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APRIL/MAY 2007
Issue # 47

Secretary Desk Part I

Classic Drop Front Design

Router Work Station

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Skill Builders

- Cutting Dados & Grooves
- Installing Hinges

Circular Saws

12 Models Compared

Hand Saws

Are you using the right one?

PLUS: WORKSHOP PROJECTS

- MARKING GAUGE
- TENONING JIG

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ISSUE #47

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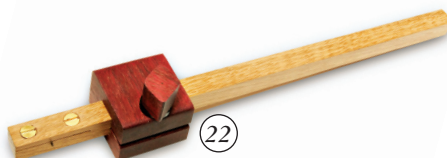
Cover photo by Ray Pilon



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CANADIAN WOODWORKING 1

LINDA FULCHER

Canadian Woodworking Magazine has given me a new appreciation when I look at a project.

Ten years ago I may have seen the potting bench and then spent time imagining potting up some begonias. (That is, IF I had managed to dig them up in the fall –but that is another story!)

Now I still imagine pots and soil and plants (too numerous to mention) but I also think "Wow, not one piece of metal was used in the making of this bench!"

I love organic things and the more organic the better. They just have a warm feel to me. And you can't get much more organic than a potting bench made entirely out of wood.

The practical side of this, as author, Michael Kampen, points out (page 18); is that by not using metal, there will be no rust to stain the bench. Yes, that is another awesome bonus.

The old me would have absorbed this detail in an instant and then switched back to imagining a matching grow-stand and dreaming of all the little seedlings ready to plant. Instead I found myself wondering, "Well if he didn't use any metal to put this together, what kind of joinery did he use?"

linda@canadianwoodworking.com



PAUL FULCHER

The router is a surprisingly useful tool that is considered by many woodworkers to be a staple in their arsenal of woodworking tools.

If you don't already own a router, you may want to consider adding one to your workshop soon, as we are ramping up for a whole bunch of projects that will be best made using a router.

If you already have a router, then mounting it in a table (or workstation) is your next step.

Mounting your router adds to it's ease of use, safety, and adaptability.

To help prepare you for our upcoming router projects, this issue features an attractive and practical router workstation (see page 10). This project may be just the thing to inspire you to pick up a new router, or to dust off your old one. Either way, this router workstation is sure to help you become a better and more versatile woodworker.

This issue also features the beginning of a new series, aptly named "WoodChuckles" (see page 42). This series, written by Canadian writer Don Wilkinson, takes a look at the lighter side of the hobby of woodworking.

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Corrections:

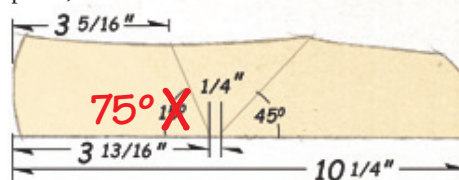
(February/March 2007, issue #46)

Re: Gluing Techniques

The photo and text reference to Bessey clamps was inadvertently placed in Hendrik Varju's article. Hendrik wishes to stress that he uses only #50 Pony clamps for edge-gluing, as he has found that they work best.

Re: Hand plane illustration.

The angle of the throat is 75° from the sole of the plane, not 15°.



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lettersto

Good morning

I am in the process of purchasing a new jig saw & 3" belt sander. I was wondering if your magazine has published the results of tests on these two units.

I am a new subscriber of your magazine and enjoy it very much. Any info you can send me would be appreciated.

PL Duguay
Hilton Beach, ON

PL Duguay

Thanks for your email and query.

Both of those tools will be reviewed in

upcoming issues. (Jigsaws in our June/July 2007 issue, and Belt Sanders in our August/September 2007 issue) However, that won't help you now.

Here's what I suggest:

Ask about those products on our website's 'Woodworking Forum'.

Everyday, woodworkers ask each other such questions and get responses from other woodworkers from across Canada. The nice thing about asking your peers on the forum is that the replies are not from manufacturers/sales people. Instead, you will be hearing the opinions of real woodworkers who are actually using those tools. I'm sure once you see how easy and

effective the forum is, you will be using it before every purchase.

Good luck, Paul

Threads in Forum : Woodworking	
	Thread / Thread Starter
	✓ Miller dowels jim in mtl
	✓ Installing BB Locking Casters Wayne - Oakville
	✓ What would you do advice. Bri in Mtl
	✓ Woodworking school - R. Cosman vs. Rosewood pab
	✓ Need Help with Drawer Fronts on the Bench (1 2) Edward G. Burlington

Screen shot of recent forum topics

continued on page 40

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Mahogany Secretary Desk

Part I

The secretary desk has been a popular piece of furniture since the 17th century. Also called a 'slant top' or 'drop front' desk, this style of desk offers a great combination of storage space and beauty in a small amount of floor space.

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This is a very simple, functional design that is often ornamented in two ways – veneer work on the drop front and drawers, and an elaborate interior gallery. This is the first of two articles and will focus on the case, base and large drawers. The second article will detail how to construct the gallery and finish the piece.

Solid African mahogany was the primary species with maple as the secondary species.

It's good idea to purchase all the hardware before you begin construction.

Start With the Case

- Glue up sufficient stock for the panels that make up the gables (A), case top (B) and interior writing surface (C), and mill them to size.

- With the help of a piece of $\frac{3}{4}$ " plywood, cut a 30° angle into the front top edge of the gables. Do this by screwing a number of stops to the $\frac{3}{4}$ " board to hold each gable in place, and then run an edge of the board against the table saw fence. Use a toggle clamp to secure the gables to the plywood.

- Rip the matching angle on the front edge of the case top.

- Using a table saw cut 45° mitres on the tops of the gables and both edges of the case top.

- On the case top (B) bevel the underside edge of the angle with a block plane. This will take away the sharply angled edge where the slant top will close against the case top.

- Use a block plane to bevel the angled edge of the gables (A) to meet up with the hand planed bevel on the case top.

- Machine the eight front, back and support divider rails (D, E, F), six drawer slides (G, H) and two support rail guides (I) to finished width and thickness. However, leave them a couple of inches longer than their finished dimensions.

- On the router table machine $\frac{5}{8}$ " wide dovetail grooves in the gables (A). There are eight grooves – two for the interior writing surface and six for the drawer slides.

- Rout the two dovetail grooves in the underside of the writing surface (C) using the same dovetail bit.

- You can now determine the length of the rails (D, E, F). Add the distance between gables and the depth of two dovetail grooves to get the length of the rails. Cut the eight rails and interior writing surface to length.

- Rout two $\frac{5}{8}$ " dovetail grooves in the upper side of the front top rail.

- Without changing the height of the dovetail bit in the router table, set the fence to cut the dovetail tenons on the eight rails (D, E, F), the interior writing surface (C), the six drawer slides (G, H).

- Cut a 4" long groove at both ends of the inside of the rails. This groove will accept the tenons on either end of the drawer slides (G, H). The groove should be centered and about $\frac{1}{8}$ the thickness of the rail.

- Determine the length of the drawer slides – keep the slides at least $\frac{1}{8}$ " short between the tenons' shoulders to allow the gables to expand and contract with seasonal movement.

- Cut the slides to length and machine a tenon on both ends of the six slides. This tenon will not be glued during assembly. The upper two drawer slides need to be extra wide to reach past the support rail divider.

- Rabbet the back of the case top and gables to accept the back panel. Rip the interior writing surface to width to allow the back to sit properly in the rabbet. With a $\frac{1}{4}$ " back, the interior writing surface should be ripped to 17 $\frac{3}{4}$ ".

- Drill a $\frac{1}{4}$ " hole through either end of the top front rail (D). The hole should be directly centered under the support rails. Later a dowel will be inserted into the hole from below that will fit into a groove in the underside of the support rail and will act as a stop.

- Sand and dry fit the carcass.

Assemble the Case

- The first step in the assembly process is to glue up the two gables, case top and interior writing surface. Put ample masking tape on the mitre joint that will connect the case top to the gables. Apply glue to the mitre joint and fold the case top and gables together. Slide the interior writing surface in from the back with no glue. When it's about $\frac{3}{4}$ of the way in apply glue to the front $\frac{1}{4}$ of the dovetail groove and the back $\frac{1}{4}$ of the dovetail tenon and bring the writing surface to its final position, flush with the front of the gables.

- Allow the glue to dry.

- Once the case has dried, glue in the three front rails (D). Make sure the upper rail has the dovetail grooves positioned correctly.

- Install the two support divider rails (F) that will separate the upper drawer and the support rails (R, S).

- When the front rails have dried, slide the drawer slides (G, H) in. Do not apply any glue.

- Glue the three back rails (E) into the dovetail grooves in the gables (A).

- With the case dry, set up the router and dovetail key jig to machine the keys (L) in the mitred case corners. You want the keys to appear to be the same thickness as the gable when you are complete, so set the depth accordingly. A couple of trial cuts on a piece of scrap is essential.



Dovetail keys join side to top

- Rip a dovetail strip on the table saw that will be inserted into the dovetail grooves. Tilt the blade to the same angle as the bit you used for machining the dovetail grooves in the mitred case. I used a 7° bit so I tilted the table saw blade to 7°. After each rip flip the board over to obtain the strips. The keys can be cut to rough length on the band saw and inserted into the grooves in the case. When dry, cut and sand them flush with the gables and top.

- Machine the support rails and the support rail fronts to rough size (R, S). These rails will support the drop front when it is down. The grain runs horizontally for most of the rail but the front 3" has a vertical piece tenoned to it. This provides side grain, as opposed to end grain, on the front of the support rail so the thumbnail profile can be routed to match the drawer fronts. Machine a tenon on the front end of the horizontal rail and a mating groove on the vertical piece that can be glued to the front of the rail. Apply glue to the tenons and grooves and let the two support rails dry.

- Machine a $\frac{3}{8}$ " wide groove in the underside of each support rail to accept the $\frac{1}{4}$ " dowel that will be inserted into the frame. Stop the groove about $\frac{3}{4}$ " from the front edge of the support rail.

- From the back side of the desk slide the support rail guides (I) into the dovetail grooves on the underside of the interior writing surface. They will act as guides to keep the support rails tracking properly. (The guides will keep the support rails in place by trapping the support rails between the gable and the support rail guides).

The Base Provides a Secure Platform

- Machine four aprons (Y, Z) and four legs (X) to finished size. Don't worry about apron length right now – just make sure they are long enough.

- Determine where dovetail grooves will be placed in the legs. The grooves should be as close to the outside of the leg as possible without weakening either side of the groove. Remove some of the material for the dovetail groove using the table saw.

MATERIALS LIST (All measurements in inches)

	Part	Qty	T	W	L
A	Gables	2	$\frac{7}{8}$	18	$27 \frac{3}{4}$
B	Case top	1	$\frac{7}{8}$	$11 \frac{3}{4}$	36
C	Interior writing surface	1	$\frac{7}{8}$	$17 \frac{3}{4}$	35
D	Front rails	3	$\frac{7}{8}$	3	35
E	Back rails (m)	3	$\frac{7}{8}$	3	35
F	Support divider rails	2	$\frac{7}{8}$	3	3
G	Upper drawer slides (m)	2	$\frac{7}{8}$	$4 \frac{1}{2}$	13
H	Lower drawer slides (m)	4	$\frac{7}{8}$	3	13
I	Support rail guides (m)	2	$\frac{7}{8}$	$1 \frac{1}{4}$	14
J	Front waist moulding	1	$\frac{7}{8}$	$\frac{3}{4}$	$37 \frac{1}{2}$
K	Side waist moulding	2	$\frac{7}{8}$	$\frac{3}{4}$	$18 \frac{3}{4}$
L	Dovetail keys (w)	14	$\frac{7}{8}$	$\frac{5}{8}$	$1 \frac{1}{2}$
M	Drawer faces	1	$\frac{7}{8}$	$3 \frac{1}{8}$	$34 \frac{3}{4}$
		1	$\frac{7}{8}$	$3 \frac{7}{8}$	$31 \frac{1}{4}$
		1	$\frac{7}{8}$	$4 \frac{7}{8}$	$31 \frac{3}{4}$
N	Drawer fronts & backs	1	$\frac{5}{8}$	$2 \frac{7}{8}$	$30 \frac{11}{16}$
		1	$\frac{5}{8}$	$3 \frac{5}{8}$	$34 \frac{3}{16}$
		1	$\frac{5}{8}$	$4 \frac{5}{8}$	$34 \frac{3}{16}$
		1	$\frac{5}{8}$	$2 \frac{7}{8}$	$30 \frac{11}{16}$
		1	$\frac{5}{8}$	$3 \frac{5}{8}$	$34 \frac{3}{16}$
		1	$\frac{5}{8}$	$4 \frac{5}{8}$	$34 \frac{3}{16}$
O	Drawers sides	2	$\frac{5}{8}$	$2 \frac{7}{8}$	$17 \frac{3}{8}$
		2	$\frac{5}{8}$	$3 \frac{5}{8}$	$17 \frac{3}{8}$
		2	$\frac{5}{8}$	$4 \frac{5}{8}$	$17 \frac{3}{8}$
P	Drawer keys	60	$\frac{1}{4}$	$\frac{3}{4}$	$1 \frac{1}{2}$
Q	Drawer bottoms (mp)	2	$\frac{1}{4}$	17	$33 \frac{13}{16}$
		1	$\frac{1}{4}$	17	$30 \frac{5}{16}$
R	Support rail	2	$1 \frac{13}{16}$	$2 \frac{13}{16}$	15
S	Support rail front	2	$1 \frac{13}{16}$	3	$2 \frac{13}{16}$
T	Drop front core (p)	1	$\frac{3}{4}$	$10 \frac{1}{4}$	$29 \frac{3}{4}$
U	Drop front edges	2	$1 \frac{13}{16}$	3	$13 \frac{1}{4}$
V	Drop front hidden edges	2	$\frac{3}{4}$	$1 \frac{1}{2}$	$29 \frac{3}{4}$
W	Drop front face & back (mv)	2	-	$13 \frac{1}{4}$	$29 \frac{5}{8}$
X	Legs	4	$1 \frac{13}{16}$	$1 \frac{13}{16}$	$13 \frac{1}{2}$
Y	Front and back apron	2	$\frac{7}{8}$	$4 \frac{3}{8}$	$34 \frac{1}{2}$
Z	Side aprons	2	$\frac{7}{8}$	$4 \frac{3}{8}$	16

Notes:

All stock is mahogany except:

(m) maple, (w) black walnut, (mp) mahogany ply, (mv) mahogany veneer, (p) plywood.



Drawers assembled with keys

Removing all of that material while machining a dovetail groove will be dangerous.

- Set up the router table with an appropriate dovetail bit. It might have to be slightly smaller than the bit used for the case to ensure both sides of the groove in the leg have enough material to remain structurally strong.

- Determine the length of the aprons. When determining final length of the aprons keep in mind there will be a waist moulding that transitions the case from the base. I allowed $\frac{3}{4}$ " extra on the front and two sides. You should know what profile you are going to use at this stage so you can allow for proper tolerances. Cut the aprons to length and machine dovetail tenons on both ends of the pieces.

- Cut the aprons to their final shape on the bandsaw.

- Draw the taper onto the four legs. Make the first cut on the band saw, and then use masking tape to re-secure the offcut onto the leg. Make the second cut on the line you have drawn.

- Plane and sand the legs to their final shape.

- Sand and assemble the eight parts that comprise the base. Ensure that the assembly is square.

- Make a moulding (J, K) for the transition between the case and the base. Machine a piece so you can obtain two widths of moulding out of it – about 3" wide is good, but wider is better. Shape both of the edges and rip the final moulding to width. The moulding should overhang about $\frac{1}{8}$ " on the legs and $\frac{1}{8}$ " on the apron.

Solid Drawers for Storage

- Mill material for the drawer faces (M), fronts and backs (N) and sides (O) and cut them to finished size. The drawer sides should be the length of the interior of the cabinet minus $\frac{1}{2}$ ". This allows the drawer face to be rabbeted and let into the case.

- On the table saw cut mitres for all four corner joints on the drawer.

- Run a groove around the drawer fronts, backs and sides that will accept the drawer bottoms (Q) – I used $\frac{1}{4}$ " bottoms.

For strength it should be at least $\frac{1}{2}$ " up from the bottom of the drawer side. On the back drawer pieces raise the blade on the table saw and cut through the material. This will allow the back piece to be inserted after the drawer has been assembled. It also has the benefit of allowing a bottom to be replaced if it breaks.

- Sand and assemble the drawer box with masking tape. I glue-size the partial end grain of the mitres so the glue doesn't seep too far away from the joint. When you are gluing up the drawer don't apply too much glue or the joint will not seat itself properly. (Note: Glue sizing refers to the application of a thin, often diluted, layer of glue to end grain. The glue is allowed to dry before the end grain piece is glued in place. The first coat of glue fills the pores of end grain to prevent over-absorption of glue, making the resulting bond stronger.)

- When dry, cut the notches for the keyed finger joints with a $\frac{1}{4}$ " wide dado blade on the table saw. You can space the joints so they look aesthetically pleasing. Having an odd number of joints with slightly

uneven - but still symmetrical - spacing provides some tension to the design.

- Machine long strips of wood that will be cut to rough length (about 2" long) and inserted as keys. The final pass when machining these keys to width should be made on a thickness planer so you have a nice smooth surface and you can fine tune the thickness.

- Cut the keys to rough length and glue them in place.

- Once the drawers are completely dry, trim and sand the keys flush. Sand, hand-plane or joint the sides to fit nicely inside the case. A gap of between $\frac{1}{32}$ " and $\frac{1}{16}$ " on either side makes for a well sliding drawer.

- Machine the drawer faces (M) to finished size. There should be a $\frac{1}{4}$ " overlap on all sides except the top of the top drawer face. The top should be flush with the underside of the interior writing surface so the slant top will not interfere with it.

