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Canadian
Woodworking
DECEMBER/JANUARY 2009
Issue # 57
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Issue #57

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Paul Fulcher

When Linda and I first started publishing Canadian Woodworking magazine in 1999, it was just the two of us. Together we did everything but build the projects – from finding writers and editing their articles, to laying out the pages on our kitchen table.

In those early days, the newly printed magazines were delivered on a skid to our home, and stored in our garage until we could print out the labels and stick them on each copy. It was only after an issue was mailed out that I had enough time to sit and ask myself "Now what can we pull together for the next issue?" We had no bank of articles, no bank of advertisers, and so started every issue from scratch just weeks before it was to go on press.

In all honesty, they were exciting and challenging days that I don't miss.

Now, fifty-seven issues later, we have a cross-country team of employees, contract workers, volunteers, and casual help (a total of twelve, with more on the way). And, we have a bank of articles and projects ready-to-go for the next year and beyond. These days are not nearly as nerve-racking as the initial ones, but that's really ok with me.

So, with all of our team in place, I have created myself a new position (Special Projects) and as a result will be turning this column over to Carl.

I will still be around, and actively working on the magazine, I just won't appear on this page.

Keep in touch.

pfulcher@canadianwoodworking.com

Linda Fulcher

This is both a sad and exciting decision I have made to turn this space over to our editor Carl. I have very much enjoyed learning about woodworking and writing about it to woodworkers. So while I will miss this, I am also very much looking forward to reading what Carl will write. We are about to share with you, the knowledge and love of woodworking that is Carl Duguay, something that we here at Canadian Woodworking have been enjoying these past years. Perhaps we have been a little selfish in keeping Carl to ourselves for so long. From the moment Carl came on board, he became our woodworking-pedia. When we don't understand an aspect of woodworking we have a simple solution: "Call Carl."

Carl unfailingly provides us with concise, clear answers. The magazine has grown to cover more and more complex plans, and techniques, under Carl's guidance and now I have come to realize that it is time that I get out of the way, and let you and Carl have more direct contact.

You are in for a treat. As we correspond with Carl about upcoming issues, he regularly has us weak with laughter. At the same time he has a no-nonsense approach in cutting to the point of even the most complex issues. So please welcome him, and be sure to correspond with Carl about your woodworking joys and questions. You will find him receptive to your knowledge and skill in woodworking, and willing and able to answer your most complex woodworking questions.

lfulcher@canadianwoodworking.com

CORRECTIONS: Oct/Nov '08, Issue #56

Page 17: Oneida cyclones and dusting system accessories are also available from Welbeck Sawmill, welbecksawmill.com.

Page 22: The Leigh FMT jig retails for $779; the Veritas Surface Clamp for $72.50. Both are available at Lee Valley Tools.

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It Doesn't Look Good

I see from your website's 'Wood Show' page that the Ottawa wood show is the same weekend as my 40th wedding anniversary Even after forty years, she is not going to understand… or forgive.

Worse yet, ever forget.

D. McLeod,
Ottawa, ON

• Perhaps the two of you can go out for a nice dinner. I understand that there is a food court at the show.

Pocket Combination Square

In your Oct/Nov 2008 issue there is an article about small combination squares which interested me as I have been looking for a small square for a while. In view of the large price differential, the PEC 7181-006 is clearly the best buy. However, the part number given seems to refer to the blade only, for which I was quoted a price of $25. I searched the website fowlercanada.com and cannot find the small combination square shown in your article. However there is a double square with either a 4" or 6" blade which may be more useful in view of the small size. Furthermore, this square appears to be identical to the one sold by Lee Valley at essentially the same price of $39.

Eric G.,
Ottawa, ON

• There was a typo in the part number, it should have been 7121-006 and not 7181-006. Sorry about that.

You can order by email at: sales@fowlercanada.com.

Be sure to mention part number 7121-006. The price is $39.95, and not $19.95. Even at this price the PEC is good value. I use it in the shop and am quite pleased with it.

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craftproject BY MICHAEL KAMPEN

Dollhouse

Making a dollhouse is much like building a conventional house – it takes time and patience. While there are a lot of pieces to this challenging project, they are not overly complicated to cut and assemble.

In order to make it easier to follow the MATERIALS LIST (page 9), the parts are all identified as seen when facing the front facade of the dollhouse. Before you attempt this project it's a good idea to study the illustrations. Labelling each piece as it is cut will simplify things when it comes to assembly time. I used ⅜" Baltic birch plywood for most of the project; it is rigid, strong and provides sufficient thickness for the joinery. Hence, all the dados are 3/16" x ⅜". Along with a table saw, a scroll saw is indispensable for this project and makes it easy to cut the small parts safely. An oscillating drum sander will make it simple to bevel the edges of each shingle, and assembly will be easier if you use a ¼" crown nailer and 23 gauge pin nailer, grexcanada.com, kingcanada.com or busybeetools.com.

Foundation

• Cut the floor (A) to size. Be sure that it is square or you will have a hard time making the upper pieces fit together.

• Lay out the lines for the dados and cut them on the table saw.

• Cut the five pieces (B, C) that form the support for the floor ensuring that they are exactly flush with the edges of the main floor.

• Using glue and a crown nailer, fasten the foundation pieces to the underside of the floor, ensuring that the center piece does not cover up the dado. Glue and nail the ends of the sides, and use wood filler to fill any holes left by the nailer.

• After the glue has cured, sand the edges and top of the foundation.

Walls

As this part of the project progresses, use a pin nailer to tack the pieces together in the proper orientation and confirm the actual size of every piece in place before cutting. This will allow you to accommodate any variances in your construction. The measurements in the materials list were taken from the actual parts before I assembled the house.

• Cut the left (D) front (E) and right (F) outside walls to size, leaving the tops square for now. Mark the location of the dados, making your measurements from the bottom edge of the pieces. Cut the dados and pin the wall pieces in place on the foundation.

• Cut the second (G) and third (H) floors to rough size. Mark and cut out the large notches for the stairs on both floors, and cut the bevels for the stairs. Slide the second floor in place and apply a long clamp across the open back to exert enough pressure to hold the floor in place.

• Cut the porch side (I) and front (J) walls to size. Set the pieces in place on the main floor (A) and confirm the location of the two floor dados. Mark and cut the dados on the

Shop Tip

It makes little sense to install a dado head on your table saw for the limited number of dados to be cut on this project. Instead, use a regular blade to remove the waste, readjusting the fence after each cut. This will leave a slightly irregular bottom to the channel which can be quickly and easily cleaned up with the Veritas small router plane, #05P38.50, leevalley.com. This eliminates the tedious tuning required to accommodate the undersized plywood with a dado stack.

table saw. Cut a notch out of the end of the dado on the side wall (I) to accommodate the second floor. Set the porch front wall (J) in place. These pieces should fit snugly without gaps. Once you are happy with the fit, pin the pieces together at the edges to hold everything in place for now.

• Cut a notch on the left end of the third floor (H) to accommodate the outside wall (D) and set the floor in place. Apply another clamp across the back of the house to hold the floor in position between the end walls.

• With the three floors in place, measure the exact distance between the floors. If your measurements vary from those in the materials list, adjust the height of the walls (K, L) to reflect the actual measurements.

• Cut the first (K) and second (L) floor divider walls to size, and fit them in place. Cut the opening for the door in (K) now as well.

• Disassemble the walls and mark the roof line on the right side wall (F). Use a scroll saw to cut off the triangular waste sections. Use this piece as a pattern to transfer the roof line to the left side wall (D), cutting off the waste sections.

• Mark and cut out the roof line on the front wall (E).

• Cut the first floor stair support (M) and top floor divider walls (N) from these off-cuts. Cut the door opening in (M) at this time.

Roof

Preparing the four roof pieces involves making some bevelled cuts. Cut the main roof sections on the table saw. Make the bevelled cuts on the top and bottom edges of the dormer roof on the table saw, and then make the angled cut on the scroll saw. Tilt the table on your scroll saw and cut the bevels on the soffit edge.

• Cut the front (O) and rear (P) roof panels to size and bevel the long edges on the table saw.

• Use the roof panels to mark the location of the bevel cuts on the third floor (H) where it meets the roof panel. Remove the third floor and cut these bevels on the scroll saw.

• Replace the third floor and then use the pinner to tack both roofs in place.

• Cut the left (Q) and right (R) dormer

Wedge Cutting Jig

Cutting the small oak wedges for the shingles is best done on a bandsaw. Build this jig from shop scraps to make the job easy.

- Cut a base from a piece of ¾" plywood.
- Fasten a runner to the underside to run in the miter track on your bandsaw.
- Fasten another scrap of wood to the plywood at an angle to the blade to serve as a fence.
- Make a cut into the jig with the blade, stopping just after entering the fence.
- Place a pencil mark on the fence about ⅛" from the saw cut.

Place the blank stock on the jig and make a cut on the end of the stock. Throw this first piece away. Flip the piece over (top for bottom) and move the edge to the pencil mark and make another cut to make the first true shingle. Keep flipping the piece over after every cut until it is too short to work with, and then move on to another piece of stock.

roof panels and the valley support strips (S) to size.

• Bevel one edge of the support strips on the table saw. Pin the dormer roof sections together along the ridge and set them in place. Reach through the front window and use a pencil to draw a line marking where the dormer panels meet the front panel. Make the final angled cuts to fit the support pieces together, on the scroll saw.

• Cut the porch roof (T) to size, bevelling the top and bottom edges. Cut the porch ceiling (U) to size, but don't bevel the edges.

• Cut the stair panels (V) to size and bevel the top and bottom edges.

• Pin all of the pieces in place to be sure everything fits together properly. When you are satisfied, take all of the pieces apart and pull all of the pins out with a pair of pliers.

Wall Perforations

• On the inside of the three peaked wall sections (D, E, F) mark the centerline and draw a vertical line from the peak to the base. Draw another line two inches below the dado that the second and third floors sit in. These two lines will be used to locate the windows.

• Prepare a plywood template of the three window sizes and mark the center of the window on the top and bottom edges. To locate the window openings, line up the top edge of the window template with the horizontal line and center it on the vertical line. Trace around the edge of the template with a sharp pencil.

• Drill a small hole away from the edge of each opening and cut out the windows carefully on the scroll saw. There won't be any trim to hide a sloppy cut on the inside so take your time and make the opening as true as possible.

• Mark and cut out the door opening on the porch front wall (J).

• Sand all of the exposed interior wall surfaces in preparation for painting.

Paint the Interior

To liven up the inside of the house and to

Stapler Skate

To keep your crown stapler perfectly perpendicular to the surface, make a skate out of scrap 2 x 4 to fit the bottom of your gun. Place a spacer under the heel of the gun until the nosepiece is perpendicular to the surface. Rip a piece of scrap to fit under and behind the gun. Trace any irregularities on the underside of the gun onto the skate and cut it to shape on the scroll saw. Load the gun full of staples and then use some painter's tape to temporarily fasten the skate to the base of the gun.

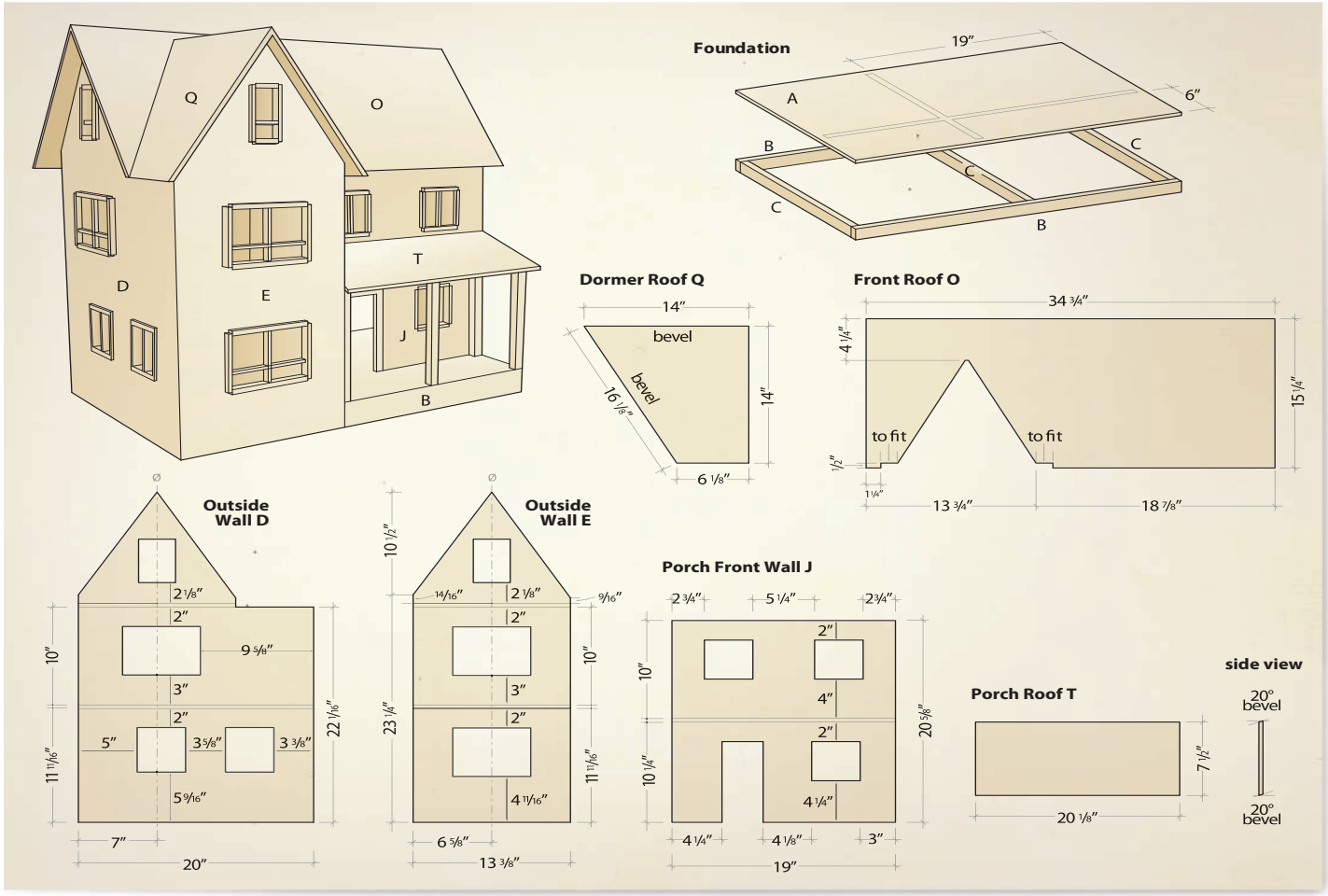


Illustration by: www.JamesProvost.com

provide some contrast between the floors, walls and ceilings I painted the interior plywood surfaces with a milk paint, lamemoiredelartisan.com, in traditional colours. With milk paint it is impossible not to end up with a great looking result, but more importantly excess paint will not obstruct the dados the way an acrylic or other film forming finish would. When the milk paint is dry, the excess powder is simply rubbed off the surface before sealing, leaving a clear full size dado for joinery. Apply a coat of Watco Natural Oil to the surfaces and then wax the painted surfaces to seal them before assembly.

Assemble the Shell

Headless pins are fine when holding trim in place while the glue sets and for temporary assembly and fitting operations. To hold the house together switch to a ¼" narrow crown stapler as it provides superior holding power. Use 1" staples for the wall-to-floor and wall-to-ceiling joints. Because the material is only ⅜" thick, it is imperative that the staples go in perfectly perpendicular to the surface, so take the time to make a 'skate' for the stapler. Assemble the pieces in the same order they were cut, but don't assemble the porch section yet.

Porch

• Mill the pieces for the porch posts (W) to size and sand them using a sanding mop, stockroomsupply.com. Since the porch ceiling is unfinished, it is best to apply a coat of Watco Oil to them now to avoid the need to mask off sections later.

