERY YEAR FROM READERS. HERE ARE A FEW TO TRY.



.45 caliber cartridge tray makes a great 1/2" shank bit holder.

From Bullets to Bit Storage

Plastic gun cartridge divider trays make excellent router bit holders. One reader uses them both to store his bits and to keep similar bit styles or sets together. He says .45 caliber holders are perfect for storing 1/2"-shank bits; .38 caliber carriers are just right for 3/8" shanks, and either .17 or .22 caliber sizes work well for holding 1/4" bits. You can often find them free of charge at a gun club, gun supplies store or at a shooting range.



Scrap MDF and Bondo® combine to create a perfect router insert template.



Adjustable Router Trammel

This adjustable trammel jig is simple to make from a couple lengths of 5/16"-diameter steel rod found at a home center or hardware store, a piece of scrap wood and a nail. It uses the edge-guide mounting holes of your router base so you can adjust it to rout any size circle you need, provided the rods are long enough. Cut the steel rod into two matching lengths and file their ends smooth. With the rods inserted in your router base and tightened down with screws, locate their other ends on the trammel's wooden rail — a 3/4"-thick scrap, 1 1/4" wide and about 5" long. The rail should sit flush with the work surface once the rods are installed. Drill a pair of slightly undersized holes through the rail for the rods and pound them into the rail holes. Drill a third hole down through the rail to hold a casing nail that serves as a pivot point. Here's a \$5 jig that will make circle-cutting both accurate and easy.

"Poor Man's" Router Table Insert Template

The best way to cut an insert opening in a router table is by guiding your router with a flush-trim bit against a template made for the insert plate. One reader makes them from shop scraps and auto body filler. Here's how: Rip 3"-wide pieces of MDF or other scrap into strips that are about 6" longer than each of the sides of your insert plate. Your template material can be 1/8" to 1/4" or so thicker than the plate and still work fine. Wax the corner areas of your plate to keep glue from sticking to it, and place it on a flat, waxed paper surface. Stagger the strips around the plate so each strip extends past the next. Epoxy the strips together, making sure that all four strips fit tightly around the plate. Now mix up some quick-set two-part auto body filler and pack it into the corners of the template up to the insert plate to fill the gaps. When the filler dries, carefully tap the plate free and shave away any extra filler from the corner curves. You now have an inside template that matches your router plate's shape perfectly. The longer "ears" of the template make clamping easier, too.

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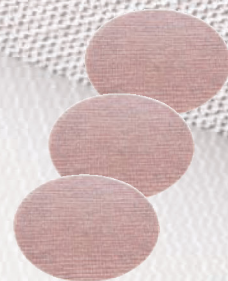
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Offer!**

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Between November 1st – December 31st, 2013

Purchase one of the three available Mirka® CEROS tools (MIM32520CAUS, MIM55020CAUS, MIM65020CAUS) and receive three Abranet assortment boxes.

(Approximately a \$100.00 value at suggested shop prices!)

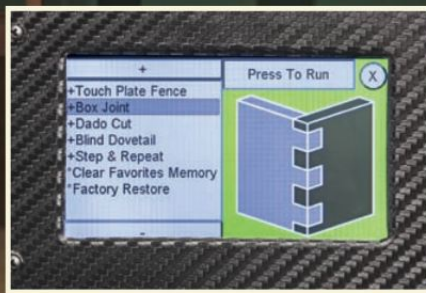
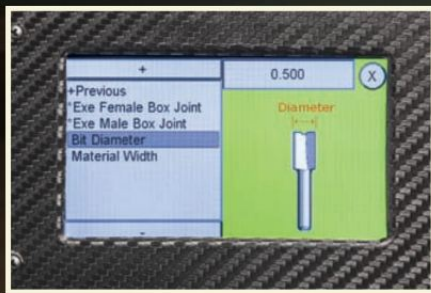
Customers can download the offer at mirka-ceros.com which can be faxed or mailed along with proof of purchase to receive the free products. Forms must be received by January 31st, 2014.

Abranet assortment boxes will be shipped directly from Mirka Abrasives.

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