- On the router table rout a thumbnail profile on all four sides of each drawer face. I used a $\frac{1}{4}$ " radius bit. Also, rout the



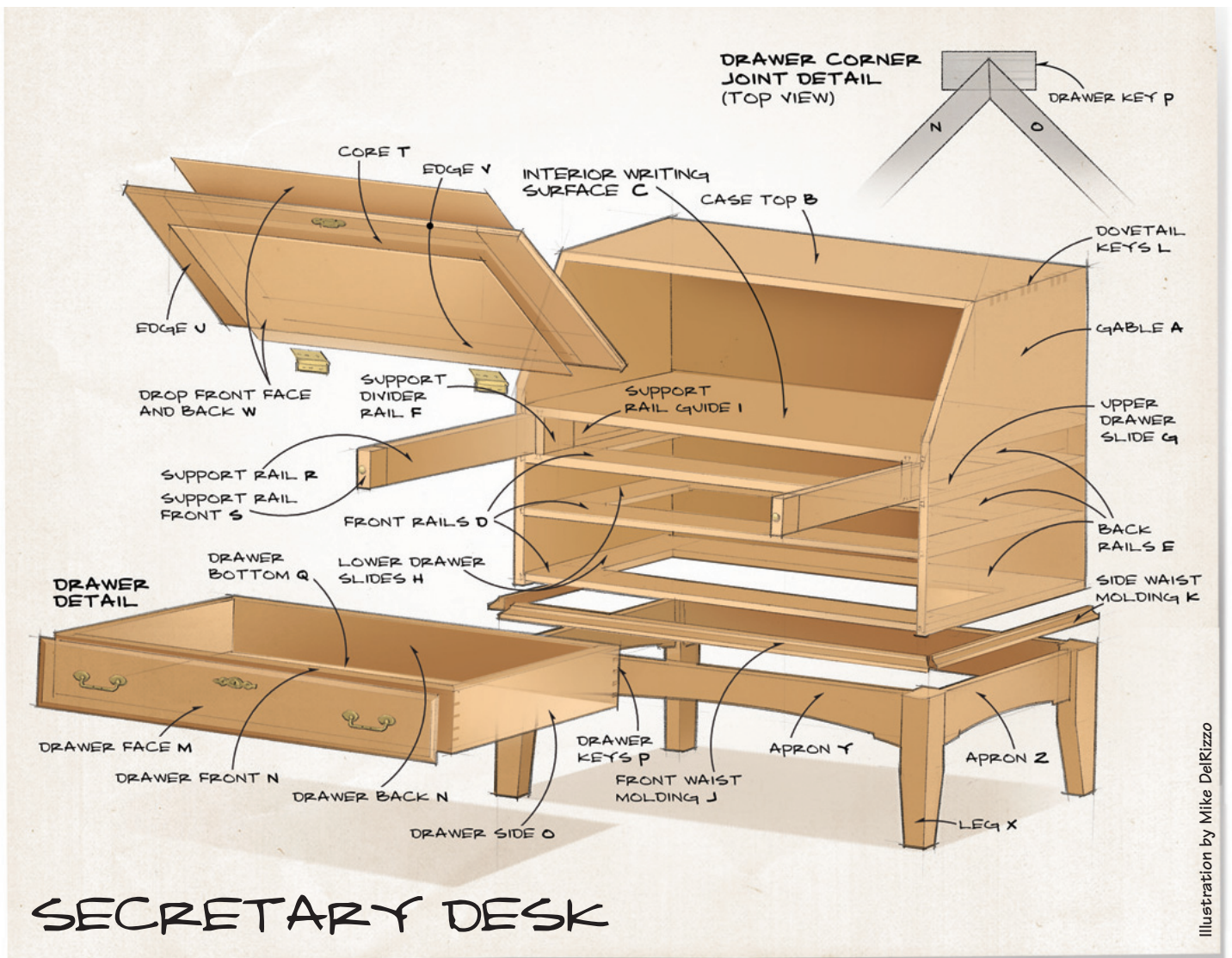
Support rail extended

same profile on the front four sides of the two support rails (R, S). Cut the support rails to length.

- Cut a $\frac{3}{8}$ " deep rabbet on all four sides of each drawer face - except the top of the top drawer face. This rabbet will allow the drawer front to sit $\frac{3}{8}$ " inside the case.

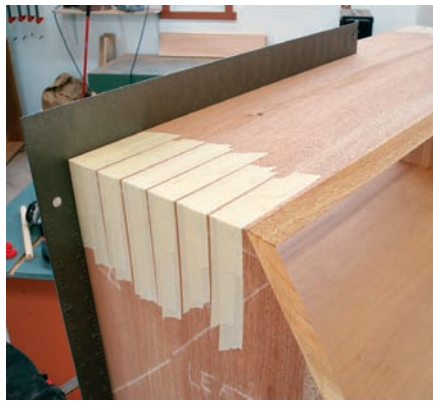
The Drop Front Is Faced with Figured Veneer

- As I mentioned earlier, one of the places that often is enhanced with figured wood is the drop front. I chose a wide piece of blistered mahogany veneer for the face and back (W) of the drop front.





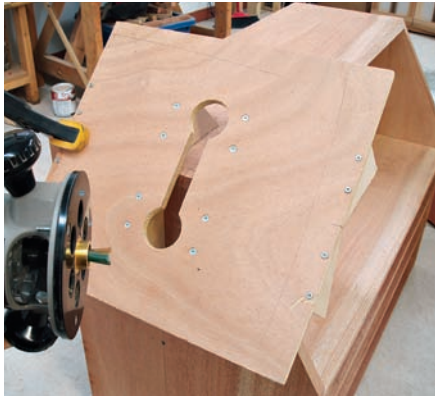
Cut gables with sled



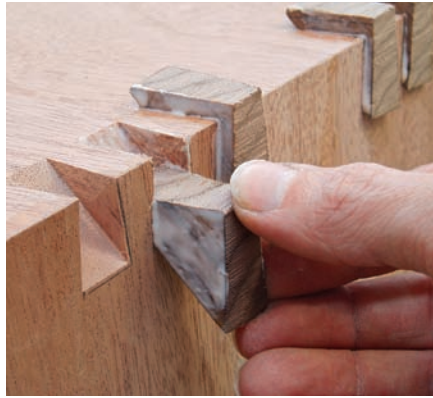
Hold mitre joint with masking tape while glue dries



Mark out dovetails



Use jig for routing dovetail keys



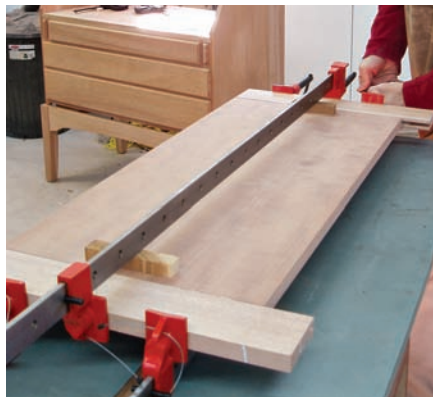
Glue keys in place



Rout dados for the rails



Insert shelves from back side



Clamp the drop front



Use jig for cutting drawer key slots



Cut slots for drawer keys



Cut dovetails



Bandsaw legs to shape

When veneering, always balance both sides of the veneered panel with the same (or very similar) veneer. This will protect against warping.

- Cut a $\frac{3}{4}$ " thick piece of oversized plywood for the core (T) of the drop front. It must be flat, strong and have an even surface – don't cheap out on plywood core quality.

- To avoid having any plywood showing, glue $\frac{1}{2}$ " solid wood (V) along both long edges of the plywood. This will give you something to shape when the drop front is complete.

- When dry, trim the pieces of solid wood flush to the plywood core so the veneer can be adhered to the face of the drop front.

- Trim the veneer oversize.

- Assemble two flat cauls, sufficient clamps, glue, a glue roller, some clamping blocks and a few sheets of newsprint. A helper doesn't hurt either.

- Roll the glue onto one side of the plywood core then place the core onto a piece of veneer. I put the glue on evenly and a little thicker than normal because I'm not putting any glue on the veneer – it will curl.

- Place some newsprint between the veneer and the caul. This stops the veneer from adhering to the caul if a bit of glue seeps out.

- Roll glue on the other side of the core and put the other veneer on.

- Sandwich everything between a couple of clamps and then double check - make sure the veneer is placed properly, the cauls have full coverage and the paper is in the right place.

- Put on all the clamps you can. Space them evenly and apply even pressure. You

don't need to use excessive force. Blocks or battens can be used to evenly distribute pressure and are especially helpful when you don't have a lot of clamps.

- Let the piece dry overnight or longer.

- Determine the overall length of the drop front and attach the solid drop front sides. Machine a tenon on the drop front core and a groove on the drop front sides and glue them together.

- Take your time when cutting the drop front to size. First, measure the case opening for the drop front and determine how wide and long the drop front should be. Cut it oversize at first. When attached to the hinges it might sit differently than you anticipated.

- Machine a $\frac{1}{4}$ " wide x $\frac{3}{8}$ " deep rabbet around the two sides and top of the drop front. Note that the edge that will be hinged to the case does not receive a rabbet. The rabbets will be cut on the back of the drop front and will allow it to sit partially inside the case.

- Mortise for the hinges. Attach both hinges and see how your top fits. It probably will not close properly, at first. Re-cut the drop front to size and re-rabbet the back edge until it fits.

- Rout the same thumbnail profile on the four front edges of the drop front as you did on the drawer fronts.

Finishing Touches

- Turn the base over and install adjustable levelers on the bottom of each leg. First, drill a 1" hole $\frac{3}{8}$ " deep. This will accept the 3-Prong 1/4-20 T-Nuts (Lee Valley #00N22.03).

- Drill a $\frac{1}{4}$ " hole at least $1\frac{1}{4}$ " deep in the center of the larger hole to make room for the threaded plastic guide. Hammer in the T-Nut and screw in a plastic guide (Lee Valley #00F15.01).

- Attach the case to the base with four L-brackets or wooden cleats.

- Cut the waist moulding (J, K) to size. Glue the front piece directly to the lower front rail and strengthen it with glue blocks. The two side pieces will be glued to the case side for the front 4" only. A screw in an elongated hole will hold the back of the moulding tight to the case and allow the gables to move with the seasonal changes.

In the next article I will describe how to build the gallery and finish the desk.

ROB BROWN
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finishingtips

by Circa 1850



What type of finish should I use for my latest project? There are just too many options at the hardware store.

Choosing the best finish is often a matter of personal preference. Although some woodworkers have favorite finishes, the same finish is not always appropriate for each project. The best way to narrow down your choices is to evaluate the specific project based on the **look and feel** you'd like to achieve, as well as figuring out how much **protection** it will require.

Oils are penetrating finishes that produce a soft, natural look. They bring out the nuances of the wood grain, while keeping it from drying out. Oils are easy to apply, but offer less protection than varnishes.



Varnishes and polyurethanes create a very hard, durable finish, and come in a variety of lustres. As they provide the best protection, they are ideal for most high-traffic projects. However, they can give the look and feel of a coating.



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Photo courtesy: Rob Nichele

Router Work Station

Without a doubt, the router is one of the most useful tools in our shop and to really get the most out of this tool it is best to mount it in a table. Not only does this increase the utility of the router, but for many operations it makes it easier to rout smaller parts safely. With a table mounted router you can also use large panel raising bits.

I prefer heavy steel tops for most of the tool surfaces in the shop and as a result decided it best to purchase the top as a manufactured unit. This ensures you will have a flat, stable surface that won't change over time. While it is possible to make a top out of sheet stock like melamine or plywood, over time, these

tops will sag under the weight of a router and there is no guarantee that the piece will be perfectly flat to begin with. If the weight of the router causes the top to become dished it will be virtually impossible to get accurate results, and using the router table will be an endless source of frustration.

I've provided two options (at two different price points) for the hardware for this project. One version uses the ProMax cast iron top from Bench Dog tools, and the other uses a Lee Valley steel router table. Both versions feature above the table bit height adjustment and bit changing which, if you use your router on

a regular basis, you will soon come to regard as a real convenience and a significant time saver. The Bench Dog version uses a ProMax router lift with a Porter Cable 7518, 3/4hp production router while the Lee Valley version uses a Freud FT1700VCE 2 1/4hp router which offers above the table bit changing and height adjustment as part of its design. I've used both of these tables extensively and can recommend them both without reservation.

The basic cabinet is the same for both versions. It contains a compartment with dust collection for the router, and three drawers fitted with full extension ball bearing slides. Over the years I have found that my router table is most often used out in the open, so on this version I provided ample space for bit storage on either end. A previous version of the table had the bit storage in a drawer and I was always concerned with a bit changing wrench or similar tool falling into the open drawer packed with router bits. To prevent this from happening, the bits are now stored in holders mounted on shelves in the ends – nothing can fall on them in there. The shelves are deep enough to accommodate large 3/4" panel raising bits. If you are unlikely to use such large bits you could make the shelves somewhat narrower and gain a little extra space in the drawers.

I've chosen to prepare all the pieces and finish them in advance before assembling the cabinet using dowels, and the method of construction reflects this. The router table is held together with dowels and using the DowelMax jig provided foolproof alignment of all of the parts during assembly and glue-up. If you choose another method, such as biscuits, read through the entire process, as you will need to modify some of the design as well as the order of operations. The table is built around a plywood core that is then edge banded and all of the remaining parts are fitted in sequence. When the entire cabinet is finished, it is then taken apart and the curved pieces shaped to give it a softer, less blocky look. With all of the shaping done, the parts are sanded and finished and the cabinet assembled and the hardware installed.

Begin With the Body

I've chosen to use Baltic birch for the core of this project and for the drawers for several reasons. The light colour makes the interior of the cabinet brighter and the greater quality and number of plies in the Baltic birch results in a stiffer cabinet. This also allows the drawers to be

assembled using 1/2" material without sacrificing strength. Another reason is of a more practical nature. Baltic birch plywood is sold in 5' x 5' sheets and is much easier to handle in a smaller shop, and when compared to a decent sheet of plywood, it was actually the cheapest option.

- Cut the Baltic birch plywood parts for the bottom (A), two sides (B) and the back (C).

- Cut two 3/4" dados on the top side of the bottom piece, 3 3/8" in from each end to house the sides.

- Cut a 1/2" dado down the length of each side piece, 1" in from the back edge of the plywood. This will house the back.

- Cut a 3/4" dado across each side piece, 12 7/8" down from the top edge.

- Dry fit the base, sides and back. If everything comes together smoothly, confirm the measurements for the horizontal divider (D) and cut it to size.

- Sand the panels with 220-grit paper and apply a coat of oil. Be sure not to get any oil in the dados. Follow the oil with a coat or two of paste wax. The wax will make it easier to clean the dust from the cabinet after use.

- Lay one of the sides on your workbench with the dados facing up. Apply glue to the dados and set the horizontal divider in place, then set the back into its dado. Apply glue to the dados on the other side and smooth it out to keep it from dripping when the panel is inverted. Turn the panel over and set it in place. The two sides and the back should be flush on top.

- Apply glue to the dados in the bottom and spread it out. Set the center assembly in place in the dados. Apply clamps to the cabinet and check it for square.

- While the glue cures on the clamped-up center section of the cabinet, select some lumber to edge band the plywood. Try to choose pieces that look interesting from the edge since they will be the parts that will be showing on the finished cabinet.

- Mill enough stock for the following pieces of edge banding: front and rear banding for the bottom (E), front side caps (F), rear side caps (G), and the horizontal divider edge cap (H). Mill them to width and thickness, but leave a little extra length.

- Trim the edge banding to length for the bottom, and using a dowelling jig, drill 1" deep dowel holes spaced approximately every 2" along the edges of the bottom to receive the edge banding.

- Set the edge banding for the sides on the bottom and trim it to length. Be certain to use the lower edge as a reference point for the drilling since the tops will be trimmed back later to accommodate the

upper stretchers. Note that the edge banding on the rear of the sides is only 5/8" thick, so only drill holes to a depth of 1/4" and use 1/4" dowels.

- Mill the material for side filler pieces (I), legs (J), upper (K) and lower side stretchers (L), and front (M) and rear upper stretchers (N). Do not cut them to final length at this stage.

- Drill dowel holes down both long edges on the side filler pieces as well as corresponding dowel holes centered 3/8" in from the front edge of the plywood sides in such a manner to line up the fronts of the side filler pieces with the front edges of the plywood sides.

- Using the extension arm with the DowelMax jig, drill two rows of shelf holes on the inside faces of the four side filler pieces. It's not necessary to drill holes from top to bottom, each side will hold three shelves, and you only need to drill one or two holes above and below each position to give you all the adjustability you will ever need.

- Mill enough stock for the six router bit shelves (O) and cut them to length to fit between the side filler pieces on each end. Use the dowelling jig in combination with a shim to drill holes into the end of the shelves to house the shelf pins. Drill these so that the center of the 1/4" hole is 5/16" up from the bottom of the shelf. Use a chisel to remove the wood along the bottom edge so that the shelf will slip down over the shelf pin.

- Cut a 3/4" wide x 3/8" deep dado 4" up from the base of each leg. This transfers some of the load from the heavy cast iron top from the leg to the bottom.

- The centerline of the dowels, which will run down the length of the legs in



**Bench Dog
work station
back**

order to mate with the side filler pieces, must be set back an additional $\frac{1}{4}$ " (with the back legs being mirror images of those in the front) to provide a lip to hold back the shelves inside the compartment. Drill the dowel holes, making sure to match them to the holes in the side filler strips.

- Cut a dado on the inside edge of the lower side stretcher, $\frac{1}{8}$ " down from the top ($\frac{3}{4}$ " wide x $\frac{3}{8}$ " deep).

- Drill two dowel holes into each end of the lower side stretchers with corresponding holes on the inside edges of the legs.

- Drill two dowel holes into each end of the upper side stretchers.

- Drill corresponding holes into the legs, making certain that the top of the legs and the top of the stretchers line up with each other.

Bring It All Together - For Now

- Before proceeding to the next stage of

construction, it is advisable to assemble all of the pieces made so far and confirm measurements for the doors and the length for the front and rear upper stretchers from the actual project. Use the materials list as a guide.

- Using four dowels in each of the longer pieces, dry fit the edge banding and the four side filler pieces. Do not fit the front edge banding for the sides at this stage.

- Dry fit the legs, upper and lower side stretchers into the left and right leg assemblies.

- Using three dowels per leg, dry fit the ends to the side filler pieces and apply clamps to carefully draw everything tight.

- Measure between the leg assemblies for the final length of the front/rear upper stretchers and cut them to fit.

- With the stretchers cut to fit, set them in place lining the top edge up with the top edge of the leg.