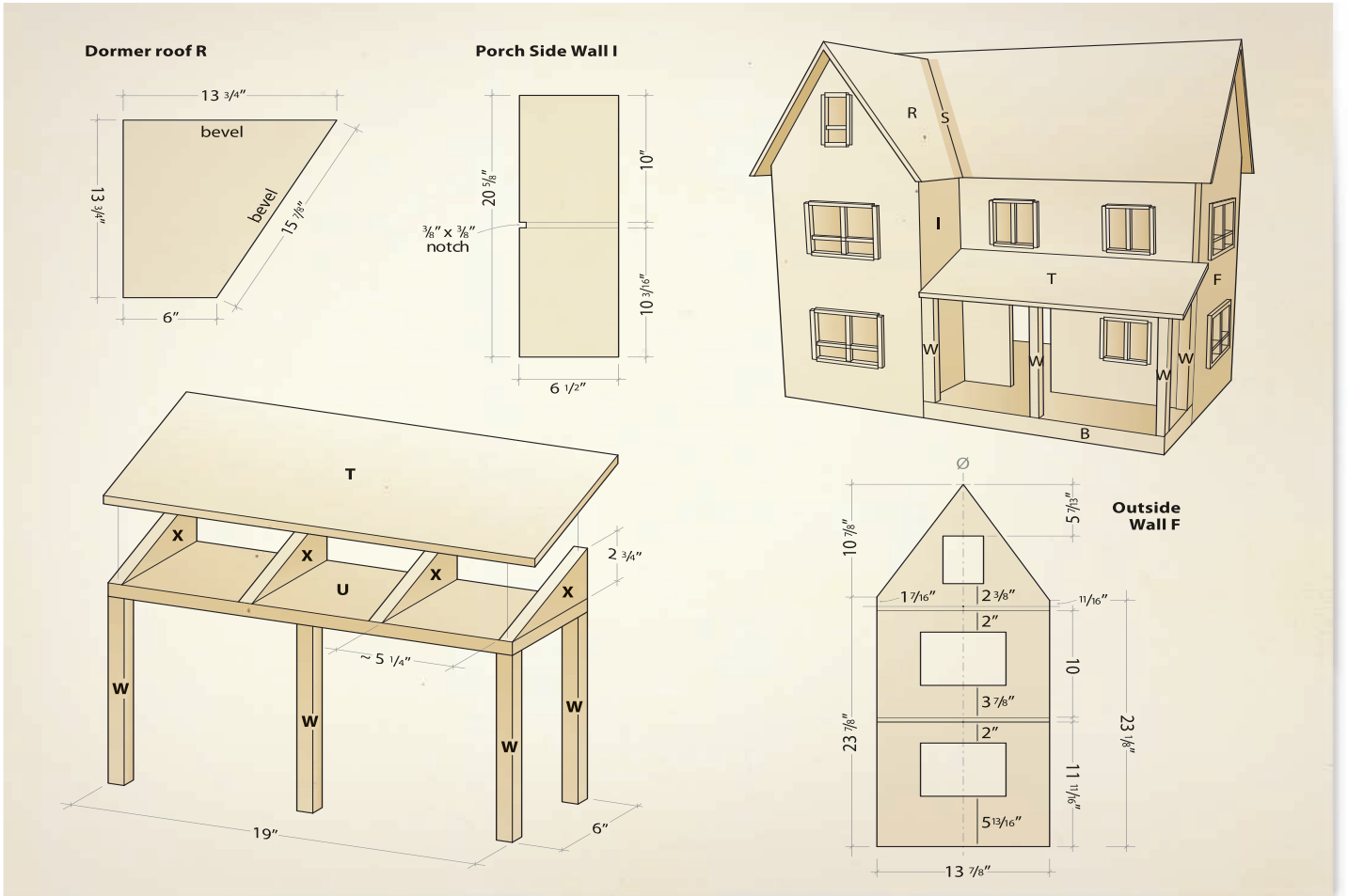
• Staple the three corner posts in place under the ceiling. Do not fasten the front center post in place yet or you will not have enough space for access to the front wall and porch side wall with the pinner to secure the logs in place.

• Mill the pieces for the porch roof trusses (X) to size and glue and staple them in place, being careful to allow enough room to staple the center post in place later.

• Set the porch in place and drive a couple of staples into the front wall at an angle through the top edge of the truss sections. Use the pinner to fasten the two corner legs to the walls and toenail the post bottoms into the base.

Exterior Cladding

To give the exterior a harmonious appearance, carefully select your material so all of the exterior cladding (the logs) show tight vertical grain on the exposed face. The exterior cladding on the house is made from red cedar and to provide some visual contrast, the soffits and fascia boards are cut from lighter coloured quarter-sawn western hemlock. I have only included the cross sectional dimensions of the cladding materials and the method I used



to manufacture the stock; on installation these will need to be cut to length to fit your project as built. Mill the pieces and install them in the order outlined below.

Soffits

• Mill material for the thick soffit (Y) and the thin soffit (Z).

• Scribe the pieces for the all of the horizontal sections onto the thick soffit and then cut them to fit using the scroll saw. Do only the horizontal pieces at this point. Use the same method to apply the thin soffit to the sloped sections on the gable ends after the logs have been applied to the walls.

• Finish the soffit pieces using the sanding mop and apply a coat of oil to the exposed areas.

• Glue and pin the horizontal sections in place.

Corner Posts

One option for the cladding is to run the logs to the end of the wall and then overlap each layer with the next one as in traditional log construction. However, for a cleaner look, make the corner posts frame each wall and then fill in the interior space.

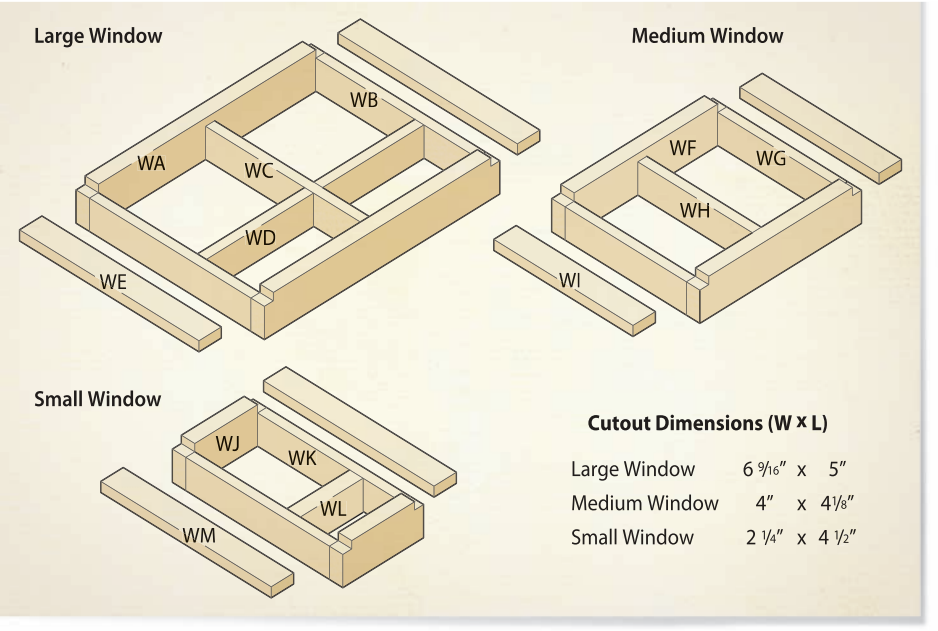
• Mill the material for the corner posts (AA) to the correct cross sectional dimension. Cut a 5⁄16" rabbet into one edge of each; this will mate with the wall and provide a surface for glue.

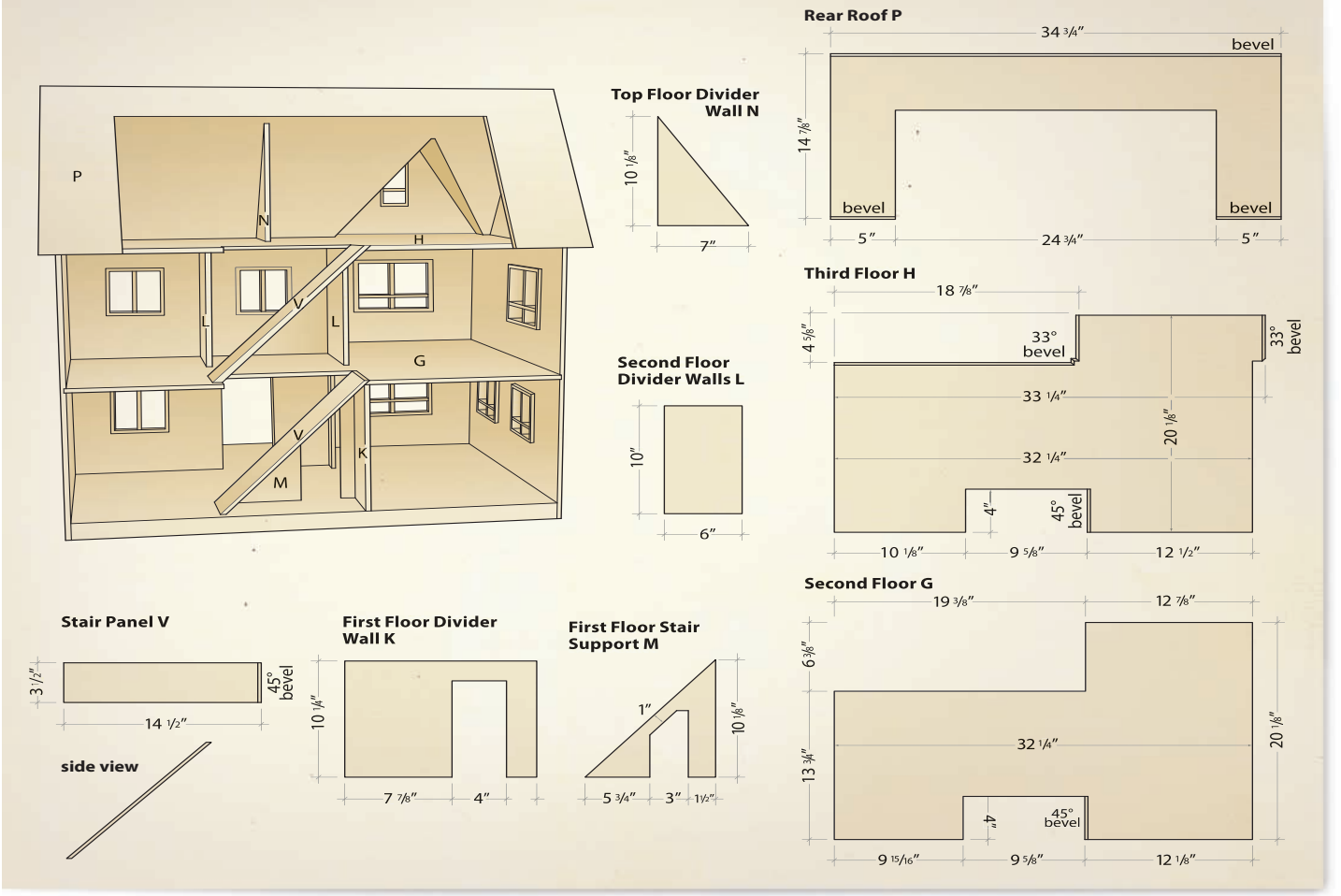
• Measure from the base of the wall to the underside of the soffit and cut the corner posts to length. Sand them using the sanding mop and apply a coat of oil to the exposed surfaces.

• When installing the corner posts run a bead of glue along the rabbet and use the pinner to fasten it in place. Clean up any glue squeeze-out immediately to get a tight fit when applying the logs.

Logs and Fascia

All of the log stock (AB) for this house was milled from cedar boards with a flat





MATERIALS LIST (All measurements in inches)

Part		Qty	T	W	L
A	Foundation – floor	1	3/8	20	32
B	Foundation – front, back	2	3/4	1 1/4	32
C	Foundation – sides, middle	3	3/4	1 1/4	18 1/2
D	Outside wall – left	1	3/8	20	34 1/8
E	Outside wall – front	1	3/8	13 3/8	33 3/4
F	Outside wall – right	1	3/8	13 7/8	34 1/8
G	Second floor	1	3/8	20 1/8	32 1/4
H	Third floor	1	3/8	20 1/8	32 1/4
I	Porch side wall	1	3/8	6 1/2	20 5/8
J	Porch front wall	1	3/8	19	20 5/8
K	First floor divider wall	1	3/8	13 3/8	10 1/4
L	Second floor divider walls	2	3/8	6	10
M	First floor stair supports	2	3/8	9 1/4	10 1/8
N	Top floor divider wall	1	3/8	10 1/8	7
O	Front roof	1	3/8	15 1/4	34 3/4
P	Rear roof	1	3/8	14 7/8	34 3/4
Q	Dormer roof - left	1	3/8	14	14
R	Dormer roof - right	1	3/8	13 3/4	13 3/4
S	Roof valley supports	2	3/4	5/8	14
T	Porch roof	1	3/8	7 1/2	20 1/8
U	Porch ceiling	1	3/8	6	19
V	Stair panel	1	3/8	3 1/2	14 1/2
W	Porch posts**	4	3/4	3/4	10 1/8
X	Porch roof trusses*	4	3/4	6	2 3/4
Cut the following pieces to final length during assembly					
Y	Thick soffit *		3/8	2	46
Z	Thin soffit*		1/4	2	96
AA	Corner posts**		3/4	3/4	120
AB	Logs**		3/8	3/4	2,865
AC	Fascia*		1/4	7/8	96
AD	Ridge cap**		9/16	9/16	52
AE	Shingles***		3/4	1	48
AF	Porch edge banding*		3/8	1 1/2	21
AG	Edge banding**		5/8	5/8	240
AH	Stair tread**		1 19/64	3 1/2	60
AI	Stair edging**		1/4	7/8	64
AK	Door window trim*		3/8	1/4	10
AL	Porch gable*		1/4	1	20

Notes: all 3/8" material is Baltic birch plywood; unless noted, use any hardwood for the 3/4" stock.
* Western hemlock, quarter-sawn ** Western red cedar, quarter-sawn
*** Red Oak. Final dimension of shingles are 1/8" x 7/8" x 1 1/2"

face grain pattern. When sliced into strips , the grain at the edge of the boards provided the proper pattern for the logs.

• Mill the starter board to a thickness of 3/4". Dress the most attractive edge with the jointer.
• Set up a fence on your bandsaw to rip a strip from the edge that is slightly thicker than the 3/8" finished dimension, and set it aside.
• Take the starter board to the jointer and dress the raw edge to remove the saw marks, and then head back to the bandsaw to rip another strip. Continue working between these machines repeating the previous steps until you have enough stock for the logs.
• Install a 45° chamfer bit in the router table. Set the fence to bevel the two face edges on each log. The resultant bevelled face should be about 3/32" wide. To make working with these pieces safe, use a pair of feather boards, one on the fence and one on the table, to hold the wood firmly in place during routing. It's easiest to apply the logs in sections. Begin with the section below the windows on each wall, and then move up to the short sections between the windows. Cut all of the pieces to fit into a section, keeping them stacked in place until an entire section has been filled. Then go to the sanding mop and sand every piece, following this with a coat of Oil on the

WINDOW SCHEDULE (All measurements in inches)

Part		Qty	T	W	L
WA	Large window – top and bottom	10	3/8	15/16	6 9/16
WB	Large window - sides	10	1/4	3/4	4 1/2
WC	Large window – vertical dividers	5	1/4	3/4	4 1/2
WD	Large window – horizontal dividers	5	1/4	3/4	6 1/16
WE	Large window - shutters	10	1/4	5/8	5 9/32
WF	Medium window – top and bottom	10	3/8	15/16	4
WG	Medium window - sides	10	1/4	3/4	3 5/8
WH	Medium window - divider	5	1/4	3/4	3 5/8
WI	Medium window - shutters	10	1/4	5/8	4 1/2
WJ	Small window – top and bottom	6	3/8	15/16	2 1/4
WK	Small window - sides	6	1/4	3/4	4
WL	Small window - divider	3	1/4	3/4	4 3/4
WM	Small window - shutters	6	1/4	5/8	4 3/4

exposed faces. Then glue and pin them in place.

• After the entire wall has been clad, scribe the thin soffit (Y) and cut it to fit on the sloped sections. The porch area will require some additional work, so leave the two porch walls until the end.

• Mill the fascia stock (AC) to the correct cross sectional area and then cut the pieces to cover up the edge of the plywood roof panels and angled soffits. Sand and apply some finish to the exposed areas and glue them in place.

Ridge Cap and Roof

At this point the house is assembled and clad, with the exception of the porch area. Extra porch trim still is needed on the leading edge and the roof needs to be made and installed.

• Mill a board for the ridge cap (AD) to the correct thickness and joint one edge square to the face.

• Use the table saw to cut a rabbet on the edge of the board.

• To work with this piece safely, cut the rabbeted edge from the larger board thus forming the ridge cap on one edge and then rip this piece from the larger board.

• Sand the pieces. The ridge cap, like the shingles, remains unfinished.

• Glue and pin the ridge cap so that the ends overhang the plywood roof edge by about ⅛".

The roof is covered with individual shingles cut from red oak and held in place with glue and pins. The shingles are cut on the bandsaw with a special wedge-cutting jig, and while not complicated, the sheer number of them makes this a time consuming task. Build the jig to make the shingles and then keep it handy for any time you need to cut wedges in the future.

• Try to select stock for the shingles (AE) that shows a perfectly vertical grain pattern on the edge of the board. Set up a stop block on your crosscut sled and cut enough short sections to cut the number of shingles you need. As it is hard to determine just how many pieces you'll need, leave the stop block set in place in the event that you need to cut more.

• Cut the individual shingles on the bandsaw with the wedge-cutting jig. Flip the piece over after every cut to maintain the wedge shape of the shingle.

• Light and shadow plays a great part in how we perceive a surface. To give the roof some definition each shingle needs to be bevelled. This is a simple, if somewhat time-consuming procedure, and can best be done on an oscillating spindle sander. Set up the largest sanding drum available and gently touch the edge of each shingle on both long sides.

• The lower edge of the shingle should overhang the edge of the roof slightly. To keep things looking orderly it helps to draw in some reference lines to keep the installation straight and square as it progresses. I drew a line 1 ¼" up from the bottom edge of the roof on all panels to guide the first course. After that the shingles just sit one above the other as they move up the roof.

• Make a pattern on paper for the shingles on both sides of the valley; both sides will need to be cut at somewhat different angles. Begin at the bottom and work your way up the roof to the peak.

• When the valleys have been shingled, move on and finish the rest of the roof.

• Use the headless pinner and glue to hold the first few courses and the shingles at the edges of each panel as well as the partial row at the top of the roof, in place. For the rest, use glue on the back of each shingle to set it in place.

• Mill the porch edge banding (AF) to

cover the exposed plywood on the leading edge of the porch roof. Apply soffit and fascia stock to the gable end of the porch roof.

Clad the Porch

The porch must be finished and installed before cladding the porch walls. Cut trim pieces (AK) to frame the door and apply them with glue and pins. Continue filling in the area under the porch roof with the remainder of the logs. The only area where the cladding is not built up from the bottom is the section of wall above the porch roof. Begin cladding this from the soffit on down until you get to the last few courses. At this point you will need to trim one of the pieces to fill the gap between the shingles and the first complete log before fastening the remaining pieces in place.

Final Details

• Mill the edge banding (AG) to cover any exposed plywood edges at the rear of the house. Cut a ¼" x ⅜" groove on the edge of the banding that will be applied to the plywood edges. Glue and pin the banding in place.

• Mill the stair tread (AH) to size and glue and pin it to the surface of the stair panels. Mill the riser stair edging (AI) and glue and pin it to edges of the stair panels.

• Test fit the windows in the openings. They should be rather snug. You may need to fine tune the opening with a file. When the window has been installed, pin it in place through the sides into the wall. Cover the remaining exposed edge at each side by applying the shutters.

• Mark out the window in the front door and cut it out using a scroll saw. Cut some door window trim (AK) and fit it to the opening in the door. Fasten the ¾" hinges to the door and then hang the door on the wall from the inside.

• Mill material for the porch gable (AL) and fasten it in place with the pinner and some glue.

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Patents Pending

BY CARL DUGUAY

Solvents

Solvents are useful products that can make the finishing process easier. But, they need to be treated with caution and common sense.

In most shops you'll likely find at least a few of the following solvents – mineral spirits, paint thinner, paint and varnish remover, turpentine, lacquer thinner, varsol, naphtha (camping stove fuel or white gas), methyl hydrate, acetone, or isoproponol. I often see woodworkers using these solvents without employing any form of personal protection. While I don't think that we need to get paranoid about the use of solvents in the shop, I do think that we need to remind ourselves that these products can be highly toxic. Most of them are also flammable, and environmental pollutants when not properly disposed of. There is the prospect of short term toxicity when exposed to these products for a brief period of time – for example, the light-headedness that comes from breathing lacquer thinner fumes. We may not think much of it at the time, but what about after twenty or thirty years of breathing in these fumes? Health and safety experts warn that repeated exposure to toxic solvents may produce general deterioration of health by an accumulation of toxins in one or more organs. Getting into the safety habit when using solvents takes a bit of self-discipline, and a little more time away from our woodworking. But we may well be doing ourselves (and our families) more good than we realize.

Personal Protection

One of the easiest things to do when using solvents is to ensure that there is proper ventilation in your shop. Ideally you want to locate your finishing station near a window, which you can open for the duration of the finishing session. Placing a low velocity fan near the window will help move fumes out of the shop. This is particularly important if you work in a small shop.

A disposable dust mask is not at all effective in keeping toxic fumes out of your nasal passages and lungs. Purchase and use an air purifying respirator with an organic vapour cartridge. A half face mask like the North Safety 5400 costs about $40, northsafety.ca. The cartridges cost $15 and last quite a long time. You can also add an N95 particulate filter ($5) onto the cartridges. This makes for a complete and highly effective dust and vapour protection system.

You should also wear gloves when handling solvents. Nitrile or neoprene gloves, leevalley.com, are an excellent all around choice. Latex and vinyl gloves offer limited protection and are better suited for use when applying finishes and stains. Finally, it goes without saying that you should always wear eye protection in the shop - not just when finishing. High impact safety glasses are a good choice. For maximum eye protection choose chemical splash goggles. Polycarbonate lenses offer better impact resistance than glass or plastic, but they scratch more easily. If you wear prescription glasses you can purchase safety overglasses. Regardless of what you select, don't buy an inexpensive, ill-fitting

pair – they'll end up in a drawer. Eye protection that meets the Canada Standards Association standard Z94.3, can be had for under $25, leevalley.com.

Community Protection

It's irresponsible to dispose of solvents in the garbage or down the drain. The best solution is to take the liquids to a recycle centre. Most large cities have one. You can also call your local garbage collection or waste disposal service for information. For those who don't have access to a recycle centre, consider recycling your own. Allow the solid material to settle, and then pour off the thinner. You don't want to use the thinner again in a finish, but you can use it for cleaning tasks. During the summer you can pour liquids into a shallow pan and allow it to evaporate in the sun - just ensure pets and wildlife don't have access to the pan. If you have other ways to dispose of solvents let me know, and we'll print them in upcoming issues of the magazine.

Common Workshop Solvents

By far, the most popular finishes for hobbyist woodworkers are oil based finishes (varnish, polyurethane, oils, varnish/oil blends, stains), water based finishes and stains, and shellac. Just about any of these finishes or stains can be diluted with solvents. Being able to change how quickly a finish dries can go a long way to make wood finishing a less taxing experience. Some solvents enable you to speed up the drying time, while others slow it down. For these three classes of finishes you really only need three solvents.

Most varnishes are on the viscous (thick) side, and can take quite a while to dry. If, like most woodworkers, you don't have a separate finishing room, the varnished surface will pick up a lot of dust. When brushed on a vertical surface heavy bodied finishes invariably sag. If applied too thick the cured finish takes on a plastic look. The right solvent will speed up the drying time of the varnish so that dust has little time to settle, and when brushing a vertical surface there will be less tendency for the finish to sag and run.

There are two common solvents for **oil based finishes**; paint thinner and mineral spirits. Mineral spirits contain fewer aromatic solvents (benzene, toluene, xylene) than paint thinners. The higher level of purity is reflected in the price (about $4 per litre for paint thinner and $10 per litre for mineral spirits). Varsol is a registered trademark of Imperial Oil, and has a slightly higher level of purity than mineral spirits. These products are relatively toxic and flammable. When it comes to thinning oil based products you can confidently use any of these three solvents. Naphtha, a product very similar to mineral spirits, is one that you likely have read about in US magazines. The Canadian equivalent is white gas, or camping stove fuel. It has a marginally faster evaporation rate than mineral spirits. Naphtha is very toxic and flammable.

If you have difficulties brushing or ragging on varnish, polyurethane or polymerized tung oil, you can add anywhere from 10% to 50% mineral spirits – the exact amount isn't critical. Just bear in mind that the more you dilute the oil, the more coats you will have to lay on in order to get adequate protection. Start with about 10% and if you find it's still too thick, add a bit more mineral spirits. Allow each coat to thoroughly dry between applications.

Water based finishes present their own problems. Unlike varnish, they tend to dry very quickly, making it difficult to maintain a wet edge, which can result in lap marks, or cause bubbles to appear, particularly on a large surface. The quick drying nature of water based finishes also makes them more difficult to brush on than varnish. Fortunately, the solvent for water based finishes is water. Water based finishes are very complex, and it's best to use distilled water, adding no more than 10%. There are water based retarders that extend the drying time but these are not widely available.

Shellac is a wonderful all purpose finish that is particularly suited for woodworking projects that aren't subject to a lot of heavy use, or won't be in contact with alcohol or water. It also makes an excellent sealer coat for any finish. In the US, they use denatured alcohol (ethanol) to dissolve the shellac flakes or thin the shellac. In Canada denatured alcohol is virtually impossible to find. Instead, use isopropanol (isopropyl alcohol), available from feed supply stores and large garden centres. A slight drawback is that isopropanol dries more quickly than denatured alcohol. There are different grades - ensure that the one you use is 99% pure. It's not the same as gas line antifreeze. Isopropanol is relatively nontoxic and highly flammable. Avoid methyl hydrate (methanol), as it is much more toxic (not only through inhalation but also absorption through the skin).

Keep your woodfinishing safe by properly storing, using and disposing of solvents. Long may you woodwork!

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BY CARL DUGUAY

photo courtesy of Murphy Wall-Beds Hardware Inc., murphywallbeds.com

Wall Beds

If you need a room in your home to serve double duty, there is no better way to manage space than with a wall bed.

Maybe the kids have flown the coop and you want to use the bedroom as an arts room, but don't want to lose the bed. Or perhaps you've started a home-based business, and really need to turn the guest room into an office – but still need to accommodate Aunt Edna's bi-annual visits. What's the creative home handyperson to do?

Wall beds (also referred to as Murphy beds, after the inventor of the first modern wall bed) provide a convenient, affordable way to extend the usable floor space of any room. As the name implies, a wall bed is just that – a bed that is stored against a wall. Placing a bed, horizontally or vertically, into a cabinet and securing the cabinet against the wall is not too complicated. If you've ever built a hutch, corner cabinet or similar large scale piece of furniture, then you likely have the skills to build a wall bed.

Essentially it involves building a frame (to hold the mattress), building a cabinet, into which the frame and mattress fit, and attaching a set of legs to the box. The legs typically fold up against the side or end of the frame, or in more elaborate cabinets, are integrated into the face panel. A pair of metal springs or a piston lift enable you to easily and safely lower or raise the bed frame into the box. A latch holds the mattress frame securely in the cabinet in the closed position, and mattress straps keep the mattress taut against the mattress frame. Fitting the hardware to the mattress frame and the sides of the cabinet is likely the most time consuming part of the project.

The cabinetry that surrounds the bed can be as simple or ornate as you would like. The least expensive option, and perhaps the

option of last resort, is to build the entire wall bed out of melamine. A more attractive option is to use a combination of AA grade plywood and solid wood to match the other furnishing in the room or in the house. You can add side options (bookshelves, or other cabinetry) or incorporate halogen lighting into the top of the cabinet frame. The side options can be added at a later date. While you could build separate doors for the cabinet for a more formal look, typically the face panel on the mattress frame serves as the door to the cabinet. The face panel can be something as simple as a sheet of plywood, or as elaborate as a frame and panel affair.

You can mount a single, double (full) or queen sized mattress into a wall bed, and have the bed open horizontally or vertically. If you need to purchase a mattress do so at the start of the project, so you can verify the dimensions of the frame and cabinet. Cabinets are typically 16" to 18" deep, and approximately 88" (7' 4") high. Note that wall beds don't use box springs – the mattress frame usually incorporates a plywood base or wooden slats on which the mattress rests. As well, pillows are typically stored in a closet or chest of drawers, and not on the mattress when it is closed.

Some companies, murphybed.com, sell complete wall bed kits (without the mattress). Expect to pay upwards of $2,000 for a basic melamine bed system with a wood tone finish. Hardware kits, which include the spring mechanism and legs and start at about $350 are also available, murphybed.com or leevalley.com. A piston lift kit is slightly less expensive. If the kit you select doesn't come with a wall bed plan, then it's a good idea to purchase a plan, leevalley.com. The plans will give you the construction details required to build a basic bed, and you can easily customize the design to suit your specific needs.

If there is a wall bed retailer in your locality, visit the store to get a better idea of how they are constructed. Before building, purchase a plan and spend some time reviewing it. And give yourself time - building a wall bed is not a weekend project, but then again, it is well within the scope of any woodworker with intermediate level skills.

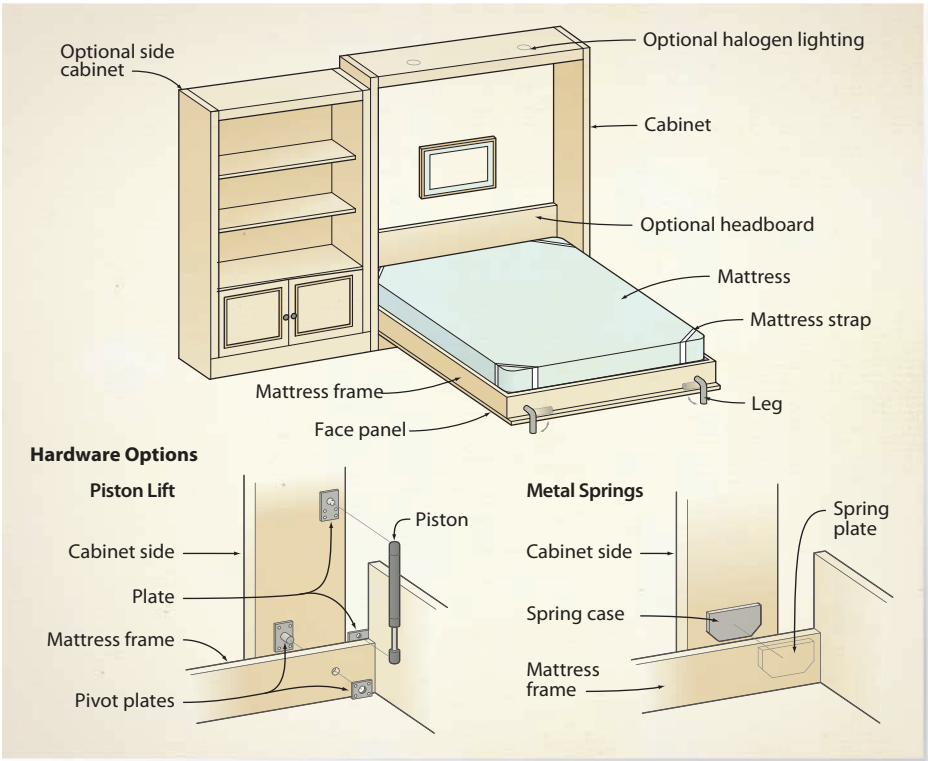

Illustration by: www.JamesProvost.com

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turningproject

BY ALLAN CUSWORTH

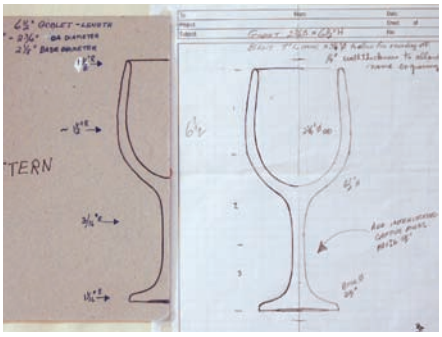
Wedding Goblet

This goblet with its two captive rings on the stem, symbolizes everlasting love between a bride and groom, and signifies a strong bond for the couple's future.