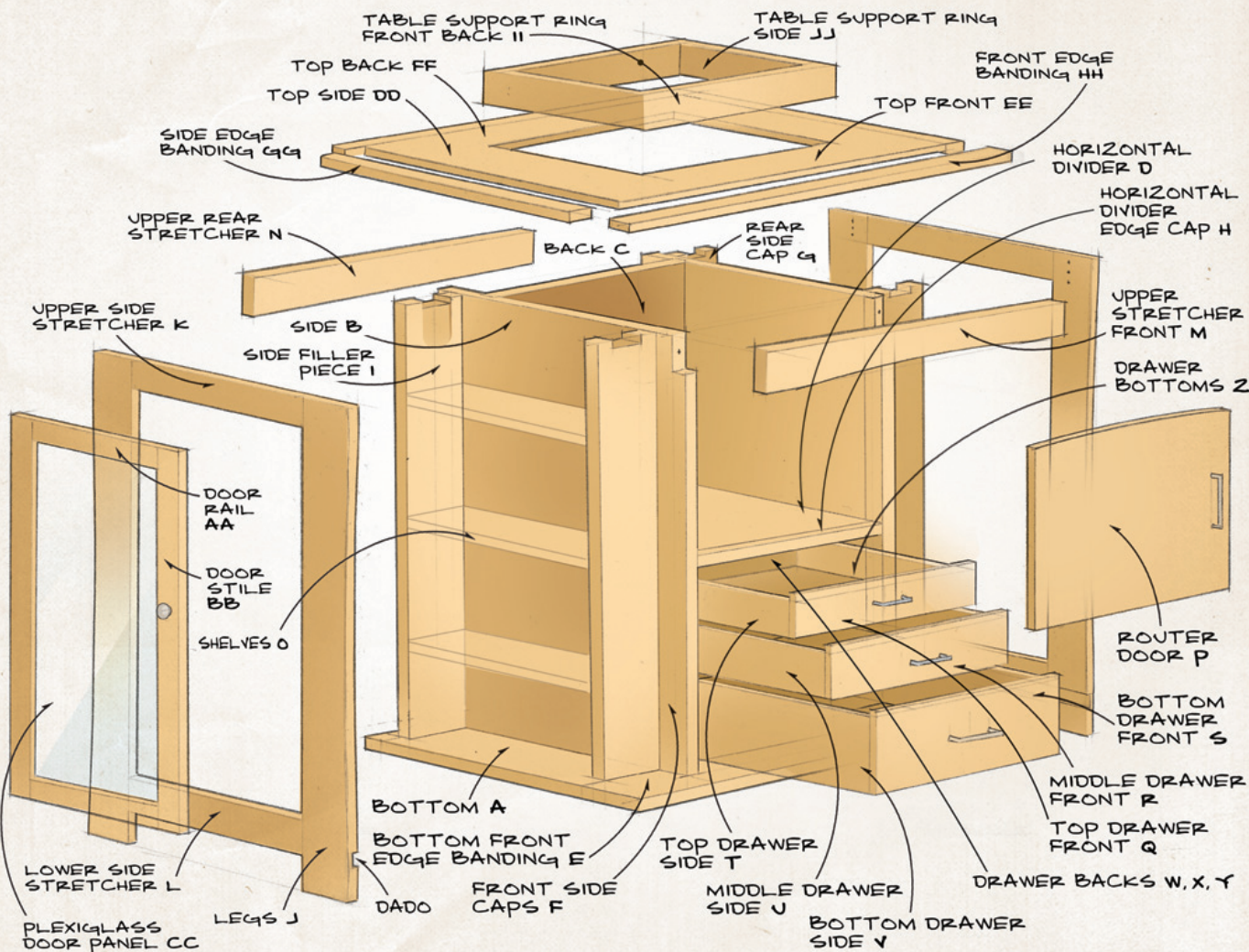
- To accommodate the mounting of the Bench Dog cast iron top, the rear surface of the front upper stretcher must be $16\frac{1}{4}$ " from the front side of the rear upper stretcher. The exact mounting details for the Bench Dog and Lee Valley tops are covered individually in the materials list.

- Cut a guide block (approximately $1\frac{1}{8}$ " wide) to set the distance between the side filler piece and the rear of the front upper stretcher. Use this to draw a reference line indicating the back of the front stretcher, and drill dowel holes in the legs as well as the ends of the stretcher.

- Measure the distance from the underside of the rear stretcher to the top of the bottom and cut the two rear side end caps to length.

- Install the front upper stretcher. Do not cut the edge banding to length at this stage or it will be too short after the stretcher has been shaped, set them aside for now.

Illustration by Mike DeRizzo



ROUTER WORK STATION

Get Into Shape

• When a project contains curved parts it is almost always easier, more accurate and much safer to cut all of the joinery on the piece of wood while it is still square. After all of the parts are cut to size and fitted to the cabinet, remove the legs and front stretcher from the cabinet. Use a drawing batten (see Drawing Curves, Canadian Woodworking, April/May 2006, Issue #41) to draw a gentle arc on the legs as well as the front stretcher. The arc on the legs is $\frac{3}{4}$ " offset and the one on the front stretcher is just a little less than $\frac{1}{2}$ ". Cut these on a band saw and fair the curve with a sander. Alternatively you could make a template using some $\frac{3}{4}$ " plywood and use a flush trimming bit to bring them to the final shape.

• With the legs and the front stretcher shaped, reassemble the cabinet and measure and trim the edge banding for the front side pieces. Set them in place using three dowels per side.

Of Doors and Drawers

• With the arc cut into the front stretcher, it is time to fit the router cavity door and prepare the drawer components. For this cabinet I chose to use the same hardware as you would find in any modern kitchen. The door is inset and hung with Euro-style hinges and the drawers run on 100-lb, full-extension ball bearing slides. These slides typically require $\frac{1}{2}$ " clearance on each side for the hardware, but it is best to have the hinges and slides on hand to confirm any clearances and requirements before beginning construction.

• Cut a piece of $\frac{3}{4}$ " thick plywood for the door (P). The upper stretcher is arched, and I chose to shape the door to match the curve in the upper stretcher. The easiest way to do this is to use the stretcher as a pattern, cut the curve on the band saw and fair the curve with a sander.

• Cut the fronts for the three drawers (Q, R, S) from $\frac{3}{4}$ " thick plywood.

• Cut the sides (T, U, V) and the ends (W, X, Y) for the drawers in one session with one set-up. This will ensure the drawers are all square and of equal size.

• Cut three bottoms (Z) for the drawers.

• Using the dowel jig, drill holes for dowels to joint the drawer sides and ends. The holes in the sides should be $\frac{3}{4}$ " deep, while the holes on the front and back are 1" deep.

• Sand the drawer pieces with 150-grit paper and apply a coat of oil, followed by a coat of wax to the drawer parts.

• Glue the drawers together; clamp them up, being sure to check the diagonals for square.

MATERIALS LIST (All measurements in inches)

	Part	Qty	T	W	L
A	Bottom	1	$\frac{3}{4}$	15	24
B	Sides (p)	2	$\frac{3}{4}$	15	28 $\frac{1}{2}$
C	Back (p)	1	$\frac{1}{2}$	16	28 $\frac{1}{8}$
D	Horizontal divider (p)	1	$\frac{3}{4}$	14 $\frac{1}{2}$	16 $\frac{1}{8}$
E	Bottom front/rear edge banding	2	$\frac{3}{4}$	2 $\frac{1}{4}$	24
F	Front side caps	2	$\frac{3}{4}$	1 $\frac{1}{4}$	28 $\frac{1}{8}$
G	Rear side caps	2	$\frac{3}{4}$	$\frac{5}{8}$	25 $\frac{1}{8}$
H	Horizontal divider edge cap	1	$\frac{3}{4}$	1 $\frac{1}{4}$	15 $\frac{5}{8}$
I	Side filler pieces	4	$\frac{3}{4}$	3 $\frac{1}{4}$	28 $\frac{1}{8}$
J	Legs	4	$\frac{3}{4}$	3	32 $\frac{7}{8}$
K	Upper side stretchers	2	$\frac{3}{4}$	1 $\frac{1}{2}$	13 $\frac{1}{8}$
L	Lower side stretchers	2	$\frac{3}{4}$	2 $\frac{1}{8}$	13 $\frac{1}{8}$
M	Upper stretcher, front	1	$\frac{3}{4}$	2 $\frac{3}{4}$	23 $\frac{1}{4}$
N	Upper stretcher, rear	1	$\frac{3}{4}$	2 $\frac{1}{2}$	23 $\frac{1}{4}$
O	Shelves	6	$\frac{3}{4}$	3 $\frac{1}{4}$	13 $\frac{1}{8}$
P	Router door	1	$\frac{3}{4}$	10 $\frac{3}{8}$	15 $\frac{1}{4}$
Q	Top drawer front	1	$\frac{3}{4}$	3	15 $\frac{1}{4}$
R	Middle drawer front	1	$\frac{3}{4}$	4 $\frac{3}{4}$	15 $\frac{1}{4}$
S	Bottom drawer front	1	$\frac{3}{4}$	6 $\frac{1}{2}$	15 $\frac{1}{4}$
T	Top drawer side	2	$\frac{1}{2}$	2 $\frac{1}{2}$	13 $\frac{7}{8}$
U	Middle drawer side	2	$\frac{1}{2}$	4	13 $\frac{7}{8}$
V	Bottom drawer side	2	$\frac{1}{2}$	6	13 $\frac{7}{8}$
W	Top drawer end	2	$\frac{1}{2}$	2 $\frac{1}{2}$	13 $\frac{5}{8}$
X	Middle drawer end	2	$\frac{1}{2}$	4	13 $\frac{5}{8}$
Y	Bottom drawer end	2	$\frac{1}{2}$	6	13 $\frac{5}{8}$
Z	Drawer bottoms	3	$\frac{1}{4}$	13 $\frac{1}{8}$	13 $\frac{3}{8}$
AA	Door rails	4	$\frac{3}{4}$	1 $\frac{1}{2}$	10 $\frac{1}{8}$
BB	Door stiles	4	$\frac{3}{4}$	1 $\frac{1}{2}$	26 $\frac{1}{8}$
CC	Plexiglas door panels	2	3 mm	10 $\frac{13}{16}$	23 $\frac{7}{8}$
DD	Top, sides	2	$\frac{3}{4}$	4 $\frac{1}{2}$	18 $\frac{5}{8}$
EE	Top, front	1	$\frac{3}{4}$	2 $\frac{3}{8}$	15 $\frac{1}{4}$
FF	Top, back	1	$\frac{3}{4}$	3 $\frac{1}{2}$	15 $\frac{1}{4}$
GG	Edge banding, sides	2	$\frac{3}{4}$	$\frac{7}{8}$	18 $\frac{5}{8}$
HH	Edge banding, front/back	2	$\frac{3}{4}$	1	26 $\frac{3}{8}$
II	Table support ring, front/back	2	$\frac{3}{4}$	1 $\frac{3}{4}$	16 $\frac{1}{2}$
JJ	Table support ring, sides	2	$\frac{3}{4}$	1 $\frac{3}{4}$	12 $\frac{1}{2}$
KK	Metal angle brackets	4		3	3

Notes:

(p) Baltic birch plywood. You will also need 2 knobs, 2 pairs of hinges (Lee Valley #00H.5122)



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The Finish Line

• To make the finishing process as tidy and foolproof as possible, I prefer to finish as many pieces as possible before assembling a project. By doing this I am never faced with the prospect of sanding into a corner or trying to get a decent finish in tight areas without making a big mess.

• Take the project apart and sand all of the parts through to 150-grit.

• Apply a coat of Watco Natural Oil to all of the visible parts including the drawer boxes and follow this with a coat of paste wax. Any glue that squeezes out of the dowel holes during assembly will not stick to anything and will pop off of the finished surfaces easily.

• The doors and drawer fronts are painted using milk paint in Liberty Blue. I order my milk paint from Toronto-based Homestead House Paint Company in 1/2 or 1-pound bags. They are the only company in Canada that manufactures milk paint. It is an easy finish to apply and get perfect results. It also wears exceedingly well. Milk paint is made of pigments, lime and casein and penetrates into the wood causing the colour to become part of the surface as well as hardening to a durable cement-like finish that won't peel, flake or fade.

Bring It All Together - For Good

• By the time you get to this stage, you will have put the cabinet together a number of times, which will serve as good practice for the final run with glue. Before beginning, prepare an area with enough space to lay out all of the parts and supplies. Be sure to have enough glue and dowels at the ready as once the glue-up starts you will need to proceed without delay. The water in the glue will cause the dowels to swell as they absorb some of the moisture and you don't want to risk having a dowel lock into place before you can fit the piece to the cabinet.

• Glue the edge banding to the plywood section of the core. Begin with the bottom edge banding, followed by the sides and then the horizontal divider. Use clamps to hold them until the glue sets up.

• Glue up one end assembly containing the legs and the upper and lower end stretchers. Glue the corresponding two side filler pieces in place and then glue the leg assembly in place. Apply glue to the dado at the bottom of the leg as well.

• Glue the upper front and rear stretchers into place on the end you just installed.

• Glue up the second leg assembly and glue it in place on the end. Don't forget to apply glue to the upper stretcher dowel holes.

• Apply sufficient clamps to draw the assembly tight and check it for square.

• When the glue has set, remove the clamps, pop off any errant glue and touch up any areas of the finish that need attention.

Doors and Drawers

• Hang the upper door in the router cavity opening using European hinges designed for inset doors. The 35mm hole for the cup on the door side of the hinge requires a saw tooth or Forstner bit and should be drilled on a drill press while the mounting holes for the plate that fastens to the cabinet could be drilled with a regular drill bit with a depth stop. A far easier method of drilling these holes is to use the Veritas hinge boring jig from Lee Valley Tools. (See the Hinges article page 28).

• The easiest and most foolproof method to mount the drawer slides is to cut a piece of plywood the same length as the slide, and equal to the distance from the bottom of the uppermost slide to the bottom of the opening. Don't forget to add 1/4" to this, as the slide is set back 1/4" from the bottom of the drawer box. Also, allow for any additional space the drawer front drops below the bottom of the drawer box when determining the height of the plywood spacer. Set this against the side and screw the slide to the cabinet side. Repeat this for the other side. Cut the plywood spacer down for the next drawer and repeat. For the bottom drawer, simply lay a piece of 1/2" plywood under the slide.

The Doors

• The bit storage on either end is accessed through a door with a Plexiglas panel. This will provide protection for the bits, yet still allow you to easily locate the profile you need.

• With the cabinet assembled, confirm the final measurements for the doorframe members.

• Mill enough stock for the rails (AA) and stiles (BB). To maximize the open area in the door, these pieces are only 1 1/2" wide, which still allows two 3/8" dowels per joint.

• Drill the holes for the dowels and assemble the door with glue.

• When the glue has set, mount a 3/8" piloted rabbeting bit in your router and rout a rebate for the Plexiglas (CC) in the door. If this is an upgrade for an existing router table use your old table for this procedure. If this is your first router table then build the doors after you mount the top to the cabinet and install the router.

• The door is mounted using no-mortise hinges. Use a set of shims to fit the door into the opening. Trim one side at a time until the door fits with an even gap all the way around.



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- Sand the door and finish it in the same manner as the rest of the cabinet.

- Use wooden strips or silicone caulk to mount the Plexiglas in the door. If you use silicone, select one that cures sufficiently hard as some brands remain very flexible, which will allow the Plexiglas to fall out in time.

- I use a simple shop made jig to set the hinge on the opening and then drill the screw holes with a self-centering bit.

- The same jig is then turned around to mount the same hinge to the door, the foot of the jig establishing the proper gap at the bottom or top of the door. Screw the hinge to the door and then using the holes drilled in the cabinet earlier, mount the door to the cabinet.

- Place ¼" dowels in the shelf pin holes and set the shelves over these.

- Decide how you would like to organize your router bits and fasten the Lee Valley bit holders (Item 16J03.61 & .62) to the shelves.

Power

- With the above-the-table bit changing and adjustment that these versions offer, it only makes sense to move the power switch to the front of the cabinet for safety and convenience. There are several different switches available for this, the Bench Dog version I chose easily mounts in a number of possible positions. Which position you mount it in is a matter of personal preference. Some people who use a router fence for most operations like to have it mounted up on the fence for ease of access. If you do a lot of pattern routing or other operations where you do not use a fence, mounting the switch on the right hand side of the cabinet might prove a more useful option.



**Work station
with Veritas top**

Dust Collection and Cooling

- When the cabinet has been fully assembled, cut a 4" hole in the back of the router cavity with a hole saw. Fasten a dust collection flange to the back with a blast gate and affix a 4" hose from a dust collector. It is important to use a dust collector with an enclosed router for two reasons. When the router is working it will generate a fair amount of heat, and in a confined space this will cause excessive heat build-up which will degrade the motor windings over time as well as causing additional stress on bearings and other parts. The airflow provided by the dust collector will help keep the router cooler as well as collecting the debris and dust that will inevitably make its way into the cabinet. In addition to the heat build-up, not collecting this material could plug the cooling vents and inner works of the router.

- When hooked up to a 4" hose, there is sufficient airflow to keep the router cool and clean. In addition to the dust collector, I also prefer to have my Fein vacuum hooked up to a port on the fence as well to catch material above the table. The Fein has a built in receptacle that the router plugs into, and when the router is turned on it automatically turns on the vacuum. Using both of these methods of collecting the shavings it is possible to capture almost all of the debris generated during most routing operations leaving the shop a much cleaner place to work.

Top: Lee Valley Version

- The Lee Valley router table is designed to be elevated leaving the perimeter free. This top is one smooth steel surface without any tracks and the accessories such as the fence clamp to the edge of the steel table. To mount this top on the cabinet will require you to build a base for the steel top.

- Cut the plywood parts for the top (DD, EE, FF). You could cut a full size top and then cut a hole in the center for the router but this will use much more material. Dowel the four parts together to form the top.

- Sand the top and paint it using the same milk paint used for the door and drawer fronts.

- Cut the edge banding for the base (GG, HH), sand and finish them as the rest of the cabinet and dowel these to the edges of the plywood top.

- Cut the four pieces for the table support ring (II, JJ).

- Modify four 3" x 3" angle brackets to mount the router table to the base using the four bolts on the underside of the table. Notch the top edge of the ring for the brackets so the top sits flat on the wood.

- Sand the four outside faces. Use two dowels in each corner to hold it together and screw it to the top from the underside.

- Place the top on the cabinet, centered on the opening and use some metal or wooden straps to tie it to the base.

- Place the steel top on the ring and fasten it to the table using wood screws through the angle brackets.

- The Freud FT1700VCE router features above-the-table bit changing and adjustment. You will need to drill two holes in the top, one to access the lift mechanism and the other to access the locking mechanism. Use the template and follow the instructions that come with the router.

- Mount the power switch at the back of the cabinet and drill a hole in the back of the router cavity for the cord.

Top: Bench Dog Variation

- The Bench Dog Pro Max top is one heavy-duty chunk of cast iron and it sits directly on the cabinet. It is held in place using four angle brackets.

These steps must be done before the cabinet is assembled:

- The four angle brackets butt up against the inside faces of the front and rear stretchers. To make room for the rear bracket, cut a mortise into the rear side filler piece to accommodate the bracket.

- To provide clearance for the bolt that fastens the bracket to the Pro Max top, cut a ½" deep notch in the top of the four side filler pieces.

These steps are done after the cabinet has been assembled:

- Drill a ⅜" diameter hole 1¼" down from the top, 1⅜" in from each leg for the connector bolt.

- Place the cast iron top on the cabinet and fasten it in place using metal screws.

- Mount the Porter Cable 7518 in the Bench Dog Pro Lift following the detailed instructions that come with the Pro Lift.

- Set the Pro Lift into the opening in the Bench Dog top, level it using the adjustment screws to provide a smooth transition between the two.

- Mount the switch toward the back of the cabinet on the right hand side and drill a hole in the back of the router compartment for the power cord.

In coming issues, we will be featuring a number of projects/articles on routing, so get going on this project so you'll be ready to rout.

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Cedar Potting Bench

This bench is made of cedar, with all of the parts being milled from deck and fencing lumber - readily available from most building supply centres. When choosing your material, try to find pieces without knots and with tight vertical grain. When planing dry cedar, knots can easily take a chunk out of your knives, as well as becoming a weak spot in the finished board.

This project is fairly straightforward, no fancy joinery or complicated techniques to learn. The potting bench could be built in two configurations - permanent or knock-down for seasonal storage. Additionally, there is not one piece of metal used that would eventually rust and stain the bench. The secret is in using dowels to assemble all of the components. If you don't glue

some of the dowels and substitute a hard dense wood for a couple of the components, the bench can be easily disassembled for storage during the winter.