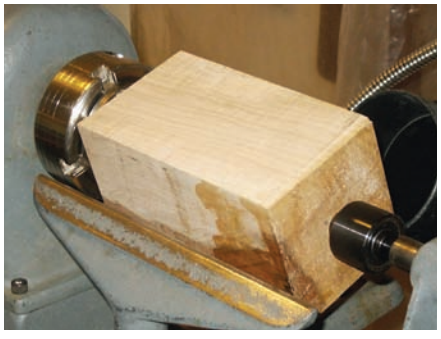
Wedding goblets follow a tradition deep rooted in medieval history, dating back centuries. Today, they still remain popular for weddings, but are also used to celebrate anniversaries and other special occasions. They are very often engraved with commemorative names, dates, and other special event details. Used as ceremonial vessels, they become valued mementos of the occasion.

A good place to begin making a wedding goblet is by drawing rough sketches of goblets - fat ones, skinny ones, tall ones, and short ones. It is a good idea also to observe the shapes of glass and ceramic goblets and decide which design appeals to you the most. I prefer a shape that is roughly two-and-a-half to three times higher than it is in diameter, with the widest diameter of the goblet cup located about one third of the distance from the top to the base. Some say this follows a natural design principle called the 'Golden Mean', but I just think it looks appealing to the eye. Choosing a design is very personal; other shapes can look appealing as well.

Once you have settled on a design, draw a half-profile pattern of the goblet's shape at the edge of a piece of stiff cardboard. You can use some other more permanent material if you want to make a number of goblets the same size and shape. Put all the dimensions and other design notes on this pattern. It's not necessary to draw the captive rings on the pattern, just make sure the dimensions are written down so you can refer to those notes when it's time to make them. This pattern will be used to transfer the design details to the wood blank on the lathe.



Author's design sketch



Block mounted

Cylinder with tenon

Select and Prepare the Block

Select a piece of dry hardwood such as big leaf maple with no higher than an 'AA' figure. A higher figured piece of wood reduces the ability to read any engraving that may be applied to the finished goblet. The piece of wood should be at least ½" longer and 1" larger in diameter than your goblet. It should not contain the pith (centre core) of the tree it was cut from, as the pith would increase the tendency of the wood to change shape during, and after, turning the goblet. The goblet I am making for this project will be about 6 ½" high by 2 ¾" to 3" in diameter.

Prepare the block for mounting by locating and marking the centers in each end and making a dimple for a four prong spur drive center, and the tailstock live center. I used a spur drive center that I mount in my four jaw chuck to make the goblet in this project but any drive center in the headstock will work. Note that the base of the goblet will be located at the tailstock end of the lathe for this part of the project.

Mount and Rough Out the Block

Mount the block securely in the lathe between centers. Then place the tool rest parallel to the ways of the lathe, about ¼" from the closest corner of the block, and high enough so the cutting edge of the spindle roughing gouge will cut at or just above the center axis of the block. The lathe speed should be set to about 600 to 1000 RPM. Make sure that you turn the block by hand to make sure it doesn't hit anything.

Round off the block with a spindle roughing gouge to form a cylinder that is larger in diameter than the outside diameter dimension on the pattern by about ⅜". This extra wood will be needed to true up the block later. Square off the block at the tailstock end. Be careful not to cut off too much wood or the block will be too short. Cut a tenon on this end to fit your particular four jaw chuck. It is important to have a good fit here since we will be creating quite a bit of stress when we hollow out the goblet cup later. The turning blank is now a cylinder.

Reverse the cylinder in the lathe and mount the tenon firmly against the jaws of the chuck. Then bring the tailstock up to support the blank. To work safely you should use tailstock support whenever possible. True up the outside diameter of the cylinder using 1" skew or a ½" spindle gouge. Then square off the end at the tailstock. Cut in as close as possible to the center; the little bit that is left will be cut off later.

Lumber make-up

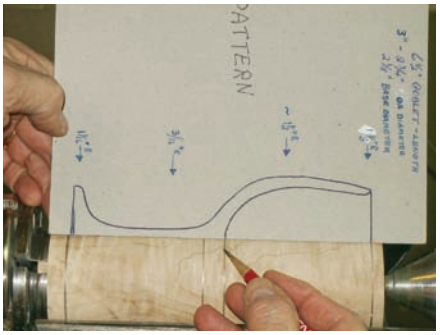
Lumber, particularly hardwood, can contain various 'figure', such as burl, birdseye, curl, tiger strip, flame, pomelle and crotch. Wood with figure is graded on a scale of 'A', light figure (some figure, but mostly plain), 'AA' medium figure (some 'AAAA' (consistent figure with excellent depth).

Transfer the Pattern

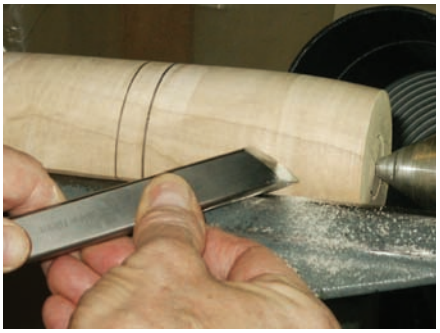
Transfer the pattern design to the cylinder using the half profile pattern you made earlier. With the lathe stopped, hold the pattern against the top of the cylinder and make pencil marks at the places where the top lip, the bottom of the base, and where any critical diameters are to be located. Also mark where the inside bottom of the cup will be. With the lathe still set at a slow speed, turn it on and hold the pencil at each mark to create a ring mark around the cylinder. We now know exactly where to start cutting as we make our goblet.

Shape the Outside of the Cup

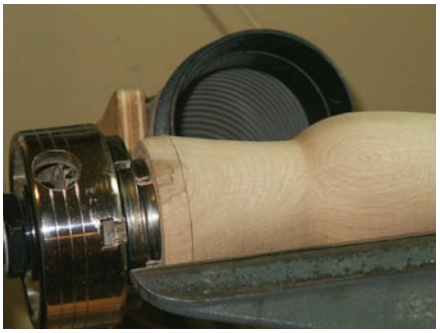
Set a caliper to the outside diameter of the goblet cup. Using a 1" skew or a ½" spindle gouge, turn the cup part of the cylinder to



Transfer pattern to blank



Shape outside of cup



Cup shape started

just proud of the pattern dimension. Leave the ring mark that shows the location of the bottom of the goblet cup to prevent accidently making the outside diameter of the cup too small. It also provides a sight line to work from when developing the final outside shape.

The lathe speed can be increased to around 1500 RPM at this point. Start to shape the outside of the goblet cup, creating a smooth curve towards the lip. Turn the top lip area to the dimension on the pattern, 2 ¼" diameter, and use a caliper set to 2 ¼" to check the measurement. Make sure that all design lines flow smoothly.

Start the curve of the bottom of the cup using a ½" spindle gouge. This creates a sight line to follow when hollowing out the cup later. It is necessary to leave the diameter at the top of the stem quite large to support the cup and reduce vibration when hollowing.

Hollow the Inside of the Cup

Before starting to hollow out the inside you should drill a hole down the center to mark the depth. Simply mount a long-shank standard ⅜" drill bit into a handle, and place a piece of masking tape on the shank of the drill at the depth measurement shown on the pattern. Remove the tailstock so that there is no chance of an elbow injury by hitting the point of the live center. Position the tool rest across the face of the cylinder and remove the little stub with a spindle gouge. You could use a small saw to cut it off before positioning the tool rest. True up the face, and cut a dimple at the center with a 1" skew or spindle gouge. Make sure that the tool rest is positioned so that the point of the drill is dead center of the dimple just made and drill the hole up to the masking tape.

Another way to drill this depth hole is to follow the same process using a drill bit in a Jacobs chuck mounted in the tailstock quill.

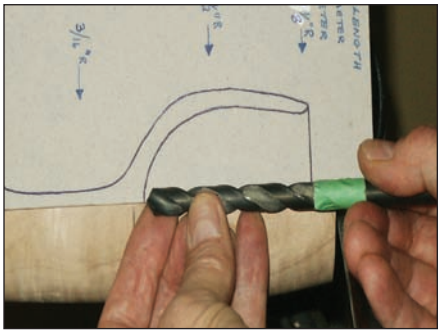
Re-position the tool rest height and hollow out the cup of the goblet using a sharp ½" bowl gouge. Always cut from the center to the edge of the cylinder so that the cutting is supported by the wood's fibres. For this project the wall is 3⁄16" thick. Use calipers to frequently check for even wall thickness in the goblet cup wall as far as possible. Since the bottom part of the outside of the cup was left wider for support, the wall will start to get thicker and you will not be able to measure it with the calipers. Just make a smooth curve on the inside then finish creating the 3⁄16" wall when completing the outside of the cup. Use a heavy duty 1" side ground radius scraper, and a ¾" round nosed scraper to smooth the inside side and bottom surfaces.

Sand the inside of the goblet cup starting with 150 grit sandpaper to remove tool marks; go through 220, 320, 400, and 600 to 800 grit. I prefer the cloth backed sanding media since it is more flexible and it lasts longer. I like to seal and finish the inside of the goblet cup now with salad bowl beeswax applied with a piece of paper towel. This finish dries hard and is food safe. I find that the Bounty brand towel does not release lint like many other brands do. Apply at least three coats of beeswax. Drying and curing each coat is done by applying friction heat with a piece of dry paper towel rather than cloth. If a paper towel catches on something, the paper tears, not your fingers.

In order to finish shaping the outside of the goblet cup you need to know the location of the inside depth, on the outside surface of the goblet. To do this, I made a depth gauge from a piece of ⅜" dowel and a piece of scrap softwood. By measuring the depth with the dowel and transferring that dimension to the outside of the goblet cup you can easily see how to shape the outside bottom of the cup. Finish shaping the outside of the cup with a ½" spindle gouge. Use calipers to check the cup wall thickness. When the outside is shaped, sand the cup outside area the same way as the inside was done. The goblet cup is

SUPPLY CHECKLIST

Four jaw chuck, spur center, live tailstock center, spindle roughing gouge, ½" bowl gouge, ½" spindle gouge, 1" skew, ¼" captive ring tool, 1⁄16" thin parting tool, 3⁄16" diamond parting tool, 1" radius scraper, ¾" round nosed scraper, depth drill, depth gauge, calipers, coping saw, masking tape, sanding cloth, salad bowl beeswax, paper towels.

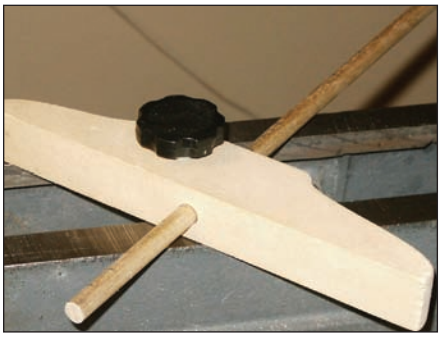


Set drill depth

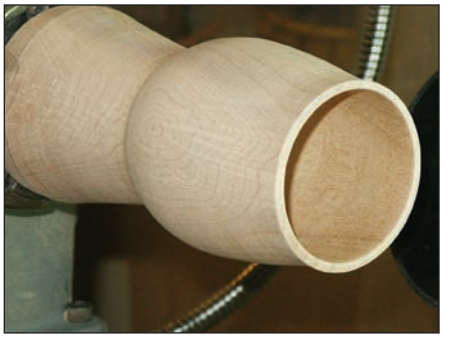
Drill pilot hole

Hollow the cup

Measure wall thickness



Depth gauge



Hollowed cup

now complete except for final sanding and finishing the outside.

Detail the Stem and Base

Starting at the cup end, shape the first ¾" of the stem to its final diameter with a graceful transition from the bottom of the cup. Add any desired design details such as a small filet, or a bead. Make sure the there is sufficient support for the cup and that it does not look top heavy.

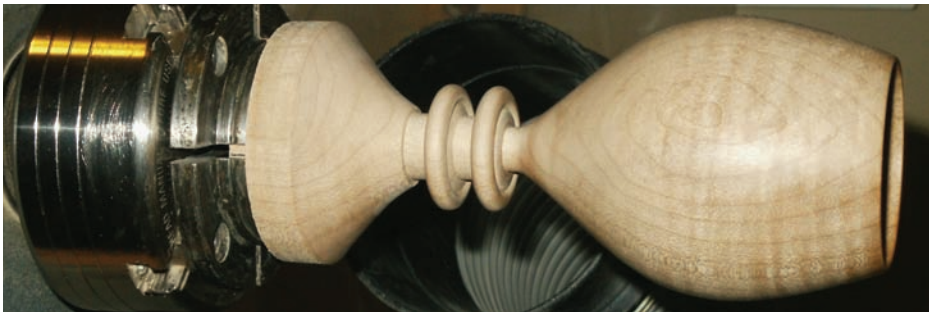
Turn the outside diameter of the base and create a graceful curve towards the rest of the stem. Keep it just proud of the desired outside diameter for the captive rings. Note that the inside part of the rings will be used to make a temporary 'sanding mandrel' to shape the inside ring surfaces.

Make the Captive Rings

The captive rings are approximately 1 ⅜" o.d. x 1" i.d. x 3/16" thick. The 3/16" thick captive rings will be released at the cup end of the stem. Using a 3/16" diamond parting tool, cut two ⅜" wide grooves in the large diameter stem creating two 3/16" wide disks. Leave a mandrel (stem) diameter of about ½". That will be used later for sanding the inside of the rings. Carefully round off the top of the disks with a ½" spindle gouge. This forms the outside surface of the captive rings. Sand the outside part of the rings using grits from 150 through 800. This has to be done now since it is very difficult to get a good sanded finish after the ring has been released.

Captive ring taped to cup

Sanding cloth taped to stem mandrel



Stem top complete; ready to release rings

Using a captive ring tool, cut in from each side of both disks being careful to keep the cross section (thickness) of the ring round. As the rings are released, tape them to the bottom of the cup with masking tape. A third ring could be released if there is enough stem length.

When all the rings are released, smooth off the lower part of the stem to approximately ½" diameter to make the sanding mandrel for the inside of the rings. Place a small strip of 150 grit sanding cloth on the stem using masking tape at the edges. Make sure it is fastened so that the turning direction of the cloth tightens the hold on the cloth. Pressure sensitive adhesive (PSA) backed abrasives may be used to eliminate the need to use masking tape. Shape and sand the inside of each ring and tape each one to the base of the goblet cup. Follow this sanding, and taping routine from the base to the cup until all the rings have been sanded with all the sanding grits from 150 through 600/800. When all the rings are sanded, leave them taped to one end. This is a labour intensive part of the process but is worth the effort when you see the final results.

Complete the Stem

Finish turning and sanding the base and stem. Add any design details, such as filets or beads, making sure you maintain smooth curves right up to the base of the goblet cup. Sand these areas with the same sanding grit configurations as before.

Rings released; stem and base done

Take the tape off the rings and let the rings go loose. Seal and finish the goblet with salad bowl beeswax using a paper towel. Since you cannot use friction heat on the loose rings, a little more time is required here. Remove the goblet from the lathe by parting it off near the headstock with a 1/16" parting tool.

Complete the Base and Bottom

Carefully reverse the goblet onto a jamb, vacuum or friction chuck, or any other suitable means of reverse holding. I used a friction chuck. Use the tailstock live center for support as long as possible. Taking very light cuts with a ½" spindle gouge, finish-turn the bottom making the base slightly concave so the goblet won't rock on a flat surface. Sand the bottom through the grits as before. Add some decorative rings on the bottom, if desired. Finally, apply the salad bowl beeswax finish. And, voila, your goblet is now finished except for buffing and/or engraving. It's best that clear beverages be used in these goblets, as darker red liquids could leave a permanent stain in the wood even though food safe finishes do seal the wood quite well.

You have just created an heirloom for some lucky bride and groom. Your goblet will be a conversation piece on their fireplace mantle for years to come.

ALLAN CUSWORTH
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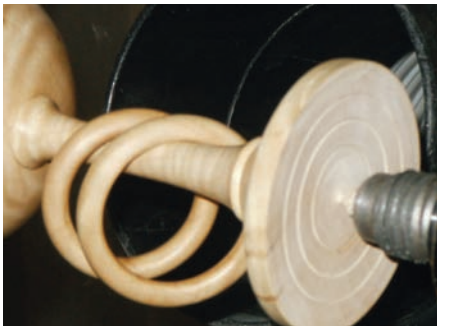

Goblet reversed to complete bottom

BY CARL DUGUAY

Display Stand

Build this elegant stand to display your favourite plant or sculpture.

I enjoy building small tables. They don't require a lot of wood, they don't take much time to build, and they provide a nice canvas for exploring design options.

The wood for this table came from project leftovers. Makore for the top panel, apron trim and feet, Garry oak for the panel frame and apron, and ash for the legs. Makore (also called African cherry) is one of my favourite woods, forloversofwood.com. It's straight grained with a fine texture, and very dimensionally stable. It machines well, is easy to work with hand tools and takes a finish beautifully. In veneer form you can also get it mottled, blistered, curly, and fiddleback. The lighter Garry oak complements the makore, while the ash lightens the overall appearance of the table.

From the Ground Up

The rough stock I had on hand was 1 ¾" x 2 ⅞" x 46", which effectively determined the dimensions of the table legs. Cutting the board in half lengthways gave me 23" legs, somewhat too short for what I had in mind. Gluing 4" blocks of makore onto the ends of the legs resolved the issue. I often use feet on table legs, sometimes joining foot to leg with dowels – other times I simply epoxy them together. After more than a decade, I've not had any come apart. On this table I simply epoxied them together.

Once the epoxy cured, I milled the stock just slightly over-sized, and then bandsawed a slight curve on the two inside faces of each leg. I began the curve about 5" from the top of the leg. The exact point at which to start isn't crucial as long as the curve is pleasing to your eye. You can bandsaw the curve freehand or use a template (see "Patterns, Templates & Jigs", Oct/Nov '07, Issue #50). A hand plane, spokeshave or sandpaper makes quick work of removing the marks left by the bandsaw.

Legs to Aprons

I usually join aprons to legs using mortise and tenon joinery. For a table that won't be subject to heavy loads, you don't need massive tenons; these are ¼" thick and ½" long. It's worth cutting shoulders on the tenons, as they serve to hide the edges of the mortises. If you cut a slight bevel on the inside of the shoulder, and ensure that the tenons don't bottom out in the mortises (cut them 1/16" shorter than the mortise depth), most, if not all of the glue will remain in the mortise, where it belongs. Assuming of course that you glue sparingly – I aim for a thin, even coat on mating surfaces.

You know the drill – dry assemble before final glue up. No matter how long you've been woodworking, it's still a good rule to follow. After I dry assembled the frame and legs, I felt that the table looked bottom heavy. Bevelling the front of each leg lightened the look of the table giving it a more elegant appearance. Again, I simply bandsawed the legs and smoothed them with a small block plane. Just before gluing the aprons to the legs I sanded everything with 220 grit paper – just enough to remove any pencil marks, residue from blue painter's tape and oil or perspiration from my hands. All of these can contaminate your finish. After gluing the aprons and legs together I glued the trim to the underside of the aprons. On this table the trim is flush with the outside of the aprons. I've also run a bead along the bottom of the apron, either routing it on the apron, or adding a piece of rounded over trim and letting it extend about ⅛" or so past the apron face. I don't like straight lines all that much, and often curve the bottom of the aprons. However, on this table I felt that curved aprons would distract the eye from the graceful curve of the legs.

Topping It Off

The top consists of a simple frame and inset panel that sits about 3/16" above the frame. I make the panel first, leaving it about 1/8" oversized, and cut the rabbet under the top edge of the panel after the panel frame is assembled. Because the panel is so small I'm not worried about seasonal wood movement. Certainly, on a panel wider than about 12" I would have re-sawn the makore and laminated it to a Baltic birch core (and veneered the bottom side as well).

After cutting the panel frame pieces to final dimension I mitered the ends. I do this on the miter saw, using a stop block to ensure that each piece is exactly the same length. I then cut a 1/4" spline slot on the inside end of each apron. These help align the pieces during assembly. For the splines I used 1/4" Baltic birch, and cut the slots on the router table with an Onsrund spiral bit. On the top inside face of each apron I cut a 1/8" by 1/2" rabbet that will seat the panel. All that's left is to cut a rabbet on the bottom of the panel (that will mate with the rabbet on the top of the aprons) and then round over the top edge of the panel. Once I'm assured that everything fits together nicely, I glue the frame together. There is no need to glue the panel to the frame. Place the frame (with the panel removed) on the aprons, and use a pocket hole jig, kregtools.com or workshopsupply.com, to secure them together. Two pocket holes per apron are sufficient. Sharp corners on tables invite confrontations with legs or other body parts, so it's a good idea to round them off. On this table I decided to simply cut off about 5/8" of the corners. I think it provides a nice facetted edge to the top and compliments the outside bevel on the legs.

A table like this is likely going to be placed somewhere in a room and left to its lonesome. So it doesn't need the same kind of finish that a dining room table requires. For display furniture I usually apply a shellac, woodessence.com or leevalley.com, followed by several coats of a thinned varnish or polyurethane (Varathane 'Wipe-On Poly', rustoleum.com, is the commercial version) on the top. While shellac has superior vapour resistance, which is what helps alleviate the effects of changes in moisture content on wood, it isn't overly water resistant, as is varnish.

MATERIALS LIST (All measurements in inches)

Part		Qty	T	W	L
A	Panel	1	1/2	9 1/2	9 1/2
B	Panel frame	4	3/4	2 1/4	13
C	Legs	4	1 3/16	1 3/16	25 1/8
D	Feet	4	1*	1*	3 1/2
E	Aprons	4	3/4	2	10**
F	Trim	4	1/8	3/4	9

* rough dimensions ** includes two 1/2" tenons

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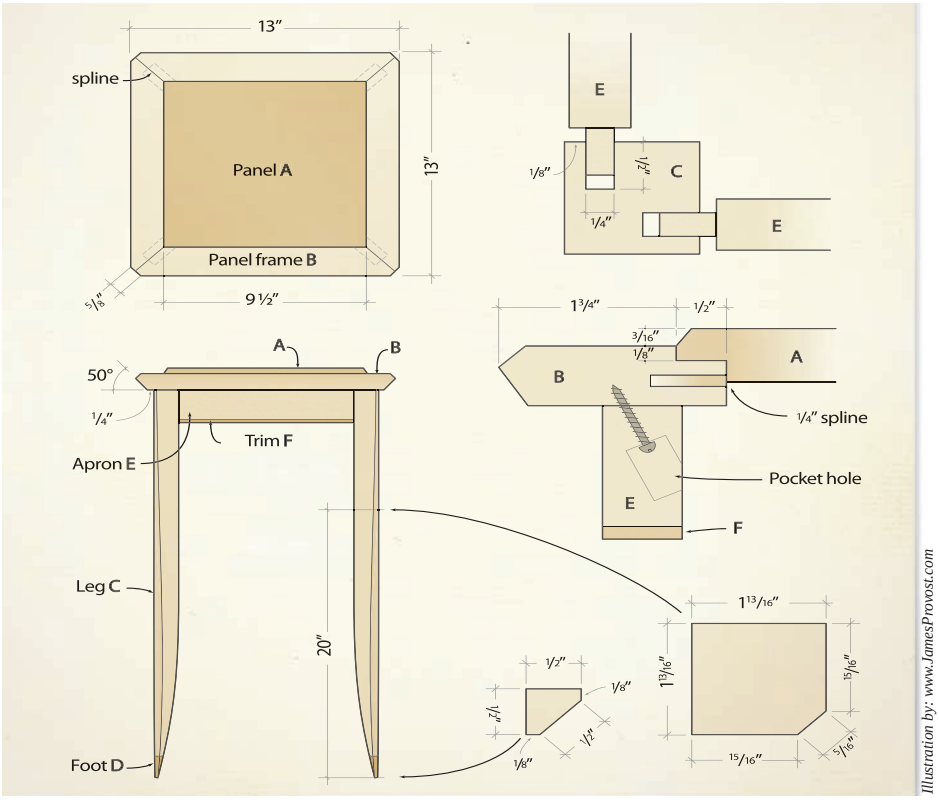


Illustration by: www.JamesProvost.com

BY KAREL AELTERMAN

Bent Lamination

Bent laminating is an easily acquired skill that will open up new avenues for expressing your woodworking creativity.

If you are one of those woodworkers who has thought about how nice it would be to use bent lamination in a project, but are intimidated by the process, think again. The process is surprisingly simple, and once you've made your first bent lamination, you'll want to include curves in all your future projects.

Layers, Laminates and Lamination

We're all familiar with laminates. If you've ever glued two pieces of wood together face-to-face you've essentially created a laminate. A laminate is simply anything made up of two or more layers of material. The technique to produce the laminate is called lamination. Bent lamination just introduces the element of curving the laminate. Lamination is different than veneering. In veneering the layers are oriented in an alternating fashion, while in laminating, the layers are oriented in the same direction.

Commercially made laminate layers are not widely available. Some lumber dealers, such as A&M Wood Specialty, forloversofwood.com, sell thin strips of 1/16" or 1/8" lumber in various species. Fortunately it's not too difficult to make your own laminate. They're easily produced by cutting strips of the desired thickness on a bandsaw or table saw and cleaning them up with a planer. The thickness of the strips depends on the radius of the curve to be obtained and on the kind of wood used - the tighter the curve, the thinner the strips should be in order to allow them to make the bend without breaking any fibres. It is easiest to find out the possible radius for a strip of wood by testing a piece. A typical 3/4" thick curved piece would be made up of six strips of 1/8" thick each. If you find that the curve you want to make is too tight, or the wood you are using does not allow you to bend it enough at that thickness, use eight strips that are a little thinner (about .09" thick).

Bent lamination is based on the principle that if several strips are glued together face-to-face against a rigid form, they retain the shape of the form. Try bending two thin strips together and see how their surfaces slide one along the other. If you clamp them together in a curve, they will keep that shape because they will not be able to slide back to their initial position. Glue accomplishes the same goal.

The Bending Form

In order to make the laminate layers conform to a certain predetermined shape and to make one layer adhere entirely and

uniformly to the next one, you need to make a form on which the layers will be clamped. There are two kinds of bending forms. The first is a two-part form that consists of matching male and female form pieces that sandwich the laminate layers together. The second is a single form and a clamping block made of bending plywood and hardwood blocks. The laminate layers are sandwiched in between the clamping block and the form.

Since bent lamination is used only for narrow parts such as drawer fronts, table legs and aprons, and chair parts, the form can be fairly narrow. MDF is the material of choice for making forms because its edges can easily be shaped into smooth curves with a bandsaw and files or spokeshaves. Forms are often made up of several identical pieces of MDF, and you can use one of the pieces as a template, and easily duplicate it with a router and template bit. The various layers of a form are then screwed and/or glued together. You need to make the form a few inches longer and wider than the final piece you are going to laminate. When assembling the form, ensure that the layers are perfectly lined up. Smooth out any imperfections with a file, spokeshave or block plane. Optionally, you can add a layer of matting board over the edges to help you achieve a perfectly smooth curve. Finally, cover the form with transparent packaging tape to prevent the glue from adhering to it.

Two-Part Bending Forms

The two pieces of a male/female form must match perfectly, while accounting for the thickness of the laminate layers. The radius of the male (convex) form must match the radius of the laminate layers on the bottom (concave) edge of the object, and not the radius of the female form. That is, the inside of the bent lamination will have a different radius than the outside.

Cutting Laminates on the Bandsaw

Cutting your own laminates is best done with a bandsaw. Make sure you equip the tool with a fence that is at least as high as the laminates you will be cutting so that the stock is well supported. Make sure the table is perpendicular to the blade and the fence is parallel to the blade. You should also use a sharp blade with three to four teeth per inch.

If you want the bent lamination to appear as much as possible as a solid block of wood, make sure you mark the edge of the wood so that you are able to put the laminates back together in the right order. Clean the strips with a planer or drum sander. It's a good idea to make a few extra strips; the thin laminates will vibrate more than a thick block of wood and some strips may get destroyed by the planer. A drum sander is a better option for thicknessing very thin strips. If you don't have a drum sander and want to use thin strips, you can use a hand plane to clean up the laminates. Use double sided tape to secure the strip to your workbench.

An easy way to cut the two parts to the form in one fell swoop is to a rout a channel halfway through the thickness of one layer of the form. Use a straight router bit the same diameter as the thickness of the laminate stack you will be bending. Stack all the layers that you will need to make up the form one on top of the other, and then drill dowel holes through the sandwich.

Dowels inserted into the holes will keep the layers together and make it easier to lift the forms. Cut the sandwich apart, separating it into male and female parts of the form. Finally, clean up the sawn edges of the forms with a template router bit, with the bearing resting against the channel sides.

When you are gluing the laminates together you can hold them temporarily in place with masking tape. A set of guide rails on the sides of the form will help align the male and female forms and allow you to concentrate on the rest of the glue-up. You will need as many clamps as you can possibly get on the form. A major advantage of the two-part form is that it does an excellent job of distributing clamping pressure.

One-Part Bending Forms

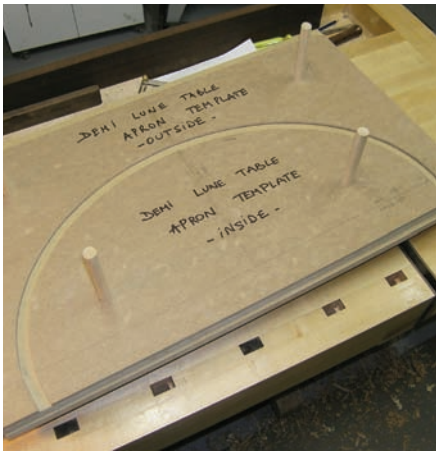
On certain projects the radius can get too tight to use a two-part form. The two part forms can also be rather large and heavy and become difficult to handle. In such cases you can use the male part of a two-part form, but a different clamping method. Make the male form large enough to drill clamping holes in it or to cut the underside in such a way that allows appropriate clamping action.