Using dowels to assemble a project is every bit as strong as mortise and tenon in everyday use, and they speed up the construction process considerably. Not having to allow additional length for tenons, will speed up the process and using a stop block when cutting multiple parts to length will assure you a square assembly. All this takes is careful lay out and accurate drilling of dowel holes. At first glance it looks like a daunting task, as there are 192 dowels in this project, which means that you will have to drill 384 holes in various pieces - and each must line up perfectly with its mate. The secret to lining

A potting bench is an ideal accessory for your patio or back yard shed, providing a convenient place to seed flats of trays in the spring, or pot-up larger plants later in the summer. The wood you choose will be influenced by its final location. Pine or red oak would be ideal if your workspace is indoors, while cedar or white oak are more weather resistant and are a better choice for a bench that will be used outdoors. The bench would also make a great workspace and serving table next to your barbecue.

all of these holes up is to always work from the same two reference faces when laying out and drilling the holes. When laying out holes manually, work from the same two common reference faces on each half of the joint and use a story stick to establish the distance between the dowels on a centerline (see Story Sticks, February/March 2006 issue # 40). Drilling these holes without a guide in softer woods like cedar can be problematic. The bit will tend to wander in both end and flat grain as the tip moves from softer summer growth to the harder winter growth. I much prefer building projects rather than spending hours laying out and drilling holes so I opted for a commercially available jig to simplify matters. (See Sidebar: Get Your Holes in a Row)

Build End Frames

• Begin by milling the lumber for the legs (A) and end stretchers (B) and cutting the pieces to length. Select and mark the best faces for the front side.

• Mill the stock for the end slats (C) and use a stop block to cut the four pieces to exactly the same length.

• With all of the parts for the ends cut, lay them out with the best faces forward as they will be assembled. The bottom of the lower stretcher is 6¼" up from the bottom of the leg. Use a square to draw a reference line across the two inner faces of the legs. These lines, as well as the underside of the bottom stretcher, are one of the two required reference faces for this joint. The inner side of the leg and the inside face of the stretchers are the other.

• Lay out and drill holes for two dowels at each joint. Repeat this for the top stretcher. Again, the inside faces of the leg and stretchers are one reference face, but this time the other reference face is the top of the leg and the top side of the stretcher.

• Chamfer the four long sides and bottom of the legs with a 45° bit on a router table. Chamfering the bottom prevents chunks from tearing out of the legs as the bench is moved. Also chamfer the long edges of the end stretchers.

• Use a band saw to cut a ¾" x 3¼" long notch out of the top ends of each end stretcher to receive the shelf runners (F).

• Assemble and clamp the end together to be sure everything fits. You don't want to get glue on everything and then find out that the clamps won't pull it tight because one or more holes were too shallow for the dowels. (See Sidebar: Successful Dowel Gluing). If everything is fine, take it apart and sand the pieces for finishing. Apply a coat of tung oil to all surfaces. With the parts finished, assemble the ends with glue and clamp.

The Middle Bits

• Mill the front and back stretchers (D) and cut them to length. Use a stop block - they must all be exactly the same length.

• Mill the four pieces for the back slats (E), also using a stop block to cut them to length.

• Lay out the back slats in a similar pattern to the ends, and lay out and drill the holes for the dowels. Be careful not to end up with the stretchers offset, or your final bench will have either a lean or a twist. In both cases the row of holes is centered on the thickness of the piece.

• The front and rear stretchers are dowelled to the legs using four dowels at each joint. The bottom of the lower stretcher is 6¼" from the bottom of the leg. Use a square to mark this location on the inside edge of all four legs. This, as well as the

bottom of the stretcher, is the first plane of reference for the dowels. The inside face of the stretcher and the inside face of the leg are the second. Lay out and drill the dowel holes.

• With the holes drilled, chamfer the edges of the stretchers and the back slats on the router table.

• Dry assemble the slats and rails together using dowels, and if everything fits, sand all of the parts for finishing and apply a coat of tung oil. When the finish has cured, glue up the rear panel. Be sure to check the diagonals for square.

On Deck

• The two decks (ie. the upper work surface and lower storage shelf) are where this project either comes together or falls apart. The upper deck is glued together forming a rigid platform with gaps between each board. The lower shelf is made of loose boards laid edge-to-edge to form a solid surface that things won't fall through. With so many boards laid side-by-side, there is the potential for considerable seasonal expansion. Failing to allow for an expansion joint would force the bottom shelf to act as a ram and pry the joints with the ends apart. On the rigid upper deck, there is space between each board for expansion and the two dowels in each end are oriented along the length to prevent the board from splitting.

• Mill the material for the four shelf runners (F) and cut them to length.

• Mill the material for the lower shelf boards (G) and cut them to length.

• Mill the material for the top boards (H) and cut them to length.

• For the following stages you will have to begin assembling the potting bench. Assemble the sides, back panel, and front stretchers. Take two of the shelf runners and set them into the notches in the lower side stretchers. Use a couple of band clamps around the legs to keep the whole assembly drawn tight, or you will be unable to accurately locate the dowel holes for the runners.

• Set the upper shelf runners into the notches in the upper stretcher. The runners should run to the edge of the chamfer on each leg. Use some form of a clamping jig to ensure the bench is standing square. I used a 12" melamine square with some 2½" clamp holes drilled into it.

• The slats for the upper deck will overhang the front, back and sides by ½" with a ¼" space between each slat. To be sure that everything aligns, it is important to establish the same reference edge for all of the dowel holes. Place one of the top boards in place and establish the proper overhang on the front and back. Transfer the location of the front edge of the two

Get Your Holes In A Row

To make dowels work in a project you have to be able to easily and accurately drill holes precisely where you need them. Over the years I've built plenty of dowel jigs for various situations, investing considerable time I would rather have spent working on my projects.

I recently picked up a DowelMax at the Victoria wood show, after watching a demonstration by its designer, Jim Lindsay. The heart of the jig is a precisely machined aluminium guide block with 5 hardened drill guides for either ⅜" or ¼" dowels. Using a combination of the fence, angle bracket and the clamp bracket with the guide block it is easy to locate the jig anywhere on the work piece. By always using the same two reference faces, drilling perfectly matched holes in facing pieces that match up every time is child's play.

A guide rod allows perfect spacing of holes on longer surfaces while drop in spacers center the jig on stock of different thicknesses. The bit included with the kit drills a perfectly sized hole for Laurier dowels.

A tool is only worth investing in if the return is worth it; it has to be cost effective, and with DowelMax commanding a premium price it has a lot to live up to. It's easy to assume that a tool like this is made by a huge company and that the price is unreasonably high. Consider that in this day of most tools being made in China, Dowelmax is a small family run business based in North Vancouver. There are over thirty components in the complete system, that are all made at three local independent machine shops out of the highest quality materials providing employment for several skilled craftsmen.

So does the DowelMax live up to the promise, and is it cost effective? In a word, absolutely. All 384 dowel holes in this project lined up as if they had been drilled using a CNC machine. Given the precision and ease of use of the DowelMax I plan on using it for a lot more projects.



shelf runners to the top board. Use this board to mark the others. This becomes the first reference edge.

- Find the center of the shelf runner end to end. Working out from there, use a square to draw lines out in either direction on $3\frac{3}{4}$ " centers. This represents the centerline of the two dowels in the runners. They are simply centered on the individual boards.

- Drill these holes to a depth of just slightly more than $\frac{3}{8}$ ". In all likelihood you will not find any $\frac{3}{8}$ " x $\frac{3}{4}$ " dowels so simply cut some $1\frac{1}{2}$ " dowels in half.

- Test fit the top boards to the runners.

An Expanding Bottom

- Set the boards for the lower shelf in place. They will be too wide for the space available so leave the last one out and a gap in the middle.

- Use a table saw or jointer to slightly bevel the edges of the two boards facing each other over the gap; 10° should be more than enough.

- Bevel one edge of the remaining board originally left out. Use the table saw set at an angle to rip the piece to width to fit in the gap, then drop it in place. With the edges on either side of the narrow center

strip bevelled, any seasonal expansion will cause the center strip to buckle upward and pop out, preventing the leg to front and rear stretcher joint from being forced open.

- With the fit confirmed for the two shelves, remove the boards and runners.

- On a router table, chamfer the edges and ends of the top boards.

- Sand all of the parts and apply tung oil to all of the pieces. Leave an area around the dowel holes on the upper assembly free of finish. This will provide additional surface area for the glue (that squeezes out of the dowel holes) to adhere to.

- Place the upper runners back in the potting bench, insert the dowels and place the top boards in place. Start at one end and remove each board individually, apply glue and press it in place. Be sure not to accidentally glue the runners or boards to the bench!

Tie It All Together

- When the glued top assembly has cured, remove the top and set it aside. Use a guide to drill a 1" deep hole in the center of each of the four notches the runners sit in.

- Place a dowel center in each of these

holes and carefully center the top on the bench. When the top is centered, press down on the four centers to mark the location in the underside of the runners. Drill this to a depth of $\frac{1}{2}$ ".

- Place a dowel in each notch and set the top assembly in place.

- Repeat this for the two bottom runners as well and insert a dowel in each notch and place the runners over the dowels. This will hold the potting bench together at this point and you can remove the band clamps.

Top It Off

- To create a little extra storage space for seeds, tools and pots, or condiments and other accoutrements next to the BBQ, add a simple hutch to the top. If you can find some wide stock then make each piece from a single board. If wide stock is not readily available in your area, glue up some narrower stock using type 2 wood glue, such as Titebond III.

- Mill the material for the five hutch components (I, J, K, L) and cut them to length.

- Lay out and drill dowel holes to join the shelf to the back. Assemble these two pieces without glue for the next step.

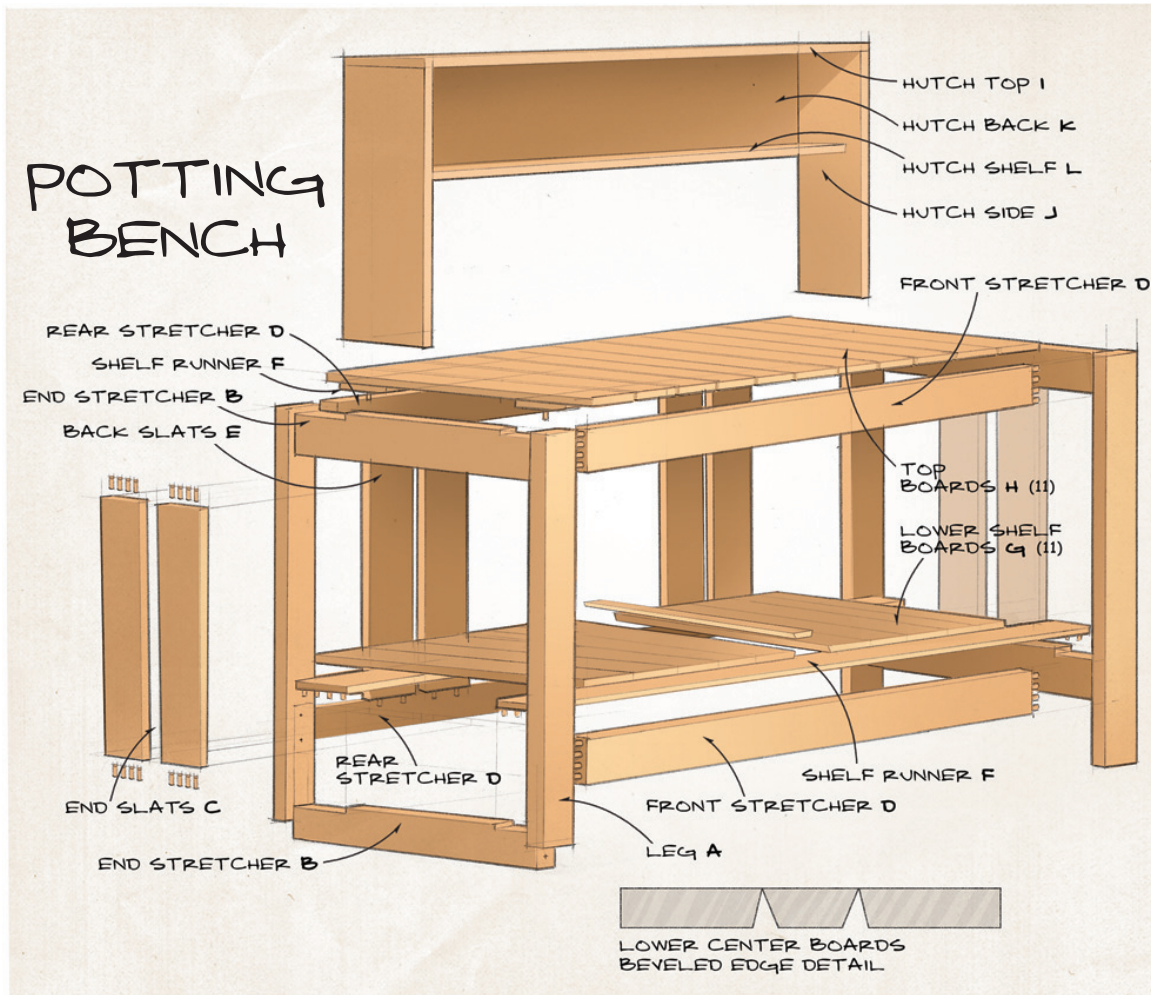


Illustration by Mike DeRizzo

MATERIALS LIST (All measurements in inches)

	Part	Qty	T	W	L
A	Legs	4	1 7/16	2 1/2	35 1/2
B	End stretchers	4	1 7/16	2 1/2	19 5/8
C	End slats	4	3/4	3 3/8	24 5/8
D	Front and rear stretchers	4	1 5/16	3 1/4	34 3/4
E	Back slats	4	3/4	3 3/8	22 5/8
F	Shelf runners	4	3/4	3 1/4	39 7/8
G	Lower shelf boards	11	3/4	3 3/8	19 5/8
H	Top boards	11	3/4	3 3/8	23 7/8
I	Hutch top	1	3/4	7 7/8	37 1/8
J	Hutch sides	2	3/4	7 3/4	17 1/2
K	Hutch back	1	3/4	5 5/8	35 1/2
L	Hutch shelf	1	3/4	5 5/8	35 1/2

Notes:

You will also need 108 3/8" x 2" dowels; 42 3/8" x 1 1/2" dowels; and 44 3/8" x 3/4" dowels

- Lay the sides on a table and place the assembled shelf and back in place between them. Line up the top edge of the back and the top edge of the sides. Mark the underside of the shelf on either side. Measure back 3/8" to locate the centerline of the dowels. Drill the holes in the ends of the shelf, back and in the sides.

- Lay out and drill the dowel holes for the top and dry fit everything.

- Disassemble the pieces and chamfer the visible edges on the router table, sand and finish each piece.

- Glue the hutch together and clamp it. Check the diagonals for square.

To Glue Or Not To Glue

- At this point the legs to front and back stretcher joints have not been glued. As well, the eight dowels that hold the four

shelf runners in place are not glued. This is where the knock down aspect mentioned earlier comes in. If you have drilled these holes accurately, the front and rear stretchers will keep the ends apart, while the dowels in the shelf runners keep the two ends together, effectively locking everything in place. Cedar is a soft wood and I would recommend making the shelf runners and the upper end stretchers out of a harder wood (teak or white oak would do nicely) or the holes will become worn quickly and your bench will rock side to side. For a permanent version simply glue these dowels in place and the bench will become perfectly rigid.

- Place the hutch on top of your finished bench and you're ready to start your seedlings for the garden.

Successful Dowel Gluing

There are three things that make a dowel joint come together perfectly. If any of the three are not right, the joint can be frustrating to assemble.

First, you need the right dowel. I've experimented with different glues and different dowels. Some work, others leave a lot to be desired. The dowels made by Laurier Woodcraft (available through Lee Valley) are superior to any I have tried. These have spiral flutes and are slightly compressed, but more importantly, they are round. All other dowels I have tried have been out of round enough to result in a sloppy or difficult assembly. Laurier dowels provide a tight solid fit that can be easily assembled by hand and in the presence of glue they expand just enough to lock the joint tight.

Second, you need the right glue. Dowels expand as they absorb water from the glue and choosing the right glue is critical for a successful joint. Normal carpenters glue will set up far too fast and lock the dowel in place before the joint is fully assembled. To allow extra working time, use a product with a longer open time. I like Titebond III which allows ample time to get the dowels in place and assemble the joint.

Third, you need to accurately drill the holes. See sidebar 'Get Your Holes in a Row' (page 19) for more on this topic.

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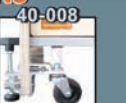

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Marking Gauge

This marking gauge is handy to have at hand whether you are laying out joinery, using it as a depth gauge, or simply using it to transfer a measurement to another location. It's a quick and simple project you could easily complete in a day.

The Fence

- This gauge uses purpleheart for the fence and quartersawn white oak for the shaft. Choose a hard wood that works easily without excessive chipping or tear out for the fence blank. After machining the blank, it is re-sawn and glued together to form the mortise for the shaft. Keep this in mind when selecting your wood and try to choose a species and cut that will hide the glue line when completed. The dense straight grain of purpleheart serves this purpose nicely.

- The three pieces that make up the marking gauge are relatively small and working with small pieces on power tools raises additional safety issues. To reduce the risk, use a longer blank than necessary to machine the parts for the fence. This will enable you to make several gauges - a couple for yourself and several for gifts.

You could alternatively make up a jig to hold the small pieces.

- Mill the fence blank (A) to be perfectly straight and square. Square up both ends at this time, the actual length is not crucial.

- Set up a $\frac{3}{8}$ " Onsrud bit in a table-mounted router. Place the fence so there is a $\frac{1}{8}$ " gap between the bit and the cutter. Raise the cutter to project barely $\frac{1}{16}$ " above the table. Use a feather board to maintain constant pressure down against the table and against the fence.

- Make one pass along the length of the board. There should be a $\frac{1}{8}$ " strip of wood remaining at the edge of the piece. This is a runner that keeps the board level during subsequent passes.

- Move the fence back and make another pass. Keep doing this until the groove is $\frac{5}{8}$ " wide.

- When the last pass has been completed, raise the bit to project $\frac{3}{16}$ " from the top and make another pass.

- Move the fence $\frac{1}{4}$ " toward the bit and make one more pass. This will result in a $\frac{5}{16}$ " x $\frac{5}{8}$ " groove running the length of the board.

- Use a table saw to rip the runner from the edge of the piece.

- Using a mitre saw or a cross cut sled on a table saw, cut the two pieces that make up the fence from the blank.

- Glue these two halves together to form the fence with a perfectly square mortise through the middle. Pay attention when

applying the clamps - the glue acts as a lubricant and the parts will tend to shift.

- Drill a $\frac{1}{8}$ " pilot hole through the fence over the compression gap.

- Counterbore one side to accept a $\frac{1}{4}$ -20 threaded insert. Drill only as deep as needed for the insert.

- From the other side, drill a clearance hole that will accept a $\frac{1}{4}$ " threaded rod.

- Ease all of the corners around the perimeter of the fence, and even out any irregularity at the glue line. Ease the edges of the face slightly but leave the edges of the mortise as they are.

The Shaft

- Select stock for the shaft (B) that is dense, wears well and is straight grained for the best results. Using a jointer and thickness planer mill the material so that it fits tightly with the mortise in the fence. For the gauge to work smoothly, the shaft must fit tightly and be perfectly straight.

- Cut the shaft to length.

Hardware

- The marking point could be any hard piece of metal that you have shaped to an appropriate point. A piece of bandsaw blade makes an ideal marking point.