The clamping block consists of one or more layers of bending plywood (more layers distribute clamping pressure more evenly) and a thin strip of bending plywood with small hardwood blocks glued to it. Generally it's difficult, if not impossible, to place a clamp over every hardwood block, but you should use as many clamps as you can manage. You can also put a layer of ⅛" cork between the work and the clamping block.

Clamping With a Vacuum Press

If you own a vacuum press system, you can use this to clamp the laminates to the male form. Just lay the stack of laminates on the form, temporarily secure it in place with tape, and insert it in the vacuum bag.

Bandsaw form template



Pieces for a form

Two-part form separated

No need for clamps here, the bag does the trick. If you use a different method to build the form than the one described above, make sure it is solid enough to withstand the great pressure inside the bag.

Dealing With Spring-back

When you bend a piece of wood that has spent its life being straight, you can expect some resistance. Bending wood will compress the fibres on one side and extend them on the other. Wood fibres have some flexibility to enable the tree to bend in the wind but their main role is to keep the tree standing. All they want to do after being compressed or extended is recover their original position. This is called 'spring-back'. The bigger the curve, the more spring-back you can expect.

There are a few ways you can deal with this issue. One way is to exaggerate the curve a little to compensate for spring-back. This is straightforward but rather tricky if you need to obtain an exact curve. I like to use glue that dries really hard and keeps the fibres as much as possible in the desired position. Both urea-formaldehyde and epoxy glues accomplish this. My favourite is urea-formaldehyde because of the easy clean-up compared to epoxy.

With these straightforward techniques, any woodworker with a basic set of skills can incorporate bent lamination into their work. Begin with a simple project. You'll be amazed at how easy it is to do, and how it opens up a myriad of design possibilities.

KAREL AELTERMAN
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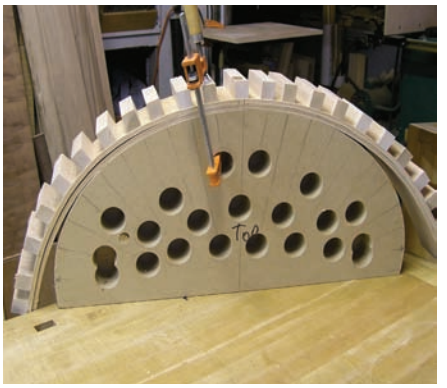
Two-part form glued and clamped



One-part bending form

Bending Plywood

In 'regular' plywood, the layers of veneer run in alternating directions; this lends rigidity to the plywood. You can bend the plywood only slightly before it breaks. In bending plywood the layers run in the same direction, allowing the plywood to bend to a much greater degree before breaking. Once it's been laminated into a curved shape the plywood will hold its shape indefinitely. Bending plywood is available in ¼", 5⁄16" and ⅜" thicknesses, and comes in several species, including poplar, birch and lauan in standard sized sheets (4' x 8') with the veneer layers running either lengthwise or widthwise.

BY THE EDITORS

Workshop Wishlist

If you are looking for ideas for the woodworkers on your gift list, here are some great suggestions from our editors. Give any of these shop tools or accessories and you are sure to get onto your woodworker's 'nice' list.

HNT A55
$297.50
craftsmanstudio.com

An outstanding Norris style smoothing plane in Gidgee from HNT Gordon, hntgordon.com.au. A hefty 2.7 lbs, this 2" by 10" plane has a 55° cutting angle and a superb micro blade adjustment mechanism. Jingle those bells.

Leigh FMT
$799
leevalley.com

The ultimate jig for routing precision mortises and tenons from Canada's premier jig company leighjigs.com. Love at first rout.

Czeck Kerf Kadet
$39.95
czeckedge.com

This gorgeous 7" marking knife has a 1/32" thick blade with a 40° bevel and 40° cutting angle. Wonderful to hold and a joy to use. Bring on the pudding.

Steel City 40200H
$599.00
steelcitytoolworks.com

13" planing width, 15 Amp motor, 2 speed gearbox planing at 16 and 23 FPM, extra rigid 4-column lead screw design, and, joy of joys, a spiral insert cutterhead. Available early 2009 (think 'gift certificate').

Milwaukee 2401-22
$149
milwaukeetool.com

Light weight and plenty of power. This 12V Li-ion sub-compact ¼" hex drill driver will be your new best friend. Where's the mistletoe?

Bosch 4100
$575
boschtools.com

The perfect bench top and worksite table saw; great features, including a smart guard system, Squarelock™ rip fence, and soft start, in a compact, durable package. Let it snow!

Porter Cable PC390
$139
deltaportercable.com

A low profile variable speed 3.5 Amp ROS featuring a new motor design for longer life, electronic load control and electronic brake. That's a wrap!

Triton TC450SPS
$139
busybeetools.com

This 3.5 Amp oscillating spindle sander from the fine folks at Triton, tritonwoodworking.com , comes with five sanding drums for quick sanding on curved stock. Yowza!

Festool Domino DF500
$840 hafele.com

A precision loose tenon joinery system that outshines biscuit and dowel joinery. German precision engineering at its best festoolusa.com. Simple, quick, effective, versatile. I'll toast to that.

King Canada 8223PN
$49.99
kingcanada.com

For most woodworkers, a headless pinner is the most versatile air nailer. This lovely unit shoots pins from ½" to 1 3/8". Take me home Santa baby.

Freud PKG0028
$399
freud.ca

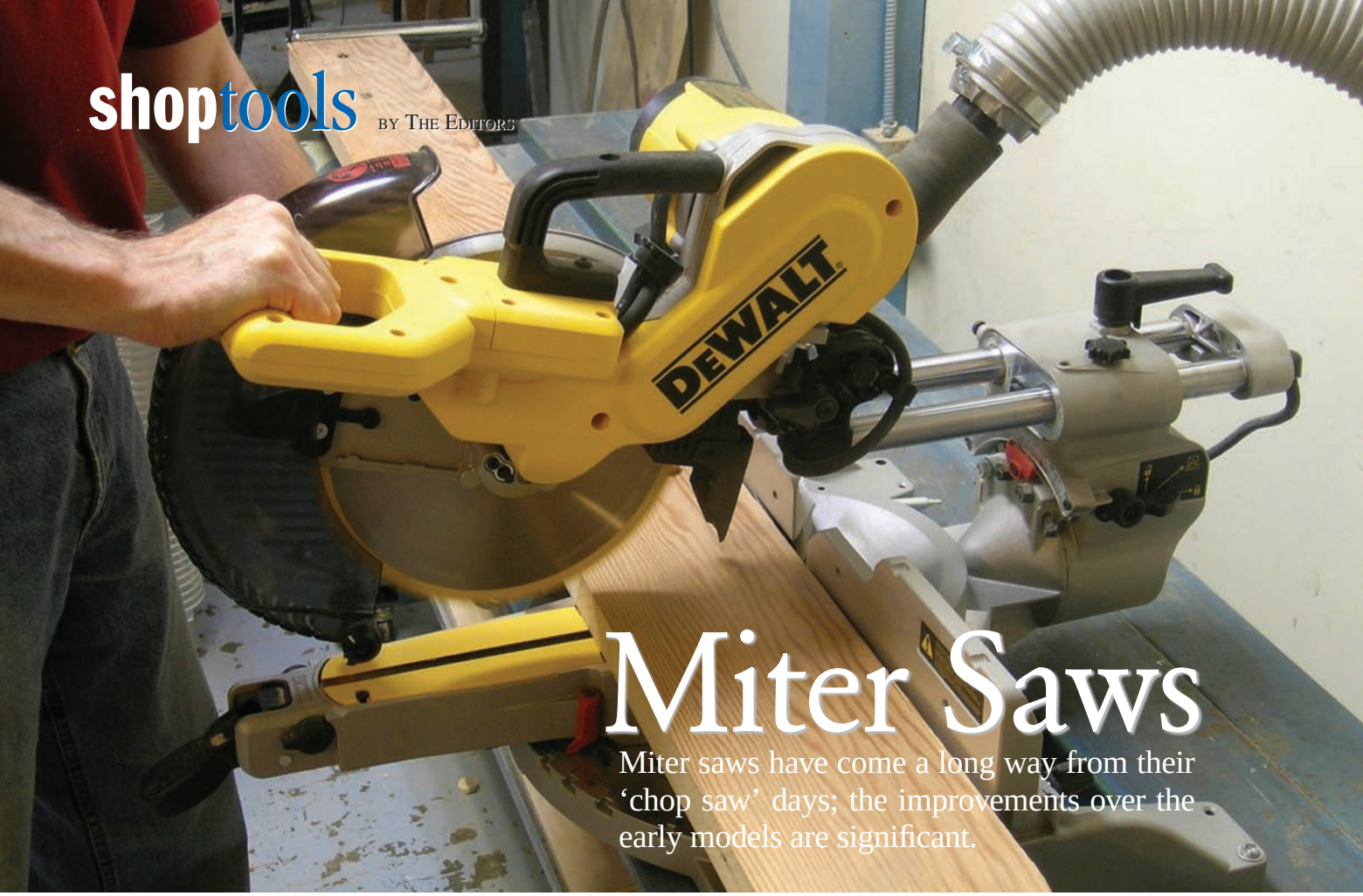
This is an ideal set-up for the small shop (plus you can easily transport it to a job site). A sturdy router bench top router table, Freud's beloved FT17000VCE 2 1/4 HP router, power safety switch, and a premium machined cast aluminum adjustable fence system. Daddy, break out the bubbly.

Dozukime Fine Cut Saw 60T22.01
$41.50
leevalley.com

A quality saw makes for quality sawing. This 24 tpi saw cuts a .016" kerf. The 16" replaceable blade handles stock up to 1 ½" thick. An exceptional saw for the little elf in your life.

General 90-150M1
$999
general.ca

This 1 HP 14" bandsaw features precision machined aluminum wheels, built-in dust collection, a laser line marker and two motor speeds (2,315 and 2,959 FPM). Zoom zoom indeed.



Miter Saws

Miter saws have come a long way from their 'chop saw' days; the improvements over the early models are significant.

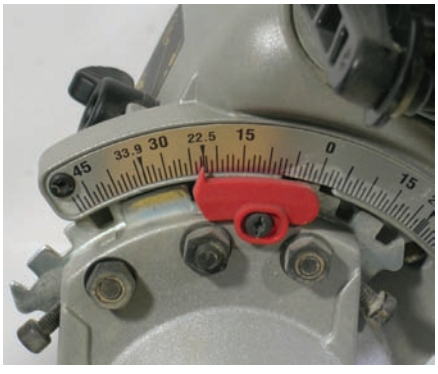
Early versions of this tool were known as chop saws because that is what they excelled at: crosscuts and miter cuts on the jobsite. They were not particularly accurate when switching between settings and were limited to rather small stock. Over the years manufacturers have been improving these saws by designing more reliable tilt mechanisms, better fences and increasing the crosscutting capacity significantly. There are about two dozen miter saw models from ten different manufacturers available across Canada, and each offers slightly different variations on these features. The current generation of these saws have improved dramatically and excel at three different kinds of cuts: miter, bevel and compound.

A compound cut involves cutting both the miter and bevel cuts in one stroke. A miter cut is made by moving the saw head from side to side making a cut at an angle across its face, making one edge of the board longer than the other. A bevel cut is made by tilting the saw head to one side or the other and cutting across the board at a 90º angle; this makes one face of the board longer than the other. Compound cuts are a combination of the two, enabling the saw to miter wider mouldings by laying them flat.

Before heading off to buy one of these versatile tools you need to ask yourself one very important question: "What will I be using this saw for?" With the many different features and variations on each of these saws, choosing the model that has the features suitable for the work you intend to do will ensure your long term satisfaction with your purchase. If all you are doing is framing walls and chopping up 2 x 4 stock, then a basic Compound Miter (CM) saw is probably your best bet. It's light, durable and can easily be moved from the shop to the job site. If, on the other hand, you need larger capacity and want a more refined saw, then a Sliding Compound Miter (SCM) saw might be more suitable. The added capacity and refinements come at a cost though. SCM saws are larger, heavier and more expensive. A basic entry level CM saw for general purpose use, such as the Skil, starts at $179.99, and tops out at $249 (DeWalt DW713 and Ridgid). With the exception of King ($169.99), SCM saws are in the $390-$599 range. One notable exception to this is the Festool Kapex; while this German-engineered tool is impressive, at $1,450 it is more than twice as expensive as the next most expensive SCM saw in our list, the Bosch 4410L at $598.

Mobility

If you're working primarily with dimensional lumber and you'll be taking the saw to a job site on a regular basis, then compact size and low weight will be important considerations. The saws in our chart range in weight from a low of 34 pounds (Rigid, Craftsman), to a hefty 55 pounds (Bosch). All these saws have holes in their bases that enable you to screw them down to your work surface so even the lightest saws will be as stable as your work bench. You'll also want to look for a model with a top-mount lifting handle, which makes carrying the saw somewhat easier, and a lock-down pin, which locks the saw



Bevel Scale

head in the down position for transporting. Sliding saws should have a rail locking knob to prevent the saw head from sliding when it's being moved. Some models (DeWalt 717) have hand indentations on the sides of the base that make it easier to life the unit. Most manufacturers also offer purpose built miter saw stands. If you will be constantly moving the saw from shop to job site, these can be a real asset.

Capacity Comes at a Cost

When you move beyond basic framing and door and window trim you might want to consider a sliding compound miter saw. With the addition of one or two rails, the saw body is able to slide back and forth across the material, dramatically increasing its cross cutting capacity. On a CM saw you can make a 6" cross cut at 90º, while on an SCM saw you can cut up to about 12" (up to 15.4" on the DeWalt DW717 by following special set-up procedures). If you will be cutting medium to large mouldings or crown mouldings then this extra capacity will be essential. When cutting crown moulding you have two options. The first is to cut the moulding on edge (upside down at the same angle as it will be installed) using a simple miter cut. The second option, which you can only do with a SCM saw, is to lay the moulding flat on the table and cut it with a more complex compound angle cut. The time and aggravation saved may well be worth the additional cost for a SCM saw.

If you will be primarily working in your shop. the additional space required for a sliding model might be a good trade for the extra width capacity. The slide mechanisms on these saws often require a considerable amount of space behind the saw, requiring you to mount the saw at a distance from other tools or a wall. The slide mechanisms on these saws are designed to tight specifications so that they operate smoothly and accurately, but this can be of concern if the saw is used on a jobsite. Jostling in a van with other tools or being dropped on a jobsite can easily damage the slide mechanism rendering it inoperable.

One of the major benefits of using a sliding compound miter saw to cross cut material is the ability to control tear-out. With the non sliding models, there is no support for the material as the blade exits the bottom of the cut. When crosscutting a board with a sliding version, bring the blade down to cut about an ⅛" into the material and draw the saw towards yourself. The rotation of the blade means that as it breaks the surface, the fibres are fully supported. At the end of the slide, bring the blade down completely and return it to the start position. At this point the teeth are cutting up into the stock and everything is fully supported with no tear-out.

Scales

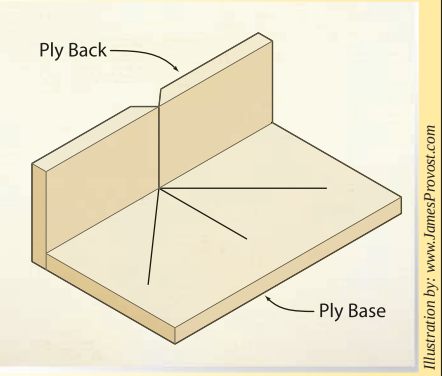
You won't find any digital displays on any of these miter saws. The miter scale across the front and the bevel scale on the rear knuckle are displayed in the old style analog scale. Some of these scales are easy to read while others require a little more effort, but the real difference between the two scales is the accuracy. The miter gauge settings are indicated on approximately a 12" radius at the front of the saw. At this distance out, with a mechanical pointer and an accurate scale you should be able to set your angle to an accuracy of ½º without too much trouble. The tilt mechanism for the bevel cuts is usually marked on

Shop Tip

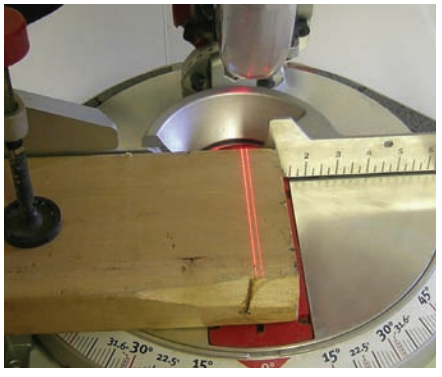
Keeping your saw blade in tip top condition means you'll always get the best cuts it can deliver. Remember that carbide is a brittle material, so exercise caution when installing and storing your blade. If you chip a tooth have it replaced. Like any tool in your shop, keep your blades clean. You can use a commercial cleaner, or a general cleaning product like Simply Green, homehardware.ca. Let the blade sit in the solution for 15 or 20 minutes, scrub it clean with an old stiff bristle brush, and then rinse and dry the blade. When you notice that you have to push a bit harder to move stock through the blade, or you see that the cuts don't look as crisp as they did, it's time to have the blade re-sharpened. Expect to pay about $25-$30 for an 80 tooth blade. For a quality blade like the Forrest Chopmaster, you should be able to re-sharpen the blade seven to eight times.

Working With Small Parts

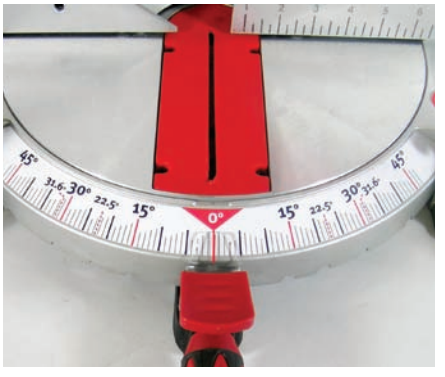
The fences on these saws are not the most effective in supporting small pieces. Cutting stock under about 12" in length requires some extra precautions. As the size of the part you are cutting decreases, the relative size of the blades teeth increases and small parts can easily be grabbed between teeth, particularly if the opening in the throat plate is very wide. When possible, cut miter ends and rip very narrow stock from a larger board. Otherwise, use a simple plywood sled, as shown in the illustration. You can also install a couple of toggle clamps onto the sled to hold extra short pieces safely.



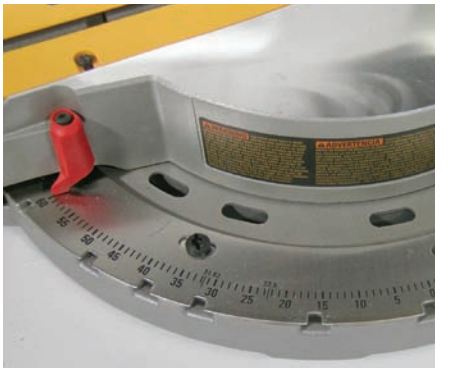
Small parts jig



Dual lasers



Easy to read miter scale



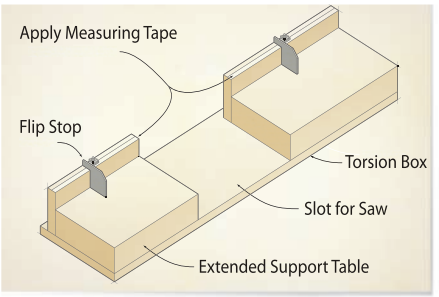
Miter detents

a much smaller scale on a tighter circle, usually something with a 3" to 4" radius. Consequently, setting an angle accurately using this scale is considerably more difficult. Using only the scale it is possible to get within a couple of degrees of the intended angle, but accuracy is a matter of luck. To set the bevel angle to within 1/10º in relation to the table use an external aid such as the Tilt Box Inclinometer, leevalley.com or the digital angle gauge, busybeetools.com.

These saws all offer detents at various points along the scale as well. These are used to set common angles quickly and not every saw offers the same selection or number of detents. To allow the user to zero in on the exact angle, the Bosch offers a micro adjustment knob that lets you fine tune the setting 2º on either side of the setting.

Table Support

As the blade descends into the work piece, it must be fully supported by the table and the fence. Because some of these saws (such as the Bosch, Festool and Rigid) allow the blade to move through a wide range of motion, a rigid fence would require a considerable gap. To resolve this, these saws incorporate movable fences. You can move the fence closer to the blade for greater support for 90º cuts and then move it away from the blade as you tilt the blade over for bevelled cuts. Even though these saws have a large footprint, they all share very short tables when measured out from either side of the blade. When working with long stock the support they offer is marginal. Unless you intend to build or purchase a miter saw stand, you'll benefit from a saw that comes with table extensions that extend from the edges of the main table to widen the table support. Some saws have extensions on both sides (B&D, Ryobi, Skil, Bosch, King), while others either have one extension (Ridgid) or none (DeWalt, Craftsman, Hitachi). The Festool offers the extensions as an option.



Workstation with extended tables

These table extensions consist of a couple of steel bars that pull out of channels in the base. At the end, a piece of metal joins the two rods and provides a rest that the material sits on. These are inherently weak at their maximum extension and if you are constantly working with long material it may be better to build a more permanent base out of plywood such as a torsion box with integral extension tables. This will also allow you to include a rear fence that will enable you to integrate a measuring tape and stop blocks for accurate repetitive cuts on longer pieces. The components for a shop made base can be purchased from Kreg Tools, kregtools.com. All the manufacturers in our list, except Skil and Festool, offer miter saw stands. In a pinch you can bolt the miter saw to a plywood base and secure it on a pair of saw horses.

All the saws come with some form of stock hold-down to secure material either against the table or against the fence. Typically the hold-downs can be used on either side of the blade. The Skil saw provides a short fence at the front of the saw that serves to hold crown moulding in place against the back fence. The Bosch has the easiest clamp to position on the work.

Blades

Like every other power tool in the shop, nothing happens until a sharp edge meets a piece of wood. To get the right results with one of these saws you must choose the correct blade for the task at hand. The saws in our chart ship with either a 40 or a 60 tooth blade. A 40 tooth blade will get you through most situations, and is quite serviceable if all you are doing is rough cutting lumber. For smoother cuts look for a saw with a 60 tooth blade. If you want the cleanest cuts on end grain in the widest variety of material, you may wish to consider a specialty blade like the Forrest Chopmaster forrestblades.com (see Sidebar).

The throat plates that ship with these saws will accommodate the full variety of bevel angles the saw will cut but this means it has a rather wide opening. This presents two problems, the first is a safety issue, the second relates to cut quality. When you are cutting narrow slivers off the end of a piece or working with small parts, because the opening is wider, there is a chance that off cut could get caught between the blade and the insert. In most cases the piece will be noisily chewed to shreds under the insert plate by the blade. It could also get caught on the plastic insert causing it to shatter in the process. The wide opening also means there is no support for the material at the edge of the cut. With proper technique this can be controlled on a

POPULAR 10" COMPOUND MITER SAWS

Black & Decker FS110L - $169.99
blackanddecker.com

Ridgid MS1065LZA - $249.00
ridgid.com

Skil 3800 - $179.99
skiltools.com

DeWalt DW713 - $249.00
dewalt.com

Ryobi TS1355LA $199.00
ryobitools.com

sliding saw, but unless a scrap board is used to back up the cut, there is little that can be done for the underside of the cut on a CM saw. Making a zero clearance insert such as the one used on a table saw will reduce tear out at any specific bevel angle (see "Zero Clearance Inserts", Feb/Mar '08, Issue #52). You could also build a small parts miter jig (see Sidebar).

Lasers can be very handy when these saws are used for carpentry work, speeding up production considerably. They are also very handy when making bevelled and compound cuts, as they show exactly where the edge of the cut will fall. The DeWalt DW713 doesn't come with a laser and the DeWalt DW717 offers it as an option while the rest of the saws in the chart include a laser. When included, the laser can be mounted on the arbour, the guard, or the rear of the saw. The Irwin Miter Saw Laser Guide, irwin.com, can be fitted to any saw not equipped with a laser. Using the laser is a matter of personal preference and should not be a deal breaker on any of these saws. For the utmost accuracy it is still best to bring the blade down to a scribed line first.

When these saws are used on a jobsite, the material is typically placed, cut and removed from the saw rather quickly and having an electric brake on the saw is a definite safety feature. When the trigger is released, a brake circuit is activated that slows the blade to a stop in a matter of seconds. Of the models featured in our list, only the Ridgid and the DeWalt DW713 do not have this feature.

Forrest Chopmaster

The Chopmaster was specifically designed for use on miter saws. Two features make this an exceptional blade. First, the 80 tooth blade employs an alternating top bevel (ATB) tooth style –four of the teeth are set at a high 30º angle, with the fifth tooth flat. This high angle ATB design allows the blade to slice rather than punch through material, resulting in a much cleaner cut. Forrest uses a double hard C4 submicron carbide in the teeth, which means that the teeth will cut longer before needing to be re-sharpened, and the large size of these teeth will give more sharpenings. The second feature that distinguishes this blade is the 5º negative face hook. A negative hook reduces the blades tendency to lift the material as it is cut, and contributes to a better surface finish. $129 at leevalley.com. See our review of the Chopmaster at: canadianwoodworking.com/ Newsletters/reviewindex.htm.

Dust collection

Dust collection on these saws usually consists of a pickup chute at the back of the blade that directs the sawdust that comes its way into a cloth bag that hangs off the back or side of the machine. These are passive pickups and rely on the velocity of the debris to get it into the bag. As such, they are quite effective, but these are still among the most difficult machines to collect sawdust from. If you have the saw mounted permanently in your shop consider replacing the collection bag with a connection to your dust collection system.

Picking the Right Saw

The right saw for you will depend, among other things, on the kind of work you do and the budget you have available. For the DIYer primarily involved in home improvement projects, or the woodworker who makes small scale projects, a CM saw is likely all you will need. The Skil 3800 offers very good value at an excellent price. It bevels and miters beyond 45º, features a dual laser, electric brake, table extensions and sliding fence. If you make larger scale projects, or if you plan on undertaking major home renovations, then a SCM saw is the better choice. The King Canada is a price stealer at $169.99, about half the price of the average SCM saw. However, as with the Craftsman it doesn't bevel or miter beyond 45º. The Bosch, DeWalt and Hitachi have similar features and all three companies have good reputations for making top quality products. You won't go wrong with either of these three.

Go to canadianwoodworking.com/data for detailed product specifications. For a review of the Skil 3800 and DeWalt DW717 go to canadianwoodworking.com/ Newsletters/reviewindex.htm

THE EDITORS

POPULAR 10" SLIDING COMPOUND MITER SAWS

Bosch 4410L - $598
boschtools.com

DeWalt DW717 - $549.99
dewalt.com

Hitachi C10FSH $579.00
hitachipowertools.ca

Craftsman 28895 - $599.99
sears.ca

Festool Kapex KS120EB - $1450.00
festoolusa.com

King Canada 8372N - $169.99
kingcanada.com

BY MARTY SCHLOSSER

Curved Panel Veneering

Tired of the look of flat doors on your cabinetry and furniture? Maybe it's time to incorporate curved panels into yourwoodworking. It's not that hard, and it adds a whole new dimension to your woodworking.

My interest in curved panel veneering began several years ago when I decided to add curved panel doors to an entertainment cabinet I was designing. Originally I decided to make coopered doors, which I felt would add an exciting design element to the cabinet. However, I quickly realized that they would require a significant investment in both time and materials. After some research I decided to try making the curved panels with a vacuum veneering system. A vacuuming system is quite affordable for the small shop, is easy to store in a small space when not in use, and more importantly, enabled me to quickly and efficiently make curved panels. In this article I'll describe the equipment required and walk you through the process I follow in making these curved panels.

What You Need

Vacuum veneering requires three basic things: a mould upon which the veneered panel will be formed, a bag into which the mould and panel materials will be placed, and a pump to generate a vacuum inside the bag. Fortunately, manufacturers have responded to the demand for vacuum veneering and offer kits and systems that are both reliable and relatively inexpensive, vacupress.com or vac-u-clamp.com. With it you can achieve consistent, predictable results quickly and easily.

The vacuum pump displaces air from the bag, resulting in the surrounding air pressing on the bag evenly, with a pressure of up to 2000 lbs. per square foot (14 psi). These two factors (high and even pressure) are what makes vacuum veneering work so well. The vacuum press does an exceptional job on both flat and curved pieces alike. Any cabinetmaker who has used mating forms (male and female profiles) with clamps, would certainly appreciate the ease of accomplishing this task with a vacuum press. In the vacuum press only one part of the form is needed, and no clamps at all. Standard veneer bags are in the 4' by 8' range, though much larger bags are available.

Anatomy Of a Curved Panel

Similar to a sheet of flat plywood, a curved panel consists of two sheets of veneer laminated to an inner core. The inner core, which provides both shape and strength to the panel, is made of two or more pieces of bendable plywood with a sheet of inexpensive veneer between each sheet of plywood. Epoxy or urea formaldehyde glues, veneersystems.com, are used to bond the veneers and plywood pieces together so they don't return to their original flat state when removed from the mould.

You can make your own shop-sawn veneer, which can match your solid stock perfectly. All you need is a well tuned bandsaw and a sharp blade. With a little bit of practice you can quickly and easily re-saw wide boards into ⅛" or 3⁄16" thick veneers. The width will depend upon the capacity of your bandsaw. However, you may wish to forego the relatively time-consuming and challenge-fraught process of making veneer sheets by purchasing commercially made veneer. Some suppliers, forloversofwood.com, carry 1⁄16" or ⅛" thick solid veneer. These veneers are available in common domestic woods like quarter sawn and flat-cut cherry or oak, and in imported common species like mahogany and sapele. Also available are paper-backed veneers, which are ideal for the first-time user or those who want to bypass the challenges of making their own veneer sheets.

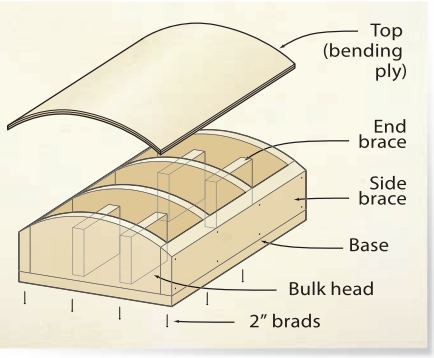
The Mould

Once you have determined the size and shape of the panel you require, you need to make a mould. Bear in mind that bendable plywood can only be bent so far before breaking: a 4mm (5⁄32") thick bendable plywood has a 16cm (6.3") bending radius as compared with 40cm (15.7") for the 8mm (5⁄16") material, so plan your panel's shape accordingly.

I use ⅝" thick MDF for both the base and the bulkhead sections of the mould, and cap them off with two layers of bendable plywood – the same material used in the panel's inner core. Regardless of which thickness of plywood you use, you need to cover the bulkheads with no less than 16mm (⅝") of plywood to ensure the mould can withstand the approximate 14 psi pressure created inside the vacuum bag.