- The blade is held in place in a groove on the shaft with a screw on either side. Drill clearance holes for the shafts of the two $\frac{5}{32}$ " brass screws. Counterbore one side to the minimum diameter of the

MATERIALS LIST

(All measurements in inches)

	Part	Qty	T	W	L
A	Fence	1	$1\frac{1}{16}$	$1\frac{7}{8}$	6
B	Shaft	1	$\frac{5}{8}$	$\frac{5}{8}$	10
C	Adjustment knob	1	1	1	1

Notes:

You will also need a $\frac{1}{4}$ -20 threaded insert, two $\frac{5}{32}$ " brass screws and nuts, and some $\frac{1}{4}$ " threaded rod. These items are available at most building supply stores.

corresponding nut to a depth equal to its thickness.

- Place the nut over the counterbored hole; use a very sharp pencil to outline the nut.

- Use a sharp chisel to remove the waste and allow the nut to be fully recessed. This should be a snug fit.

- Use a band saw to cut the compression groove into the end of the shaft.

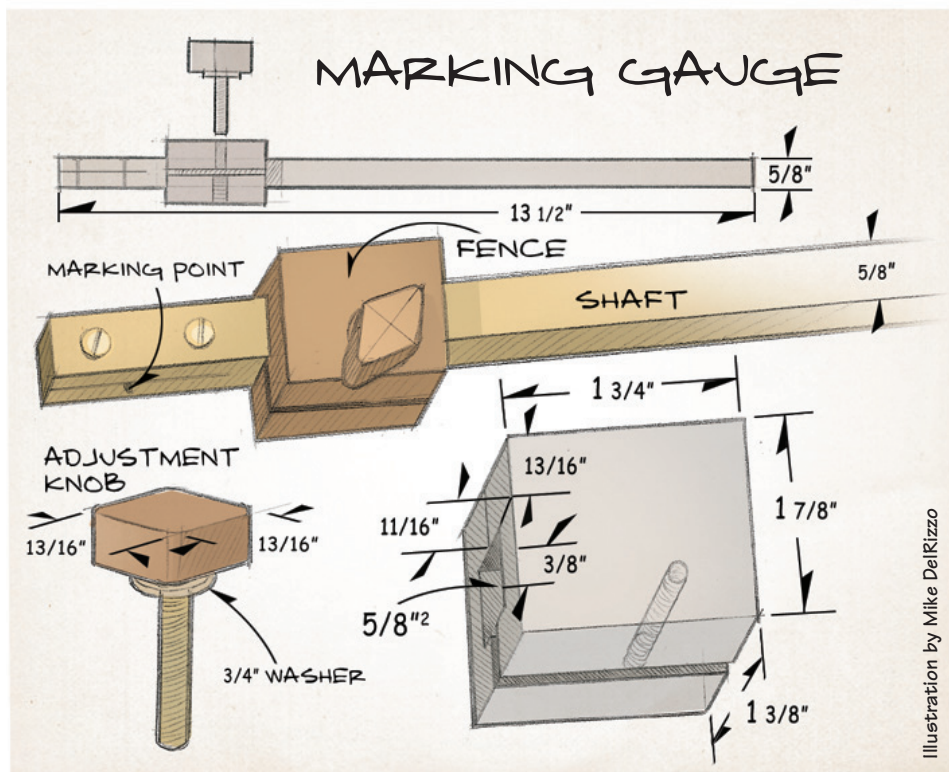
- The easiest way to cut the small notch to hold the blade is to use a scroll saw blade. A fret saw will work equally well here. The object is to carefully saw a kerf at right angles to the compression groove between the screws that will hold your metal point snugly. This should be just deep enough to allow the point to fit in place.

- Insert the point.

- Insert the brass nut into each of the counterbored sockets and use flat head brass screws, countersunk flush with the surface, to clamp it in place.

- For the fence adjustment knob (C) you will need a 1" square piece of purpleheart. Connect the diagonals to find the center and drill a 1/4" diameter hole 1/4" deep.

- Cut a piece of 1/4" threaded rod to length and chuck it into a drill press. Turn the drill press on and use a file to chamfer the leading edge. This will make it easier to



engage the threads in the insert.

- Epoxy the threaded rod into the hole in the purpleheart. Using a sander or wood files, shape the knob to what ever you find

to be a pleasing and easy to use shape.

- Insert the shaft into the fence and fasten the fence in place with the knob. - CWM

Illustration by Mike DeRizzo

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As seen on DIY Network! This simple system uses interchangeable guide templates to produce an ever growing number of beautiful decorative dovetails for drawers, boxes and furniture in no time at all. Amateurs, children and professional woodworkers will enjoy the ease of use, safety and simplicity of this system while making magnificent joints!

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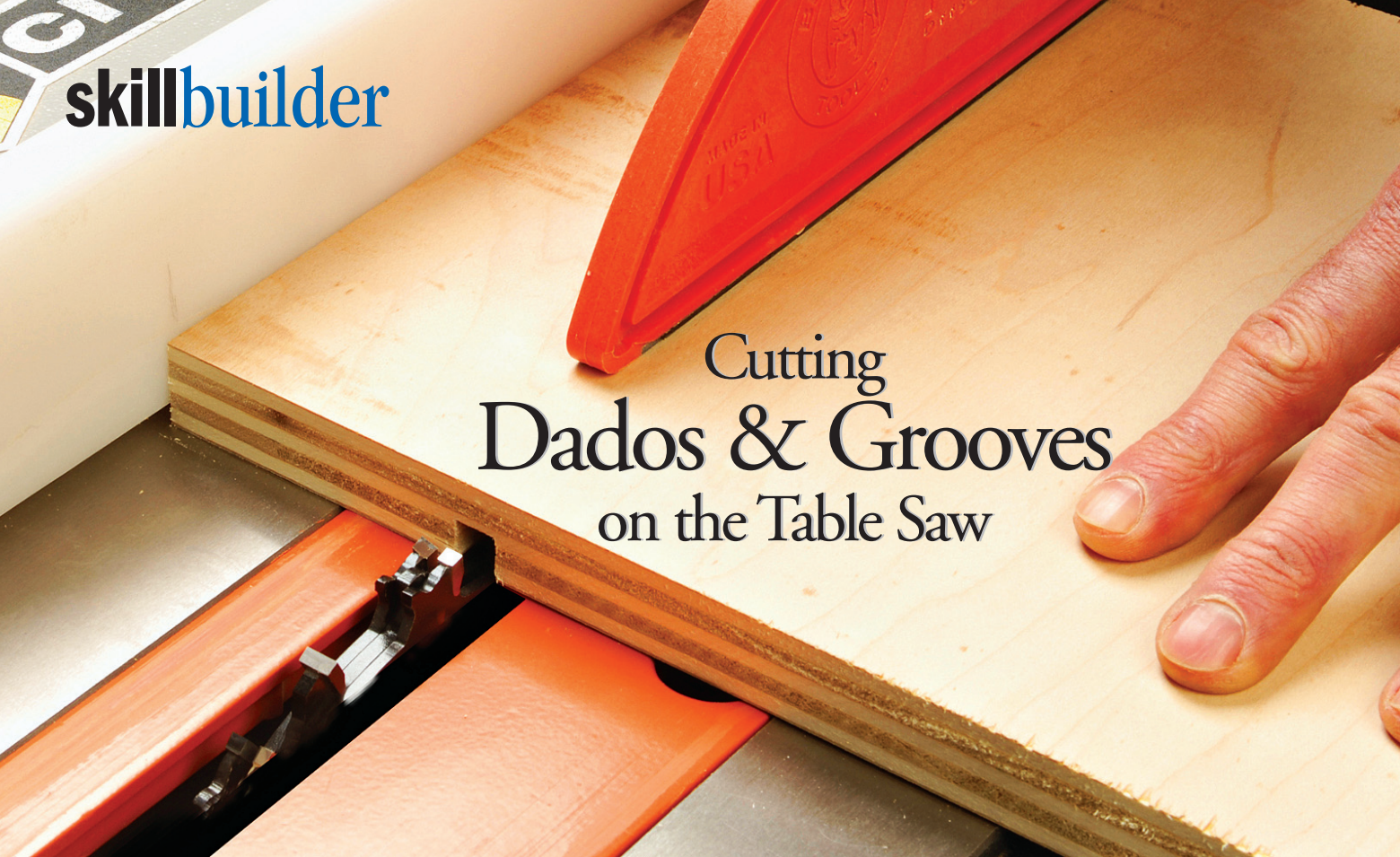
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Cutting Dados & Grooves on the Table Saw

Dados and grooves are one of the most basic joints you can use when constructing furniture projects. They provide a mechanical connection that can be reinforced with glue and screws, making a structure much more rigid than had it been fastened together with butt joints. While not as decorative as dovetails or finger joints, they are much easier to cut and are ideal for housing panels such as drawer bottoms.

Some woodworkers tend to use the terms dado and groove interchangeably. They are not the same things. A dado runs across the grain, a groove runs with the grain, a rabbet is cut on the edge of a board, and a slot is a recess cut in a board. Both the router and the table saw have their individual advantages when it comes to cutting dados. (We'll be taking an in depth look at cutting dados and grooves with the router in an upcoming issue of the magazine.) With a table saw you can cut a large number of grooves or dados in sheet goods quickly and accurately using either the rip fence or a cross cut sled, as dictated by the circumstances. When cutting a stopped dado on the table saw (a dado that stops short of one edge of a board) you will have to chisel out the ramp or notch the shelf and sacrifice the strength of a tight fitting joint.

If you are only cutting a few narrow dados, then you could lay the cut out on the stock and use a regular saw blade. Make two cuts running the length of the dado defining each side and then waste away the center portion with several repeated cuts. However, because dados are such a basic woodworking joint, it makes sense to invest in a special dado blade for your table saw, particularly if you have more than a few dados to cut. Dado blades come in two basic forms, either a wobbler or a stacked dado set.

Wobblers

Just as the name suggests, this dado blade wobbles. The blade is mounted on a special washer that will tilt the blade on its axis. How much you twist the two halves of the washer relative to each other

determines the degree of tilt and as a result the width of the dado. As the blade spins this will cause it to cut on an arc through the wood. In travelling from one side of the cut to the other, the bottom of the dado will be cut on a slight arc, which results in a bottom that is not quite flat. This isn't much of a concern if all of the ends of the dados will be hidden by a face frame for example but looks sloppy if the ends are exposed. There is a tendency on veneered sheet stock and melamine to have some chipping on the edges. Additionally, wobble blades tend to vibrate in use more than stacked dado blades.

Stacked Dado Sets

Stacked dados are made up of two outside blades separated by a number of chipper cutters. The outside blades look like conventional saw blades, and score a clean outer cut. The inner chippers then remove the waste. To cut a dado of a certain width, mount the first outside blade on the saw arbour and begin adding the center cutters. Follow any specific instructions that come with your set, but it is best to stagger the chippers evenly. This will balance the blade a little bit more effectively and as a result the saw will run smoother with less vibration. These blades produce the best dados with just about dead flat bottoms. Because a stacked dado set is much wider than a conventional saw blade, you will need to replace the table saw's throat insert plate with a dadoing insert plate. Most saws come with this insert. If yours did not, you can likely purchase one from your saw manufacturer, or make one yourself.

Cutting Dados

Cabinetmakers often use dados and grooves when constructing projects out of sheet goods given the ease and speed with which they can be cut on the table saw. One of the drawbacks however, is that a $\frac{3}{4}$ " sheet of plywood is rarely $\frac{3}{4}$ " thick. Before beginning to cut dados for any project using sheet goods, measure the actual thickness of the material you will be working with.

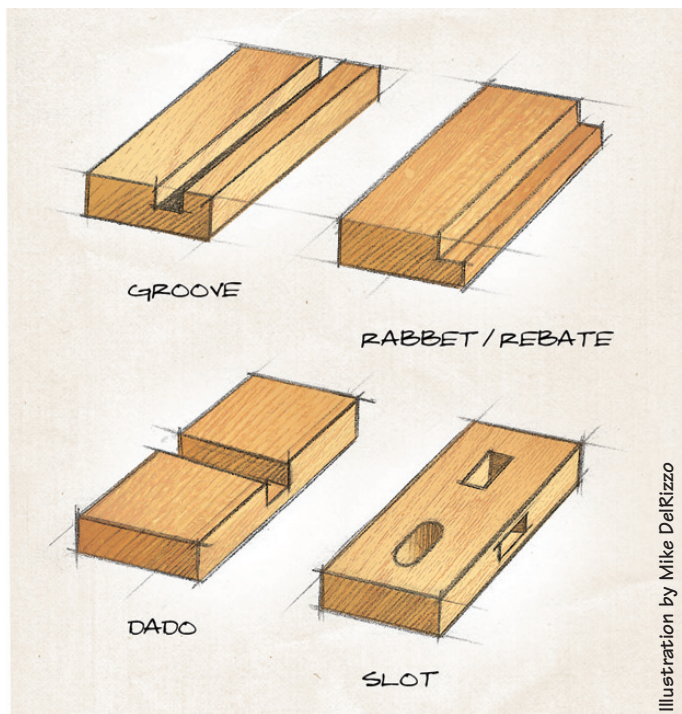
To adjust a stacking dado you use a set of shims that are usually supplied with the set. If shims did not come with your dado set you can buy them from most tool outlets. Plastic or brass shims will last for years. You can also buy lower priced paper shims that work just as well. Place the first outside cutter on the saw and then add enough cutters to the stack so that the final width of the stack is just slightly less than the thickness of the material that will go into the dado. Make a test cut in a piece of scrap and use a digital calliper to measure the width of the dado. With the calliper set to this width, zero the display and then measure the material itself. The calliper will display the difference between the two. Use this measurement and the calliper to put together a stack of shims of the required thickness. Place these on the stack, again observing any special instructions specific to your set, and make a test cut. If all has gone well, the material should now fit snugly into the dado. If it easily drops into the dado, it is too big, and if you need a mallet to seat it in the dado it is too tight. It should push in with only average pressure so as to provide room for glue on the sides and the bottom. If the fit is too tight, the material being inserted will scrape all of the glue off the sidewalls of the dado and trap it at the bottom preventing the panel from fully entering the dado. Some dado sets are not adjustable for thicknesses less than $\frac{1}{4}$ ". In this case, cut your dados with a standard $\frac{1}{8}$ " saw blade, and sneak up on the dado width.

Although all stacking dado sets share the same features, there can be considerable variation between them. The quality and type of carbide is one thing to consider. Some manufacturers use special 'micro grain' formulations, and fabricate their own carbide. Over time, pieces of carbide will eventually start to wear away from the leading edges of all blades. On micro grain carbide, the pieces that break away are smaller, and as a result the tool is able to maintain a working edge longer before needing to be taken to a sharpening service.

Using A Stacked Dado Set Safely

The first time you install a dado blade set on your saw you'll be impressed by how little sound it makes with all of those teeth spinning at once. Just as with regular saw blades, the blade must be parallel to the guide slots and the fence or you will get splintering and burning during the cut. Because a dado does not cut all of the way through your stock you will need to remove the splitter assembly from your saw when you install a dado set. Before you install the dado blade, raise the blade to its highest position and use an engineers square to set the blade exactly 90° to the table. Remove your regular blade, along with the throat insert, and install the dado set. Then install the dado insert plate.

When you are cutting a dado in larger panels, always use push sticks or better yet, push blocks. The dado is being cut on the underside out of your sight; you don't want any part of your hand to be in the wrong place as the blade emerges at the end of the cut. Using the rip fence to guide the cut is only safe if the pieces are wide enough in relation to their length to provide adequate bearing surface on the fence. For narrower panels use a cross cut sled for safety and accuracy. Many dado sets have anti-kickback fingers that limit the amount of material each tooth can cut, which reduces the risk of kickback caused by excessive feed pressure. When



cutting rabbets always run the stock flat on the table saw rather than on the edge.

It's good practice to use an auxiliary fence with your dado set. You can make the auxiliary fence out of solid wood or plywood. With this fence you can safely use part of the dado blade to cut a rabbet – otherwise you run the risk of having the dado blade damage the rip fence.

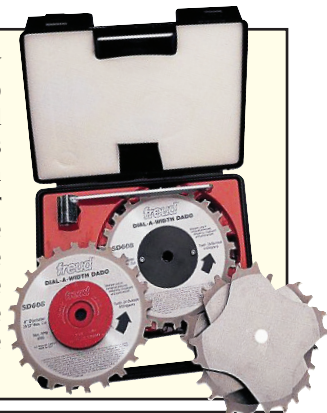
Before buying any dado set, confirm its compatibility with your specific model of saw. You may be restricted in size to a 6" set if your saw lacks the capacity to run an 8" set. As well, be sure that your arbour and nut combination provide enough length to mount the set. On some saws you may end up having to mount the chippers and one blade on the threaded portion of the shaft, depending on the width of the dado stack.

- CWM

Dado Blades are available at:

Freud Canada	freud.ca 905-670-1025
Forrest Manufacturing	forrestblades.com 800-733-7111
Lee Valley	leevalley.com 800-683-8170
Morley Miller Machinery	morleymillermachinery.com
	519-448-1361
Sharpco	sharpco.ca 888-742-7726
Tegs Tool & Machinery	tegstools.com
	Barton 905-545-5585
	Upper James 905-388-0784

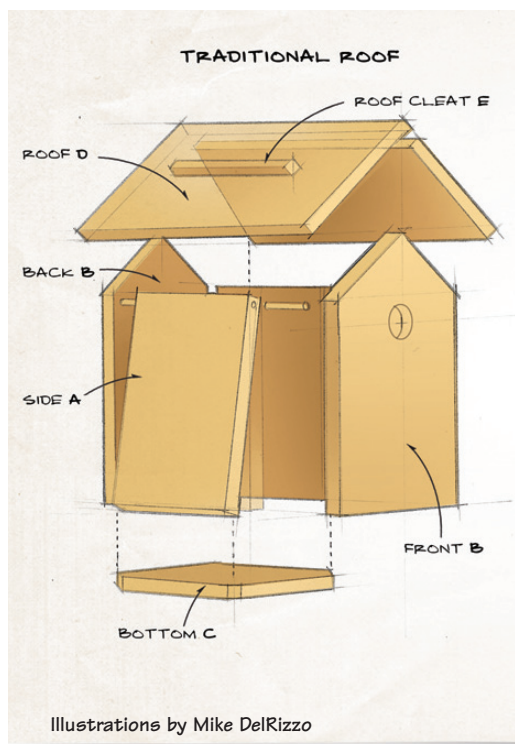
The Freud SD608 features a new way of fine-tuning the width of the dado without using shims. A patented mechanism on the outer blade allows you to adjust the outer blade in predictable increments of .004" for each detent on the dial. If using the calliper method you find a difference of .020 between the dado and the material, simply adjust the dial five clicks in the proper direction and the blade will move either in or out.





Housing for the Birds

One of the pleasures of watching as the landscaping in our yard progresses over the years and the plants mature is the increasing frequency of visits by various species of songbirds. Watching them can be an amusing and entertaining way of passing the grey winter months here on the west coast. Aside from their entertainment value they really pull their weight when it comes to the yard work. They eat insects as well as seeds from the various weeds that seem to plague every garden.



Illustrations by Mike DelRizzo

Each bird species has very specific criteria it judges a potential house against - fail to meet those needs and your avian housing project will remain vacant, or worse, become home to an invasive species such as the starling. Variables such as the dimensions of the floor area, the size of the entry hole and how far above the floor it is, as well as how high to mount the house are all important considerations when building a house designed to attract a specific species.

Making the entry hole too large will allow predator birds access to the occupants of the house. Do not place a perch under the entry hole - this is little more than pulling up a chair for the predator to rest on while it waits. To keep the interior of the house healthy, there must be adequate ventilation as well as drainage to allow any water to escape. The house must remain dry to stay warm. Provision must also be made to allow access to the interior for an annual cleaning to prevent the build-up of pests and disease.

Cedar is a great material for birdhouses. It is naturally resistant to rot, it is light (making the house easier to mount) and blends into any natural setting. Cedar can either be finished with a stain on the exterior, or left to age naturally and gracefully. Birds have very sensitive lungs, and the preference would be to not use any finish on the wood. Under no circumstances should you finish the inside of the house. Leaving the cedar a little rough also helps the birds and their young to enter and exit the house.

I've made up two different styles of houses. You could build one or both depending on your preference. Use the plans as a guide, but use bird species-specific information to make adjustments to the dimensions. Except for the shed roof, all of the parts can be cut from a 6" wide fence board. (See sidebar: *Common Bird House Measurements*). There is a parts list for each style, and I'll cover each separately. Both are held together exclusively with dowels and on one side, two dowels form

a pivot mechanism allowing the side to be swung open for access to the interior

Traditional Roof

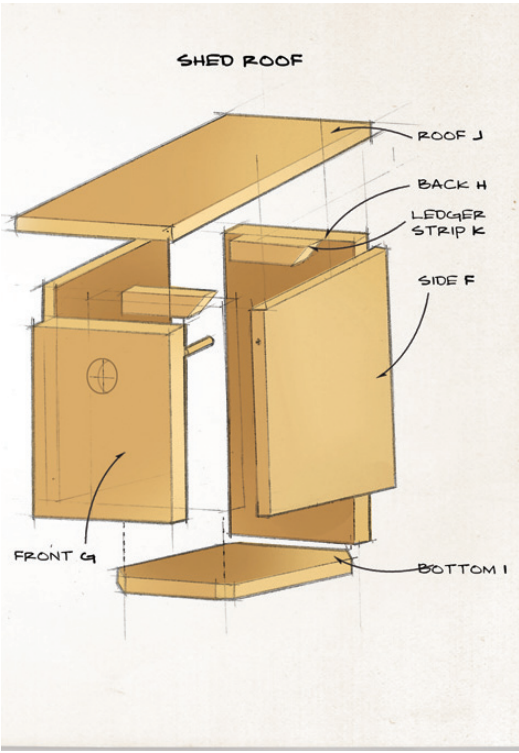
- Cut all of the parts to convenient lengths from a longer board so that they are still safe to handle on the jointer and thickness planer if you are dressing rough lumber. If you choose to leave the lumber rough, skip this step.
- With the material dressed, cut the parts for the sides (A), front and back (B), bottom (C) and roof (D) to length and rip them to width.
- Set your mitre saw to 45° and bevel the top end of the sides. Alternately bevel them on the table saw using a cross cut sled.
- Mark out the angles for the roof on the front and back, they should form a 90° angle at the peak. Cut these with a mitre saw or on a band saw.
- Use a sander to soften the four corners of the base. This will provide a little triangular drainage hole in each corner to allow water a way out.
- Use dowels to glue the two roof sections together at 90°. When the glue has set, trim the longer of the two sides back to the same width as the other side.
- Drill holes for the dowels according to the plan.
- Test fit the pieces together. There should be a ¼" gap between the top of the

sides and the underside of the roof for ventilation.

- Glue up the front, back, bottom and sides. Be sure not to put any glue in the two dowels that form the pivot mechanism. Remember to use epoxy or waterproof glue.
- Clamp everything together and let the glue set.
- Prepare a 1½" square blank (E) for the roof cleat. Apply five-minute epoxy to the end grain as well as the front and back walls of the house at the peak. Push the piece into place and secure it with a clamp. When this has set, use more epoxy to fasten the roof to the cleat.
- Drill a pilot hole for a 1½" #6 brass flat head wood screw in the lower corner of the front to hold the door shut.

Shed Roof House

- Following the same method as in the previous house, prepare enough stock for the required pieces. Cut the pieces for the sides (F), front (G), back (H) and bottom (I) to length from a 6" cedar fence board.
- Using a cross cut sled on a table saw or a sliding compound mitre saw, bevel the top edge of the front and back at approximately 20°.
 - Cut the top of the two sides at an angle of 20° to mirror the slope of the roof.
 - Use a sander to remove the corners on the bottom to provide drainage.



- Drill the holes for the dowels according to the plan.
- Test fit everything. There should be a ¼" gap between the top edge of the sides and the underside of the roof.
- Glue everything up and set it aside. Be sure not to apply glue to the dowels that form the pivot mechanism.
- If you have wide stock, make the roof (J) from one piece. If not, glue it up using waterproof wood glue (such as Titebond III). Bevel the back edge of the roof at approximately 22.5° to protect the end grain from the weather. Leave the front edge square. With the roof installed it will be sloped in and away from the weather.
- Rip two ledger strips (K) from the edge of a strip of cedar at a 20° bevel. Cut this edge about 1" wide from the board. Trim it to 4" and use a band saw to remove the section that will interfere with the door swing. Epoxy these strips in place and then epoxy the roof to the cleat and the top of the front and back respectively.
- Drill a ⅛" hole in through the front into the lower edge of the movable side to accept an L-shaped brass pin as seen in the plan.

MATERIALS LIST (All measurements in inches)					
	Part	Qty	T	W	L
Traditional Roof					
A	Sides	2	¾	4	9 ¾
B	Front and back	2	¾	5 ½	12
C	Bottom	1	¾	4	4
D	Roof	2	¾	5 ½	10
E	Roof cleat	1	¾	1 ½	1 ½
Shed Roof					
F	Sides	2	¾	5 ½	10
G	Front	1	¾	5 ½	8 ½
H	Back	1	¾	5 ½	14 ¾
I	Bottom	1	¾	4	5 ½
J	Roof	1	¾	7 ¼	10 ¾
K	Ledger strips	2	¾	1	4

COMMON BIRD HOUSE MEASUREMENTS (Project measurements in inches)					
	Floor Size	House Height	Hole Height	Hole Diameter	Height of House from Ground
Eastern Bluebird	5 x 5	8 - 12	6 - 10	1 ½	4' - 6'
Western Bluebird	5 x 5	8 - 12	6 - 10	1 ⅞	4' - 6'
Chickadees	4 x 4	8 - 10	6 - 8	1 ⅞	4' - 15'
Purple Martin	6 x 6	6	1 - 2	2 ¼	6' - 20'
Yellow-bellied Sapsucker	5 x 5	12 - 15	9 - 12	1 ½	10' - 20'
Northern Flicker	7 x 7	16 - 18	14 - 16	2 ½	6' - 20'
Robin	7 x 8	8	leave open front		6' - 15'

Mounting

These houses can be mounted one of two ways: on top of a pipe using a flange on the bottom of the house, or by an appropriate method via the back. If you mount it using the back and your mounting surface extends past your roofline, you will need to make up a block of cedar to function as a stand-off. Screw the stand off to the wall and then screw the house to the stand-off from the inside.

Installing Hinges

Look around and take note of the number of hinges that you encounter in your daily activities.

From the time you get up in the morning until you pull away from the curb on the way to work you'll encounter hinges everywhere - on the bathroom door, refrigerator, the kitchen cabinets, the front gate and even getting into your car. Each and every hinge is specifically designed to serve a unique purpose and they all look vastly different from each other. Yet they all serve the same function.

Hinges have been designed for almost every conceivable situation. The variety of hinges available to the woodworker is staggering indeed, and selecting the right hinge and installing it correctly can be a challenge. In most cases, hardware is installed during the final phase of construction after much time has been invested in the project; this is definitely not the time to make a mistake in choosing or installing the hardware. Even though the hinges are installed after the project is complete, you should choose the hinges early in the design phase and purchase them at the same time as the lumber for the project. Some hinges, such as knife hinges, require you to locate and cut the mortises before the case is assembled, so it is best to work from the actual hardware when laying out the location and size of the mortises.

Hinges allow one part of a project to move relative to another, a door on a

cabinet or a lid on a box for example. For the hinge to operate smoothly through its range of motion without binding, requires that the hinge be mounted with a certain precision and an understanding of the geometry involved. Generally, less expensive utility hinges have more play in them, which allows them to operate with a less than perfect installation. However, as you move into the higher end, solid brass hinges, from manufacturers like Brusso and Soss, which are built to much higher tolerances, there are less opportunities for adjustment. Precision hinges like this demand no less than the same level of precision from the maker.

The material that the hinge is made of will impact the final look of your project. Steel hinges tend to be more utilitarian in nature while brass hinges are more suitable to furniture projects. Brass hinges can be stamped, extruded or milled from solid brass. Stamped hinges are thinner, often

the mounting holes are not accurately drilled, and the hinge pin may be poorly fitted to the hinge.

No matter what type of hinge you use, they will all need to have three features. A leaf that mounts to the cabinet, a leaf that mounts to the door, and some form of pivot between them. For the most basic hinge, the butt hinge, this takes the form of two flat leaves with interlocking knuckles held together with a pin. How each of these is designed will dictate where the hinge is to be used.

Butt Hinges

The most common hinge you will encounter is one version or another of the butt hinge. There are many variations, but with all of them the center of rotation is located at the center of the pin. When working with hinges having flat (unswaged) leaves, it is the diameter of the barrel that determines the depth of the

mortise, not the thickness of the leaf. Some hinges are swaged - this changes the relationship between the leaf thickness and barrel diameter and as a result the depth of the mortise.

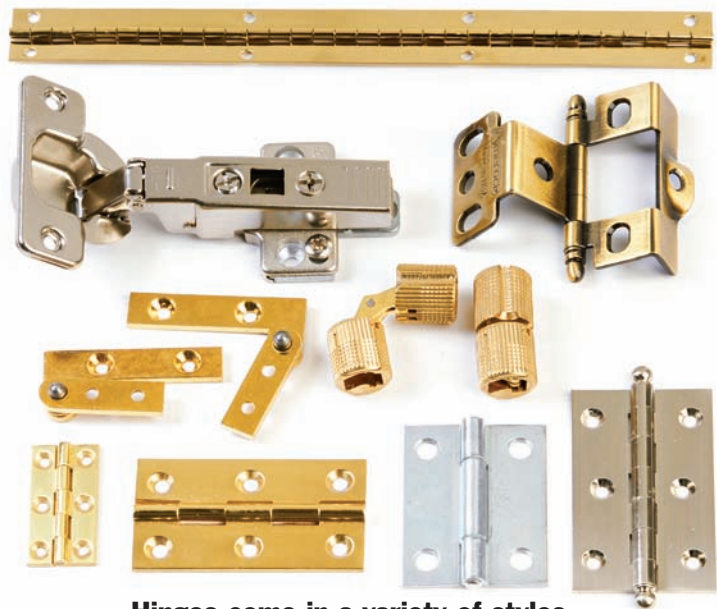
When mounting butt hinges, failure to account for wood movement can lead to a condition where the lid will not close completely – called 'bound hinges'. In most cases having the top and bottom in tight contact with each other when the hinge is installed causes this. As the wood expands seasonally, it forces the front of the box open with the hinge pin providing the pivot. This can also happen when you drive in screws that are off center to the hinge holes. This has the effect of decreasing the gap between the two pieces of wood at the hinge and causing them to be bound.

Butt hinges come untipped (referred to as regular butt hinges) and tipped. For untipped hinges the mortise is cut so that the centerline of the hinge knuckle sits slightly proud of the cabinet front. For tipped hinges locate the knuckle just forward of the cabinet front. For either type of hinge cut the mortise to the depth of the thinnest part of the hinge.

No-Mortise Hinges

No-mortise hinges are a category of butt hinge that does not require a mortise for installation. The two leaves are thin, usually $\frac{1}{16}$ ", and this sets the gap between the lid and the box or an inset door and the cabinet frame. The two leaves nest together, one smaller tab inside a larger tab. You may not need to cut mortises, but the hinge must still be mounted accurately for it to work. There is no measuring involved when hanging inset doors with this method.

To install these hinges make a simple jig to set the location for the hinge and drill the holes. Begin with a piece of wood about 1" square. Find some metal or laminate the same thickness as the hinge leaf,



Hinges come in a variety of styles

approximately 1" x 2", to act as a spacer. Determine the placement of the hinge on the door. Cut the wood to the same length as the distance from the bottom of the hinge to the bottom of the door. Fasten the spacer to the bottom of the wood block. Place the jig against the bottom edge of the door and place the hinge against the top of the jig and register the barrel against the edge. Drill holes for the screws in the two countersunk holes that are exposed. Repeat this at the other end of the door. To locate the hinge on the frame, place the jig in the bottom corner of the frame. Place the hinge on top of the jig and register the barrel against the edge. This time, use a self-centering bit to drill holes in the non-countersunk holes. Your door should be the height of the opening minus twice the hinge leaf thickness. Mount the hinge to the door with the proper undercut hinge screws, and then the door to the cabinet.

overlay the cabinet sides. Doors can open 180°. Overlay hinges are used on both overlay and inset doors. They enable doors to open 270° and 180° respectively. These hinges require careful measurement and fitting to mount properly. (For more information on installing knife hinges, see October/November '06 Issue #44, page 6 and February/March '07, issue # 46, page 7.)

Barrel Hinges

Barrel hinges get their names from their barrel shape. They have a hidden hinge mechanism and have the virtue of being completely invisible when closed. These are great hinges for jewellery boxes and small chests, and come in a variety of diameters. Careful layout and drilling of the hole is important, as the only axis of adjustment is how far it is inserted into the hole. When installing these, use a drill press with a tall fence. The depth of the hole will depend on the diameter of the hinge, so confirm this with the hardware at hand. Either lay out the holes on both sides individually or lay out one side and use some dowel centers to transfer the

Knife Hinges

Knife hinges were popularized by James Krenov and reward careful installation with a clean unobtrusive appearance. The straight knife hinges are used on doors that



Cutting mortise with a router



Cutting mortise with a chisel



Cleaning up with chisel

Easy Installation of European Style Hinges



Mounting European hinges can be confusing to the novice woodworker. Fortunately Veritas Tools has addressed this with the Veritas Hinge Boring Jig. This is a stand-alone unit designed to locate and drill the cup holes for the hinges. It also functions as a guide for drilling the screw plate mounting holes in the cabinets.

To use the hinge-boring jig to drill the cup holes, set the depth of the 35mm carbide cutter to that of the hinge cup you are working with. The two brass micrometer fences on either side of the jig are used to adjust the setback of the cup hole.

With the fences turned all of the way in, the cup hole will just break through the edge of the door. For every complete turn, the fence moves out 1mm so setting the proper setback for your application is simple. With the fences adjusted, they are locked in place with brass set screws. Some applications call for the more compact flap hinges that require the mounting holes to break through the edge of the door and it's adjoining member. By using the supplied spacers the necessary breakout can be easily achieved.

A hook gauge is used to set the distance in from the edge of the door and can be positioned to either side for use on both ends of the door. The base also comes marked out and dimpled and ready to be drilled out as a guide for drilling the holes for the screw plates.

This is a well thought out jig that makes drilling the holes for European style hinges simple, accurate and repeatable. The carbide bit cuts cleanly and is easily replaceable should it ever require it. If there are any European hinges in your future you owe it to yourself to check out this jig.

measurements to the other side. To ensure that both halves come together, use a fence against two adjacent edges. Once the holes are drilled there is no adjustment possible. To install the hinge, clamp the box and lid in the open position using a spacer between the two if needed. Open the hinge to its fully open position and insert it into both halves at once, this keeps the arm that the hinge swings on perpendicular to the side.

Piano Hinges

Piano hinges are more functional than beautiful and are best left to projects that don't demand a great deal in terms of appearance from the hardware. They are especially effective on chests and toy boxes, and could not be easier to mount. In the case of a toy box simply cut the back panel for the box a little shorter than the front and sides. Measure the barrel of the hinge and subtract $\frac{1}{8}$ " to determine how much you need to take off the back of the box. Subtracting $\frac{1}{8}$ " ensures that your top will always close properly at the front of the box.

European Hinges

These are the hinges you will find in most modern kitchen and bathroom cabinetry. They are completely hidden when the door is closed, and are completely adjustable making it easy to adjust the door for a perfect fit after installation. These hinges come in many different configurations and allow for a wider range of design options. They will work with either framed or frameless cabinets, for inset doors, or overlay doors. They also come in variations for mounting at different angles, for blind corners and for situations where the door must be fully off to the side to allow access to a drawer. In a typical kitchen project several different types of hinges may be used. To avoid confusion it is best to use hinges from one manufacturer for the entire project.

European hinges come in two pieces; the piece with the cup mounts to the door and the screw plate is attached to the side of the cabinet. The mounting holes are typically 35mm in diameter, but check the



Use centering bit to drill holes

details included with your hardware. Most manufacturers also make specialized jigs for locating the holes for their particular hinges. All you have to do is mark the centerline of the hinge and align the jig with the line and drill the holes. Such jigs make sense if you will be using many of one brand of hinge exclusively.

The Right Tools Help

There are a number of tools that will make installing hinges easier and more accurate. Templates for use with router jigs can guide a straight bit to cut a perfect mortise in no time at all. If the hinge you are using does not have radiused edges, you will need to square the edges of the routed mortise. This can be done with a sharp chisel. Try to direct the chisel down into the mortise rather than along the bottom of the mortise as this can have the unintended effect of having the chisel follow the grain and take out a larger chunk of the side. Veritas Tools make a specialized corner chisel for just this purpose. Place it on the corner, tap it with a mallet, lift out the waste, and you are left with a perfectly square corner in no time.

Possibly the single most useful tool you could have for mounting hinges is also one of the least expensive; a set of centering bits. These are special spring loaded bits that are self-centering in holes on hinges. Place the tip of the bit in the hole and as you press down, a drill bit is exposed and drills a pilot hole of the correct size and depth. When you insert the screw it will be centered in the hole and won't have the tendency to pull the hinge out of alignment.

Not all hinge screws are created equal. Some hinges require very specific screws for them to operate properly. If the wrong screw is used, it won't seat properly in the leaf and may conflict with the other side when the hinge is closed. For applications like the no mortise hinges, and other applications where a lower profile is required, use special hinge screws with undercut heads. The shoulders on these screws have been cut back to allow them to sit lower in the hinge.

- CWM



Polish dull hinges



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Corded Circular Saws

While I use a table saw for most accurate crosscuts and rips, you can't beat the convenience of a circular saw for some of those rougher cuts, like when cutting a small piece off the end of a long board. Cutting full sheets of plywood on the table saw isn't easy, so I also use a circular saw to cut sheets down into slightly oversized panels, ready to be trimmed to final sizes on the table saw later. And of course, there is the inevitable on-site work where a circular saw is vital. This tool excels on the job site for all kinds of tasks like framing, building decks and so on. Here are some of the features you should consider when looking to purchase a circular saw.

Weight and Power

Sometimes power comes at a price – increased weight. Unless you're cutting through a lot of hardwood or really thick timbers, power might not be so important. Still, getting the most powerful saw in a lightweight package is always an advantage. Among the most common entry level corded models, amperage can vary from as little as 10 amps right on up through 15 amps. You can't get higher than 15 amps on a regular 120 volt plug, so that is where these machines top out. As for weight, they can vary from 9½ lbs. up to almost 20

lbs. An average weight at the 15 amp level is about 10 lbs., which isn't bad for the average woodworker. Depending on your size and strength, you might not mind a heavier model.

Bevel Capacity and Stops

While circular saws are most often used at 90°, angled cuts do come up from time to time. The ability to angle the blade to 45° or more is important. Having pre-set stops for common angles is handy to prevent guesswork, although I wouldn't expect stops to be perfectly accurate. Most entry models will bevel to 45°. Some bevel to 50° or 51.5°, and I've seen models that tilt up to 56°. Stops are most common for 0° (vertical) and 45°, but some models also have a stop for 22.5°. Many models have no stops at all, so you'll need to use some form of an angle-finding tool to set the blade angle.

Depth of Cut

If you need to cut through thicker boards, having a large depth of cut capacity is important. The most common blade size has a 7¼" diameter, but maximum cut depth varies from one model to another. This varies depending on whether the blade is set vertically (90°) or at 45°. Of the

different models I looked at, the maximum depth of cut at 90° varied from about 2¼" to 2½". At 45°, maximum cutting depth varied from about 1½" to 1⅝". You aren't likely to need the full capacity very often, but it's great to know you have it when you need it. Sometimes a really thick beam can be cut by cutting half-way through from both sides, which might require the full depth of cut. On the downside, you can expect a fair bit of blade flex from the typically thin 7 1/4" blades at full cutting depth, especially with hardwoods.

RPMs and Noise

Motor RPMs vary a fair bit from one model to another. In reviewing a number of models, I saw RPM ratings from about 4,600 to 6,000. Higher RPMs might help you hog through those difficult boards, giving the tool more momentum before bogging down. But some of those higher RPM models can let out a high-pitched scream. Manufacturers should be able to provide you with decibel ratings at a specific distance. In any event, wear hearing protection with these power tools. Remember your safety glasses too.

Left or Right Blade

Most circular saws have the blade on the

right and are designed for a right-handed person. This makes it handy for smaller crosscuts where the tool should ride on the board, not the off-cut. The off-cut falls away to the right of the blade. The right-handed circular saw, though, can sometimes be awkward for ripping on wide panels. In order to push the tool over the main panel, not the off-cut, one has to reach a lot further and can't always get a good look at the cut line. Some manufacturers are now making circular saws with the blade on the left and marketing them as having a clearer sight-line even for right-handers. I'm not sure if I would want that design for cross-cutting, though, and that happens more often on the job site. Whenever I can't reach any further across a wide panel, I go around to the other side and pull the saw. It might seem awkward, but most saws have two handles and it is just as easy to pull the saw on longer cuts.

Ease of Blade Changes

Everyone wants a tool with convenient features, and blade changes are just one of them. The least convenient type of blade change systems requires two wrenches – one to lock the spindle and a second one to loosen the nut. The more convenient system has a spindle lock, which is usually a button or lever that locks the spindle in one place. In that case, only one wrench is required. At least one manufacturer has now come out with a completely keyless blade change. This will probably become more common in future. But until then, keep the wrench close to the machine so that you don't lose it.

Cord Length

It seems basic, but a long cord saves you from needing an extension cord every time. Some manufacturers, however, have

taken a different view. Some believe that an extension cord is inevitable. So rather than having a medium length cord on the machine plus an extension cord, they simply provide the tool with no cord at all. The extension cord plugs directly into the tool so that you aren't dragging a large plug around with you, which is likely to snag on something and pull the cord apart. This is an interesting viewpoint that is getting more popular in the construction trade.

Edge Guides

Some circular saws come with an edge guide which allows you to make straight cuts by following along an existing edge. You will also see such a feature with some jig saws. Often these 'add-on' jigs are pretty light-duty and don't work very well. But if you find one that has some weight to it and a good sized span, it could come in handy. Remember that circular saws aren't just for through cuts. They can also be used to cut a dado or groove. Cutting a groove parallel to an existing edge is something for which an edge guide would be very useful. If an edge guide isn't available, a straight edge clamped to your work piece works very well. Make your own with a piece of wood or look at the many commercial straight edges available. These are great for routers, circular saws and other power tools.

Other Features

There are a few other features you might find on some circular saw models. For example, an electric brake will stop the spinning blade quickly after making a cut, making the tool a little safer. However, you aren't likely to find this feature on an entry level model. Yet another feature some models advertise is a powerful blower that

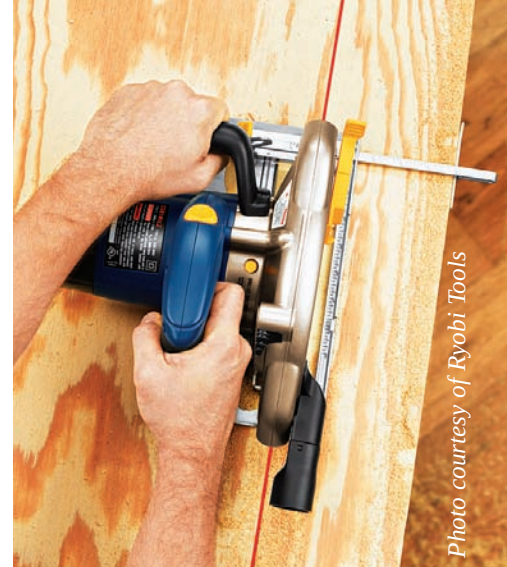


Photo courtesy of Ryobi Tools

blasts air through the cutting area, giving you a clearer view of the cut line. In general, many manufacturers are now designing circular saws with an improved sight-line to the cutting action.

Before buying a circular saw, give it a test run if you can. At the very least, hold it in your hands to see if it has a comfortable feel. See if its weight seems reasonable compared to others. Can you see the cutting area clearly? Sometimes the best tool is simply the one that just feels right.



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- Belt Sanders
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7 1/4" CORDED CIRCULAR SAWS



Black and Decker CS1030L

- \$69.95
- 13 amps, 5,000 RPMs, 15 lbs
- Bevel Range: 0° - 45°
- Bevel Stops: 0°, 45°
- Cut Depth: 2 3/8" at 90°; 1 13/16" at 45°
- 6' power cord, 2 yr warranty
- On board laser, bail handle
- Incl: 18 tooth blade, wrench

www.blackanddecker.com



Bosch CS20

- \$179.00
- 15 amps, 5,600 RPMs, 10.4 lbs
- Bevel Range: 0° - 56°
- Bevel Stops: 0°, 22.5°, 45°
- Cut Depth: 2 1/8" at 90°; 1 1/8" at 45°
- Plug ext cord into unit, 3 yr warranty
- Saw hook, blower, magnesium guards
- Incl: 24 tooth blade

www.boschtools.com



DeWalt DW368

- \$149.99
- 15 amps, 5,800 RPMs, 9.5 lbs
- Bevel Range: 0° - 56°
- Bevel Stops: 0°, 22.5°, 45°
- Cut Depth: 2 3/8" at 90°; 1 3/4" at 45°
- 9' power cord, 3 yr warranty
- Helical gears, magnesium shoe
- Incl: 18 tooth blade

www.dewalt.com

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7¼" CORDED CIRCULAR SAWS



Hitachi C7SB2

- \$129.00
 - 15 amps, 5,800 RPMs, 10.1 lbs
 - Bevel Range: 0° - 55°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1⅞" at 45°
 - 8' power cord, 5 yr warranty
 - Diecast aluminum shoe, spindle lock
 - Incl: 24 tooth blade, case
- www.hitachipowertools.ca



King 8307L

- \$49.99
 - 11 amps, 4,500 RPMs, 10 lbs
 - Bevel Range: 0° - 45°
 - Bevel Stops: 0°, 45°
 - Cut Depth: 2½" at 90°; 1¾" at 45°
 - 7' power cord, 5 yr warranty
 - Incl: 24 tooth blade
- www.kingcanada.com



Makita 5007FAK

- \$270.00
 - 15 amps, 5,800 RPMs, 11 lbs
 - Bevel Range: 0° - 45°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1¾" at 45°
 - 1 yr warranty
 - Electric brake, LED, aluminum shoe,
 - tooth thin kerf blade, rip fence
- www.makita.com



Milwaukee 6375-21

- \$257.00
 - 15 amps, 5,800 RPMs, 19.5 lbs
 - Bevel Range: 0° - 50°
 - Bevel Stops: none – has a bevel scale
 - Cut Depth: 2½" at 90°; 1⅞" at 45°
 - 10' power cord, 5 yr warranty
 - Magnesium shoe, spindle lock
 - Incl: 24 tooth blade, case, rip fence
- www.milwaukeetool.com



Porter Cable 325MAG

- \$239.00
 - 15 amps, 5,800 RPMs, 9.6 lbs
 - Bevel Range: 0° - 50°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1⅞" at 45°
 - 9' power cord, 1 yr warranty
 - Electric brake, magnesium shoe
 - Incl: 24 tooth blade
- www.portercable.com



Ridgid R3203 (6½" model)

- \$119.00
 - 15 amps, 5,800 RPMs, 10.5 lbs
 - Bevel Range: 0° - 51.5°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1¾" at 45°
 - 12' power cord, 3 yr warranty
 - Aluminum shoe, magnesium guards
 - Incl: 24 tooth blade, rip fence
- www.ridgid.com



Ryobi CSB141LZK

- \$89.95
 - 14 amps, 5,500 RPMs, 12 lbs
 - Bevel Range: 0° - 51.5°
 - Bevel Stops: 0°, 15°, 30°, 45°, 51.5°
 - Cut Depth: 2½" at 90°; 1⅞" at 45°; 1⅞" at 51.5°
 - 10' power cord, 2 yr warranty
 - Incl: 24 tooth blade, steel shoe,
 - spindle lock, dual lasers
- www.ryobitools.com



Craftsman 10860

- \$89.97
 - 14 amps, 5,000 RPMs, 10.25 lbs
 - Bevel Range: 0° - 45°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1⅞" at 45°
 - 8' power cord, 1 yr warranty
 - Steel shoe, spindle lock, laser
 - Incl: 24 tooth blade, rip fence, case
- www.sears.com



Skil 5450-01

- \$69.99
 - 13 amps, 4,600 RPMs, 13.9 lbs
 - Bevel Range: 0° - 45°
 - Bevel Stops: 0°, 22.5°, 45°
 - Cut Depth: 2½" at 90°; 1⅞" at 45°
 - 6' power cord, 1 yr warranty
 - Anti snag lower guard, safety trigger
 - Incl: 40 tooth blade, case
- www.skiltools.com

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- Visit our website: www.ForrestBlades.com

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Code WM

Carving Green Wood

Many carvers go to great lengths to avoid using green, freshly cut wood. A common concern is cracking or checking because the wood is wet. Instead, carvers will pay for kiln-dried wood and either use it in small blocks or laminate blocks together for a larger project. In my view, both these options have a down side: the size of available kiln-dried wood dictates the size of the project; and, large laminated blocks preclude the more effective use of grain possible with wood in-the-round. To have the most options, a carver should learn how to carve green wood.

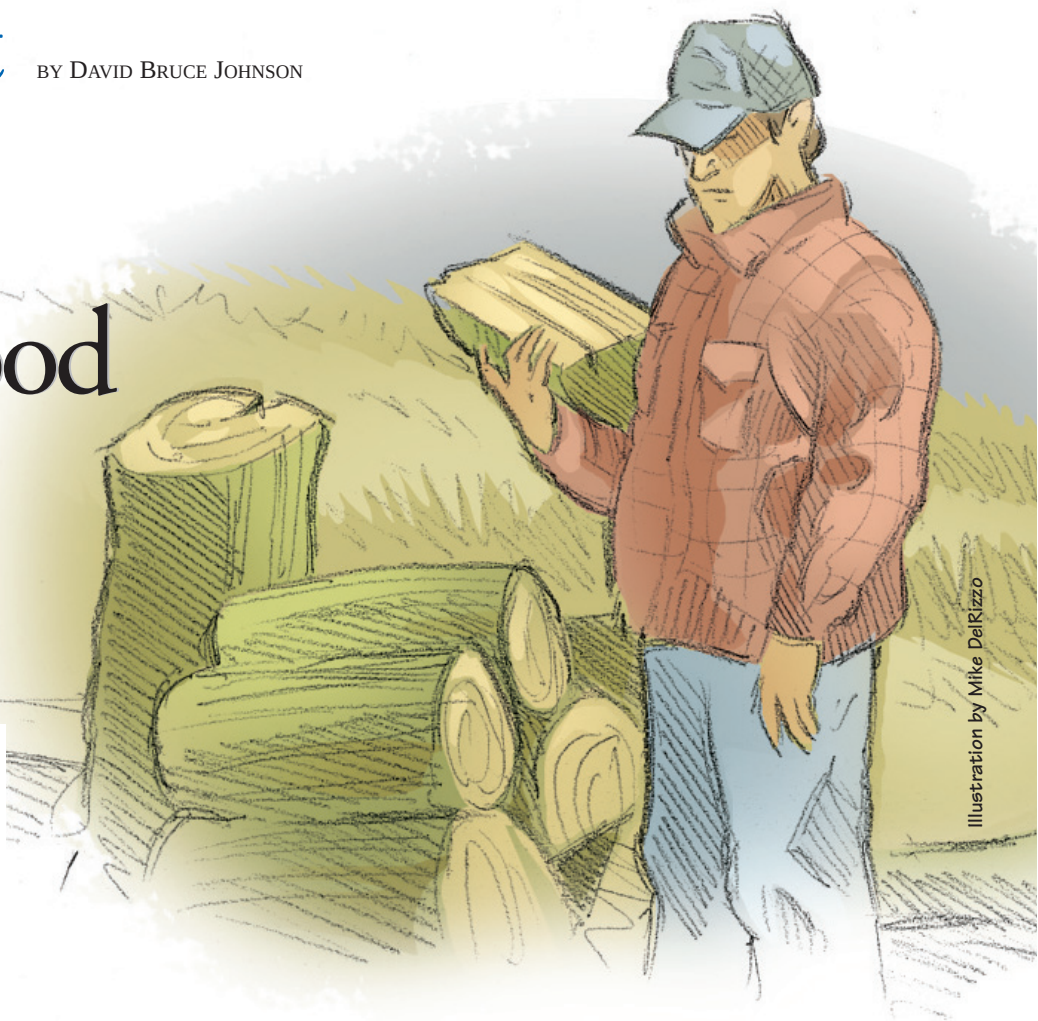


Illustration by Mike DelRizzo

The cracking of wet wood is reasonably easy to prevent if one understands why it happens. In this regard, it is interesting to note that most carvers know to seal the end of logs to inhibit cracking. Perhaps it isn't clear why this helps. Consider a piece of wood as a container filled with water. If the container shrinks too much, the water inside will burst the sides or spill over. Think of the outside of a log as that

container. If it dries, it will shrink. If it shrinks too much, the volume inside the log (which is still swollen with water) will break the outside. That is, the wood will crack. To prevent this undesirable drying, shrinking and cracking, the simple solution is to keep the outside of the log wet. In other words, keep the water in the wood.



Seal the ends



Un-sealed wood cracks



Mist and cover work between carving sessions

Many carvers believe that to carve, they need dry wood, but I ask, "How long are you prepared to wait?" I have had black walnut that was stored in a barn, out of any weather, for more than 20 years. When I started to carve it, the wood was still wet only 2" from the outside. My method is to get rid of as much wood as possible while it is wet, because you don't care about that part of the wood anyway. The more wood you remove the less water there will be in the log and the less likelihood it will crack. Then, during the carving process, the task remains to control the distribution of water inside the wood.

To control the wood's moisture content, one is actually controlling the rate of evaporation. As I noted earlier, if the wood dries too quickly, the outer layer shrinks too much. Then, because the inner wood is swollen with water, it forces the outer layer to crack. During the carving process, some water will always evaporate. Using a spray bottle periodically to dampen the piece will inhibit rapid moisture loss. At the end of each carving session, the work-in-progress should be sprayed lightly and covered with a plastic bag. The water in the wood will always seek a balance of even distribution. Enclosing the carving in a bag gives moisture deep inside the wood time to migrate toward the drier outside. If progress is going to be delayed for a lengthy period, you can also coat the piece with a light oil, even mineral oil will do. Long delays are not a problem; however, wood enclosed too long may grow mold. It is a good idea to remove the plastic bag every day for a short period, then replace it over the piece.



Cover a crack with tape

When your carving is complete, the routine of enclosing the piece for a prolonged period (overnight or throughout the day), turning the plastic bag inside out, and replacing the cover should be continued. It is also useful if the enclosed carving can be placed in a sunny location. By doing this, one is essentially creating a solar kiln in which the carving is being dried gradually.

Despite all the precautions one might take, some cracking may still occur. If so, to minimize the problem, soak the area by placing a damp cloth over the crack. Sometimes, this action might not be possible while you are carving. An alternative is to cover the crack with a piece of masking tape thus preventing more moisture loss from inside the crack. At the end of the day, soak the spot with water. The water applied on the outside, and the water migrating from the inside will usually swell the wood and close the crack.

When a crack persists at the end of a project, it should be filled to prevent moisture from evaporating inside the crack and causing it to expand. NEVER fill a crack with a hard substance like epoxy. Such materials merely prevent the crack from ever closing. Instead, use wax. I have a box of children's crayons (128 colours) from which to choose the exact colour of the wood. It is even possible to match wood grain if desired. One can fill the crack with the wax just like drawing.

After the carving is complete and a finish is applied, the moisture content in the wood will be trapped. Some evaporation



Fill cracks with wax not epoxy

and respiration will always occur with wood; however, the moisture content will seek a balance throughout the wood and cracks will close naturally. When they do, the wax will be squeezed out and can be scraped off – something that can never happen with epoxy or glue.

By learning to carve green wood, the cost of buying kiln-dried wood can be avoided, the size of a project need not be confined by the size of the block, and the beauty of the wood grain can be utilized most effectively. Cracking, and its prevention, is all about controlling moisture loss and the distribution of moisture in the wood. With this knowledge, you can now use all of the wood that you have accumulated, and have been waiting to use.

DAVID BRUCE JOHNSON
www.davidbrucejohnson.ca



'The Boxer' carved from green wood

Hand Saws

Many years ago I had to make a saw cut for some long since forgotten project, and although I've forgotten the exact nature of the cut, I remember the saw binding, sticking and flexing.



Frustrated, I tossed the saw aside and swore I'd stick to power tools from then on; they were obviously more superior, and had replaced the old, cantankerous handsaws of the past for a good reason.

Today however, I have tempered my view of hand tools and I am as likely to reach for one of my handsaws as I am to head for a powered version; often it's easier and faster, and with the right saw, more accurate to make the cut by hand. I have learned that specific saws are designed to excel at specific cuts and it's all about choosing the right saw for the cut.

'General purpose' is a term that tends to be a bit of a misnomer when it comes to handsaws. You will find that specific tasks require specific saws. There are two major factors that affect the performance of virtually all saws, the tooth pattern (rip or crosscut) and the amount of set of the teeth.

Rip Saws

Rip saws are designed to rip with the grain, along the length of a board. They tend to be about 26 inches long with 5

teeth per inch, the flat-topped teeth tipped forward toward the front of the saw, which essentially turns them into little chisels, chipping away at the wood as the board is ripped down its length. A better quality rip saw will be taper-ground, with the blade left thickest closest to the teeth for strength and thinner towards the top leading edge to keep it from binding in the cut.

Crosscut Saws

Crosscut saws are designed to cut across the grain, along the width of a board. These saws tend to be within the 22 to 26 inch range and will have 7 or 8 teeth per inch. The teeth on this saw are designed to act like knives and sever the wood fibres while clearing the waste between them. Crosscut teeth are sharpened to points to accomplish this task, unlike the rip saw teeth which are left to ride flat against the

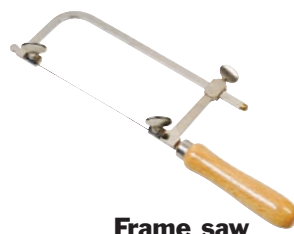
bottom of the kerf. Crosscut saws tend to have a more aggressive set in order to keep them from binding.

Set of Teeth

How a saw performs in a cut is a function of the amount of set the teeth have. Set is the amount that the tooth is bent to one side of the centerline of the blade. The more the teeth are bent away from the centerline, the more set the saw is said to have. The maximum outside distance of the teeth will determine the width of the kerf. The kerf is the area of wood that the teeth remove. In general, the wetter the wood, the wider the set should be to clear the wet stringy fibre from the blade and keep the blade from binding in the cut. For dry wood the set could be reduced considerably without affecting the cut as the fibres will tear more easily and be



Flush cut saw



Frame saw



Veneer saw

easier to eject. For example, on a dovetail saw the most control is achieved with a bare minimum of set. With this type of saw, the minimum set is ideal as the sides of the cut then naturally support the saw, keeping it cutting straight and true. Saws that are designed for flush cutting have no set at all. These can be used up against a finished surface without causing any damage to the adjacent surface.

Number of Teeth

Saws are often referenced by the number of teeth (or points) that they have per inch of saw blade. In general, saws with more teeth (and less set) make finer cuts, but they cut more slowly. Saws meant for ripping typically have fewer teeth.

Backsaws

A backsaw has either a steel or a brass spine along its back, opposite the teeth. This spine stiffens the saw, giving it strength while allowing it to be made from thinner, harder steel than is normally used in a basic handsaw. This category of saw includes dovetail and tenon saws.

Dovetail saws are likely the most useful. They are from 6 to 10 inches long with anywhere from 14 to 22 teeth per inch. What you want is a saw with a very narrow set so that it will cut a fine kerf. Dovetail saws can have one of three different types of handles: closed, open, or a cylinder-handled gentleman's handle. These saws are used for very fine work so when choosing one pay particular attention to the handle and the way it balances in your hand. I find that the gentleman's style handle doesn't offer enough control for fine work. My preference is for the open style handle.

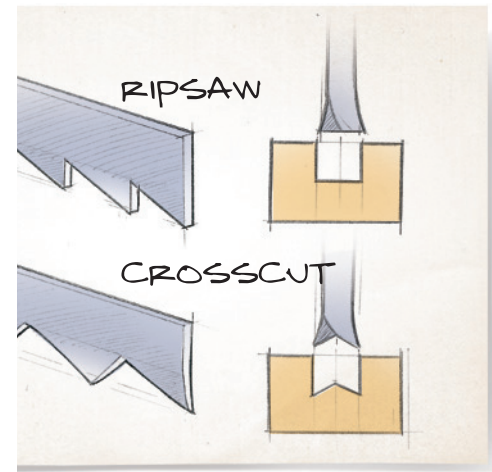
Tenon saws are larger than dovetail saws, with a blade length of 10 to 16 inches wide, a depth of 3 or 4 inches, and 12 to 15 teeth per inch. Aside from cutting tenons, this saw makes an excellent saw for finish carpentry.

Frame Saws

Western style saws are great for cutting in a straight line, but there are times when you will need to make a curved cut. This is where a coping or frame saw will be useful. These saws consist of a thin flexible blade, much like a section of band saw blade. In use this blade must be held in tension in a frame, which can be made of wood, metal or a composite material. There are three basic styles of frame saws and they all function the same way. The largest is a traditional wooden frame saw, for cutting thick stock. Coping and fret saws are much smaller, and used for precision cutting of thin stock. Some of these smaller saws accept scroll saw blades. With scroll saw blades you have access to a wide variety of tooth styles to match the work at hand. I use a small fret saw to remove the waste between the pins when hand cutting dovetails.

Japanese Saws

Unlike Western saws that cut on the push stroke, Japanese saws work on the pull stroke. This particular feature tends to give the woodworker better control. When you pull the saw the blade is under light tension, which reduces the chances of crimping the blade. Japanese saws are made from harder, thinner metal, which leaves a narrower kerf than most Western saws. The teeth are tempered, which means they stay sharp longer, but are nearly impossible to sharpen. Fortunately you can replace the blade on most Japanese saws when they become dull. The dozuki is the Japanese equivalent of the Western back saw. It was originally designed for cutting shoulders for tenons, but with its rigid back it is pretty much perfect for hand-cut joinery techniques such as dovetails. This saw tends to be 8 to 12 inches in length with about 26 tpi.



The ryoba saw combines the functions of a rip saw and crosscut saw in one blade. In Japanese, its name means 'double'. The crosscut teeth are on one side of the blade, and the rip teeth are on the other. You could saw all of the way through a piece of wood with this blade, but the trailing teeth on the second edge would roughen the cut edge and bind in the cut. This saw comes in varying lengths. Try the smaller ones for joinery and the larger ones for general cutting.

The azebiki is a type of ryoba saw that is designed to make plunge cuts. The blade has a curve in it, allowing you to start a cut in the center of a board for a mortise or to cut a hole in the center of a panel. The curve also helps to pull the sawdust out of the cut as well.

If you need to flush-cut some dowels or wooden plugs, then the kugihiki is the saw you might like to take a look at. It has a super-thin, flexible blade without a back to stiffen it. Another very important feature in this particular saw is that it has no set to its teeth – the saw will sit flush on your surface and won't scratch it. A version of this type of saw is commonly available at most retailers.



Multipurpose Saws

For rough cutting 2 x 4s and sheet stock you really don't want to use an expensive backsaw or Japanese saw. There are quite a few inexpensive, hybrid saws on the market that are suitable for both ripping and crosscutting. These saws, also called 'toolbox' or 'utility' saws, generally have hardened, Japanese-style teeth that cut on both the push and the pull strokes.

To Cut to the Chase

No matter which saw you buy, carefully think about what task it will be used for. There are many more saws out there than we've covered in this article. Find one with a quality blade and a handle that is either comfortable to start with or can be modified to fit your hand. Remember that a quality hand saw is a tool you will use for years. The right tool will feel like an extension of your hand, cut clean and straight with a minimum of effort and be a pleasure to use. In addition to being much quieter and more pleasurable to use than a screaming power saw, they are a much safer alternative because they are human-powered, and that is especially valuable when working with children in the shop.

Hand saws are available at:

European Handtools	euclideanhandtools.com 888-222-8331
Lee Valley	leevalley.com 800-683-8170
Morley Miller Machinery	morleymillermachinery.com 519-448-1361
Tegs Tool & Machinery	tegstools.com Barton 905-545-5585 Upper James 905-388-0784

Lee Valley Saw Guide and Dovetail Saw

Hand-cut dovetails are the hallmark of fine, hand crafted furniture, yet many woodworkers question their own abilities in the face of such a challenge. The Veritas dovetail saw and guide is an excellent guide to help you meet this challenge. Mark the tails and pins on your stock, and then clamp the stock in a vise, mount the guide on the stock, align it with your marks and tighten the thumbwheel on the back of the guide. With the guide firmly clamped in place, set the saw on the mark and against the side of the guide. A rare earth magnet holds the saw in place while a generously sized surface covered in a low friction material ensures that the saw stays correctly aligned; the saw easily makes a straight, flawless cut at the correct angle. The clamp that holds the guide to the board mounts in two positions; one establishes the correct angle for the pins, the other for the tails. This is by far the easiest way we've found to cut dovetails for small boxes. Add a good set of chisels and a fret saw, and with practice you'll be cutting flawless dovetails in less time than you thought.

- CWM



continued from page 2

Good day Paul

It was a pleasure to meet you at the Ottawa Wood Show.

I was at that show looking for a shadow box plan, to display military medals that I court mount for veterans, serving members of the military and police forces; and there, right before me was the cover of issue #44. It was exactly what I was looking for.

Of course I immediately took out a subscription so that I could get my hands on that particular issue.

I have enjoyed reading issue #44, and look forward to upcoming issues.

As I mentioned, I court mount medals and have done a number for members of the Canadian Forces and Police Forces.

Should any subscriber have medals they would like to have court mounted or replaced they can contact me: barrackbox@hotmail.com.

Thanks again, Colin Lyon, Rockland, ON



Dear Paul and Linda

I'd just like to say how much I enjoy your magazine. Even though I can't build all of the great ideas I see, nor afford all of the cool woodworking tools to make the jobs easier or quicker, I do okay with just a drill, table saw, mitre saw, jig saw and palm sander.

I made a smaller version of the hat/coat shelf from your February/March 2007 issue #46, and it turned out great.

The fishing rod stand in the same issue is next on my list. Keep up the great work.

M Homer, Burford, ON

Canadian Woodworking

Thanks for your eNewsletter. I have received several of them to date, and learn tips and techniques from each one.

Your 'Readers Showcase' which shows photos of reader's projects, are inspiring to me to do better, and to stretch out more.

Please keep up the good work.
G. Douglas, Oklahoma City, OK.

G. Douglas

I'm glad that you are enjoying our eNewsletter. Make sure to send us some pics of your latest project.

Paul

Paul

I look forward to your eNewsletter every month. A breath of fresh air, away from business, one morning a month.

Great ideas and a good look at new tools and time savers.

I have purchased a few items because I saw them in your newsletter and I have not been unhappy with a purchase yet.

KEEP IT UP!

G. Thorn, Toronto, ON

Publisher's Note:

To see any of the past 32 eNewsletters, or to sign up for your FREE eNewsletter subscription, go to:

canadianwoodworking.com/NewsletterTOC.php

woodworkersgallery



Featured Project

This 'Floating Top' table was made by Rob Jackson of Stratford, Ontario.

It is made of Walnut and Padauk with Pau Amerello accents.

For more photos and construction details:
canadianwoodworking.com/forum/vbpicgallery.php?

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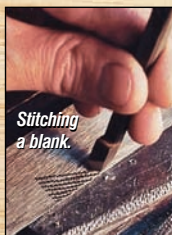
- A. 62W30.10 150mm (6"), grain 15 \$93.50
- B. 62W30.12 175mm (7"), grain 13 \$82.50

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Some Days



Illustration by Mike DelRizzo

Some days it doesn't pay to get out of bed and if anyone ever invents a machine to notify you as to which days those are, I'll be first in line to buy one. Heck, I'll even buy the prototype if I have too.

As anyone who owns a woodworking shop in their basement or garage, or who works at woodworking professionally, knows that sooner or later, something is going to go wrong somewhere. Hopefully it will only damage a bit of precious wood, or dull a tool you just spent six hours sharpening. Occasionally however, an event or series of events will make you question not only why you are involved in woodworking, but why you got out of bed at all.

I was the owner/operator of a small custom furniture shop in the Yukon. One morning, as was my habit, I arrived at the shop and put on the pot of coffee and proceeded to sweep and generally clean up before starting my day. The coffee still wasn't ready when I finished, so I fired up the tablesaw to finish a ripping job I had started the day before. I was ripping clear red cedar into 1" square boards, twenty-two feet long, for a boat project. All went well for a while and I was startled to hear a loud bang somewhere behind me and then the board vanished. The sequence may have been off but that's the way I

remember it. I stood there staring stupidly at the empty saw and wondering just how it was that a 22 foot board could simply vanish.

It took awhile but eventually I put the missing board together with the loud bang, and walked to the back of the shop 35 feet away. Standing against the wall was my plywood rack, complete with a couple sheets of $\frac{3}{4}$ " birch plywood. Projecting 17 feet out of the plywood was my lost cedar board. The other five feet were on the other side of the plywood. I felt a little sick about the close call I had just had so I figured I'd do something a little safer for a while.

I grabbed the vacuum to clean up the shavings from the turning class I had put on the night before. I heard a rattle in the hose but thought nothing of it since little wood pieces are getting sucked up all the time. I heard it hit the impellers and instantly went blind. Well, not actually blind. I just couldn't see. From the smell I figured it wasn't a piece of wood but a

bottle of cyano acrylate that had been sucked up and then shattered inside the vacuum. The fumes from the glue had instantly reacted with the moisture in my eyes and made them weep so much that I was effectively blind. The moisture in my nose unfortunately caused the glue to seal off my nasal passages to the extent that I couldn't get any air through my nose at all. I was on the point of passing out when I luckily recalled that my mouth could also be used for breathing.

I decided to go have a coffee and wait for my vision to fully clear up. I staggered over to the counter and poured a cup. I put in the cream and sugar without a hitch but as I reached across for the spoon my arm bumped the cup and sent it crashing to the floor spilling hot coffee down my leg and smashing my favorite cup. I calmly switched off the perk, turned off the lights, left my shop, and crawled back into the bed that I never should have left.



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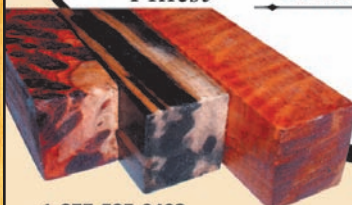
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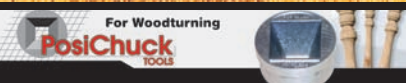
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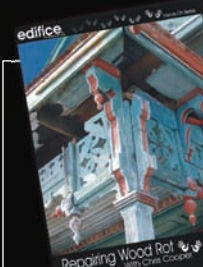
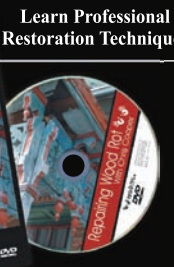
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This tenoning jig cuts tenon cheeks on rails safely and accurately with your table saw. It's designed for a beam type rip fence patterned on the Biesemeyer design. You can make two of these - one for cutting straight tenons and the other for cutting angled tenons at 45° (simply by mounting the arm at 45°). You can, of course, incorporate both these features on a single jig. The jig also cuts half lap and bridle joints. And best of all, you can make the jig from leftover pieces of ¾" sheet stock. Essentially the jig rides over the rip fence. Obviously, if you've added enhancements to your fence you will have to remove them to use this jig. The waste pieces cut from the cheeks are quite thin and can easily fall into the gap between the saw blade and the mouth of the table saw insert. For this reason, consider using a zero clearance insert on the table saw.

Making the Jig

- It's important in making this jig that the tall side (closest to the blade) is exactly parallel to the saw blade. So cut all your parts carefully. Pre-drill and countersink all the screws. The bottom of the arm, against which the stock rests, should be at least ¼" above the maximum extended height of your saw blade. To avoid chipping, screw a sacrificial backer board to the arm - replacing the board when it gets chewed up.

- Before you begin construction measure the height and width of your rip fence. You want the jig to ride smoothly over the rip fence without wobbling. If the jig wiggles too much on the fence try adding some low friction (UHMW) tape to the inner sides of the jig where they contact the fence. Also, leave a ⅛" gap between the base of the jig and the table saw top.

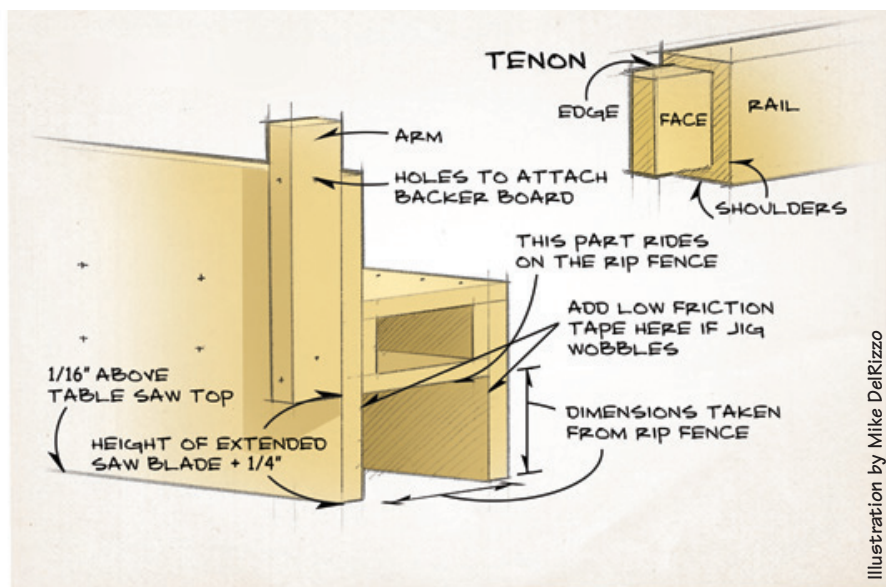
- The length of the jig is not crucial - 6" to 8" is sufficient. However you do want to make it tall enough to support long stock. A 14" high jig will accommodate stock up to 32" with ease. Make your jig to accommodate the size of tenons you cut.

Using the Jig

- This jig is very easy to use. You only need to mark the location of the tenon on one end of your stock. Cut the cheeks on the face side of each piece, flipping the stock end-to-end. Then re-set the rip fence to cut the cheeks on the edge. Again, flip each piece end-to-end. You can clamp the stock to the arm if you wish. However, it's just as easy (and quite safe) to hold the stock tightly against the side of the jig. Don't push the arm to move the jig, you'll likely cause the jig to wobble. Instead push the part of the jig that sits over the rip fence.

- After you cut the cheeks with this jig you cut the tenon shoulders by hand or on the table saw. If you have only a couple of tenons to cut, it's just as quick to cut them with a crosscut saw.

-CWM



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ART'S TOOL SALES

Art's Tool Sales and Service was started by Art & Alice Van Krimpen in 1981. The main focus was placed on the service of woodworking machinery and power tool repair. Since then the company has grown to become the leader for the major woodworking machinery manufacturers in the Niagara peninsula.

We have two store locations, our main store in St-Catharines and our latest store in the city of Welland. With 10,000 square feet of combined showrooms and a staff of six full time and three part time people, we can provide the professional help anyone needs when purchasing machinery and tooling.

Many customers are referred to us with special needs and hard to find tools, that's why we are often called the house of last resort.



We are a family owned hardware business serving the central / eastern Ontario region for over 25 years. Under the ownership of Brad O'Neil we have expanded our product lines. We carry a wide selection of hardware items for do-it-yourselfers as well as for contractors.

We have experienced tremendous growth in our power tool and woodworking machinery departments. With the addition of General/General International line of wood and metal machinery we are able to better serve our customers.

Come and visit our store. Our friendly, knowledgeable staff will be pleased to help you select the right products to suit your needs.



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