Begin by making a full scale drawing of the panel, showing both top and side profiles. The side profile drawing makes it easier to determine the shape of the bulkhead pieces, as you need to account for the thickness of the mould's bendable plywood cap. You also need your mould to be about 2" taller and wider than the panel's final size, because the vacuum bag can't fully draw down to the base of the mould - there's usually a ½" or so gap along the edges. Once you've got the mould's profile shape down pat, make a master template of ½" plywood or MDF, which you can use with your router to quickly duplicate the required number of bulkhead sections. Because the mould needs to be quite rigid to withstand the pressure that the veneer vacuum generates, you'll need one bulkhead every four to five inches. Trace the profile onto the master template material and carefully cut it out on a bandsaw or jigsaw. Remember to cut outside of the line; ⅛" to 3⁄16" works well, as most routers can readily remove that amount of material without difficulty. Follow up by final shaping with hand tools. I use a rasp to quickly get close to the line, then sandpaper to bring it to the final profile. Be as exacting as possible, and if you make a mistake and get inside the line, be willing to start over. Remember, this master template determines the shape of your panel, so you need to get it right.

Use the master template to lay out the bulkhead sections on a sheet of ⅝" MDF, and then cut them out with a bandsaw or jigsaw. Again, ensure you cut outside the layout line. Proceed with routing the bulkhead sections to their final shape. I usually fasten the master template to the rough-cut bulkhead blanks with two 1" pins, but two-sided tape works as well. A ½" diameter template bit mounted in a router table does quick work of trimming the edges; it allows for more control over the process than does a hand-held router.



Illustrations by: www.JamesProvost.com

Anatomy of mould

The bulkheads can now be fastened to the base using PVA glue and 2" brads. Be sure to brace the outside bulkhead sections to the adjacent bulkheads using MDF scraps located every 6" along the length of the bulkhead. Without this bracing, the pressure could cause the mould to cave in at the sides. Once the bulkheads have all been fastened down, cover them with bendable plywood. I usually do a dry fit of the plywood, just to ensure it will fit properly. Once satisfied, go ahead and put glue on the tops of the MDF bulkheads, and then fasten the first piece of plywood using brads. Start at one end and work your way to the other end, taking care to ensure the plywood fully contacts the bulkheads at all locations. Continue doing this until the required 16mm (⅝") minimum thickness of bendable plywood has been fastened securely. Check the plywood surfaces to ensure they're all smooth, and then sand away any imperfections.

Now is a good time to write the project name and location of the panel on your mould for future reference; you'd be surprised how challenging it can be to locate the right mould once you've got a number of them stored in your shop. Also, mark center lines on the top and sides of the mould; these will be used for lining up the panels as you go along. To keep glue from sticking to the mould, you can cover it with a thin sheet of plastic or else varnish it.

Panel Inner Core

The inner core (substrate) provides most of the panel's strength and shape, so it's important that it be made of enough layers of flexible plywood and veneer sheets to do its job. Unless the panel is very simple, I usually glue up the inner core first, then, once it's dry, do a separate glue-up to apply the face (front and back) veneers. This greatly simplifies the process.

Using a piece of string or a flexible tape measure, take measurements directly from your mould to determine the width and length of the inner core materials. These materials should be cut approximately 1" narrower and shorter than the mould, to ensure the press will hold them down firmly while they are drying. This will give you enough material to work with when it comes time to trim them to their final dimensions. Once you've cut your flexible plywood sheets and inner veneer sheets to size, clearly mark each face and the corners, so you'll remember their correct order and alignment as the glue-up progresses.

In addition to the plywood and veneer sheets, a caul sits on the sheets as they are being glued together in the press. A caul helps even out the pressure across the outer face of the panel as things are drying in the vacuum press and also keeps any glue squeeze-out from sticking to the inside of the vacuum bag. Cut your caul approximately ¼" wider and longer than the sheets being glued up. For a very shallow curve, with a 6" radius or more, you can use inexpensive melamine sheets. For a tighter radius curve you can use a flexible mesh known as Evacunet, vacupress.com, as a caul in lieu of the melamine.

Preparing For the Glue-Up

To make clean-up easier, lay down a plastic

Place panel in bag

Remove panel

Use mould as guide to trim panel edges

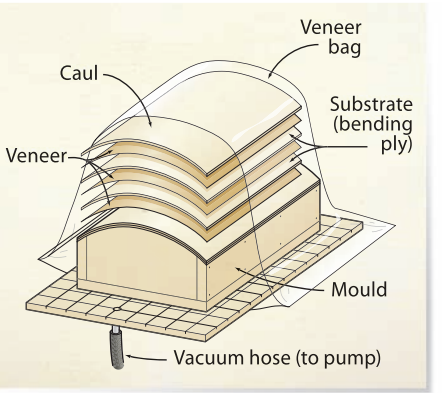
drop cloth on your workbench or table and set a container of water with clean-up rags ready to go if any glue drips. Before starting the glue-up, it's always a good idea to do a dry run of the process. This not only ensures you'll be able to efficiently get things into the bag before the glue begins to set, but affords the opportunity to check that the vacuum pump and bag are working properly before committing to the glue-up. Place your flexible plywood sheets and inner veneer sheet(s) together, lay the caul on top of the stack, and then tape them in the middle to keep them properly aligned with one another. Place this bundle on the mould in the position they will sit when you do the process using glue. Once you're happy with the positioning of the sheets, using those lines you put onto the top of the mould as a reference, draw corresponding lines on the edges of the sheets and mark one end to ensure you will get it in the right way when you are ready to do the actual glue-up. Make sure there's no sawdust on the plywood or veneer sheets, or they may not bond well to each other. With someone helping you out, slide everything into the vacuum bag and seal it up. Connect the vacuum pump to the bag and turn it on. If your mould is taller than 8", you may wish to help the process along by first using your shop vacuum to extract excess air from the bag. As the vacuum begins to draw down the bag, you may find that the bag starts to develop creases or small folds. This is normal. As long as these aren't on the panel, you can leave them be, otherwise turn off the pump and allow enough air back in to enable you to straighten the bag out, smooth the creases down and continue drawing down the vacuum. You may also need to assist the process along to ensure the panel sections are being drawn down together and that no parts of the bag get drawn underneath the stack or between the individual sheets of plywood or veneer.

The Glue-Up

Once you're happy with how everything works, turn the pump off, take everything out of the bag and remove the panels from the mould so you can start gluing them together. A few words regarding gluing panels together

Plane panel edges

are in order. First, understand that most urea formaldehyde glues are carcinogenic and therefore require you to wear an appropriate mask and protective clothing (gloves, safety glasses and long-sleeved shirt). Second, the open time for these glues is quite narrow – usually 40 minutes from the time you add water or the hardener – so you have to be prepared to work quickly. Again, that's part of the reason for doing a dry run. Third, make sure you are on the generous side when you calculate the amount of glue needed, as you won't have the time to stop part way through the process to mix up more glue.



Stack veneer atop mould

Lay your panels at the ready for the glue-up, making sure to mark clearly on each panel which sides need glue to be applied – and which don't. Once you've got everything ready, don your protective gear, mix your glue, and spread it on using a tooth-edged glue spreader followed up by a short-napped paint roller to even out the glue. Because bendable plywood is so porous and will absorb a lot of glue, I usually apply glue to all the plywood facing surfaces. This usually isn't required for the veneer sheets, unless they are especially porous. Place the sheets together as soon as the glue has been applied, making sure you've got them aligned properly and in the correct sequence. Once all panels are together, lay the caul on top of the stack and tape them at the center. With your partner's assistance, place the bundle onto the mould. Align the marks on the panel edges and top with those on the mould, ensuring the bundle is facing the right direction. Slide the now loaded mould into the vacuum bag, seal the end of the bag, then begin drawing the air out. As you did during your dry run, deal with any creases or folds that may reveal themselves and make sure the panels all draw together and are eventually sitting fully on the mould. Be willing to stop the process at any time to make corrections if you sense that things aren't aligning properly… but be quick about it as the time is ticking away and the glue is drying.

Leave everything in the press until the glue has fully set – usually overnight – then remove the loaded mould from the bag. If everything's gone right, there should be very little, if any, spring back to the panel. The greatest challenges are now behind you.

Applying Face Veneers

Applying the face veneers is much easier than making up the inner core, as there's so much less to contend with. As was done when making the inner core, first clearly mark each veneer sheet to indicate their correct alignment as well as their inside and outside faces. Be extra vigilant, as few things are more frustrating than finding out when it's too late that you've somehow glued a sheet on upside-down. I always work from the inside out and glue on the veneer sheet that faces the mould first. Once that sheet has been set on the inner core, with your assistant's help, turn it over and onto the mould. Glue the remaining veneer sheet onto the stack, again making sure everything's aligned properly. Then tape the caul back into place. Proceed with loading the veneer bag just as you had done before with the inner core.

Dealing With Edges

For drawer fronts, doors, and the like, where the edges of the panel will be exposed and you don't want the veneer to show, you have two options. Either apply veneer to these edges once the panels have been glued up, or make solid edging the same thickness as the inner core and apply it to the edges of the inner core before applying the face veneers. This latter process requires a separate glue-up on the mould to make these edgings, but to my way of thinking, looks so much more professional.

Trimming the Panel to Size

If you've been careful in building your mould, you can use it to cut your panel to the required size. Assuming the straight edges of your panel are parallel to those of your mould, you can trim those edges to size using your router and a pattern bit. The final dimensions of the other edges can usually be marked off while the panel is sitting on the mould, and in all cases, can be cut using the mould as the edge guide.

I hope that this introduction to vacuum veneering has kindled in you the desire to add curved panels to your design repertoire. There are a lot of steps involved in the process, but none are overly complicated. Once you've made a few panels, you'll wonder why you didn't attempt it long ago. I know I did.

MARTY SCHLOSSER
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BY MICHAEL KAMPEN

Rabbets, Dados and Grooves

Rabbets, dados and grooves are basic forms of joinery found in most woodworking projects. Learning to do them correctly will give your woodworking skills a solid foundation.

Whether it is a rabbet to hold a cabinet back, a dado used to house shelves in a bookcase or a groove for a drawer bottom, you can mill these joints quickly and accurately with a router. These joints are all variations on the same theme. Essentially they are butt joints - you are joining end grain to face grain. Gluing end grain to face grain will not produce a very strong joint, so for additional strength and support it is best to reinforce this type of joint by housing it in a slot. In preparing these joints you are removing a square or rectangular cross section from the face of one board to house the edge or side or end of another board.

Two factors make this housed joint stronger than a straight surface to surface butt joint. First, it increases the available glue surface and second, because one board is housed within another, there is physical support. In the case of a bookshelf, the glue will hold the piece together, but when you load up the shelf with your favourite woodworking books the load will transfer directly to the sides of the bookcase, which in turn transfers the load directly to the floor. Of course, the thickness of the shelf, the width of the span and the load on the shelf will determine the amount of deflection in the shelf.

Basic Anatomy

Although these three joints may at first glance seem very similar, they are in fact different, and the approaches used to cut them will not be the same. Before we get to the techniques, there are two dimensions that you will need to be concerned with as you cut these joints: width and depth.

Rabbet – a notch cut with or across the grain on the edge of a board with the two sides 90° to each other.
Dado – a square or rectangular slot that runs across the grain.
Groove – a square or rectangular slot that that runs with the grain.

Rabbets are somewhat different – we'll look at them shortly.

Because of their similarity, dados and grooves are often referred to as 'slots'. The difference between the two is that a dado is milled across grain, while a groove is milled with the grain. The slot can run the full width of a board, it can be stopped on one end, or it can be stopped on both ends, in which case it essentially becomes a mortise. When deciding on the depth of the slot, use guidelines similar to that of mortise and tenon joints. When you mill a slot in a board, cut it approximately 1/3 the thickness of the board. You want to have sufficient material under the joint, as in the case of a bookcase, to support the weight of the loaded shelf, but not so deep that you risk weakening the receiving piece. The width of the slot will usually be the same thickness as the material that will be housed in the slot. In some instances you may wish to mill a shoulder on the material (e.g. a tenon) that will be housed in the

slot; this serves to cover the edges of the slot, making for a cleaner appearance.

A rabbet is cut on the end or face (edge) of a board - the extruding piece is the tongue. This joint is frequently used for simple box joinery where joint strength is not critical, to attach backs to cabinets, and for drawer assembly. The width of a rabbet is typically determined by the thickness of the piece that it will receive, or the depth of the slot into which it will be inserted. If you are making a cabinet with a ⅜" thick back and ¾" sides, then the rabbet would be ⅜"wide. In this case, to give sufficient surface area for gluing or screwing the back into place, the depth of the rabbet should be ½ to ⅓ the thickness of the side piece.

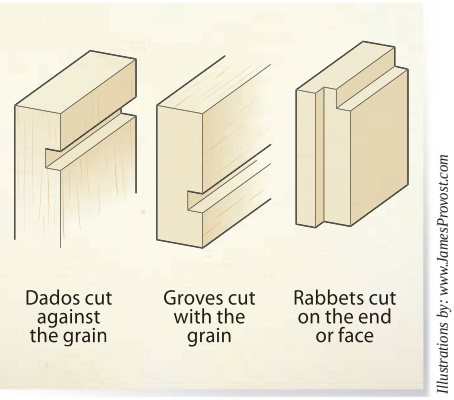
Milling Techniques

There are two common approaches to cutting a slot to the proper width, and which one you chose will depend on the project at hand and the material you are working with. You can cut the slot to exactly fit the material it will house, or you can the slot with a standard size cutter and then mill the stock to thickness for a perfect fit.

Most woodworkers use standard widths in their construction – ¼", ½", ¾". However, most plywood comes in non-standard thicknesses – 15⁄64", 31⁄64", and 23⁄64". Unless you use specialty 'plywood bits', leevalley.com, ground to these non-standard thicknesses, you'll need to tweak the slot to fit the plywood. If you use a lot of plywood in your projects then these bits are a good investment. If you only use dados and grooves with plywood occasionally it is more cost effective to make the cuts in several passes until you have achieved a perfect fit. When using solid wood, if the design and construction process permit, you may be able to size your material for a perfect fit after cutting the slot.

As you work through your project and begin to look at the methods used to cut these joints using either a hand-held or table-mounted router, the differences will start to appear. Grooves are typically close to the edge of stock, and this makes it an ideal situation to use a table-mounted router with a fence. If your cut is close to the edge of the stock you will be able to use a slot-cutting bit to mill the groove with the material running vertically against the fence. The new four wing cutters, freud.ca, provide a super smooth cut and superior chip clearing ability. If the groove is more than an inch or so from the edge of the material you will need to switch to a straight or spiral bit, and run the material horizontally on the table instead. Be sure to anticipate where the bit will emerge from the material and keep your hands away from that area. Because the grain and the cut run the same direction there will be little or no blow-out as the bit leaves the cut. The router table excels at cutting grooves and the easiest are those that are open at both ends. When milling a groove that must stop part way along the stock, use a stop block, or place a mark on the top of the stock and at the point where the groove ends; feed the material through until the two marks line up, and then turn the router off. When the bit has stopped rotating, lift the piece off the table. If you are routing a groove with two stopped ends (a mortise) then you will need to lower the work onto a spinning bit to start the cut.

Dados are often at a distance from the end of the board. Unless you have a very wide and reasonably short work piece, you won't be able to safely rout this with a fence on a table; you'll need to build a jig to guide a hand held router. In most cases a simple T-square guide is effective. Ensure that you make provisions to back up the cut as the bit exits the stock to prevent tearing-out the edge next to the exit.

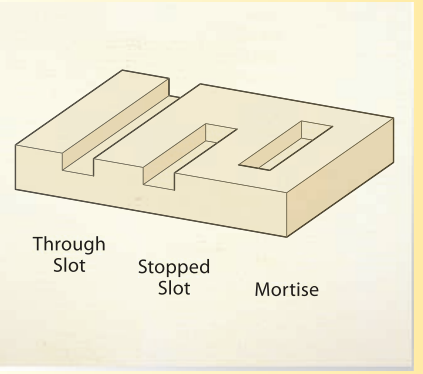


Illustrations by: www.JamesProvost.com

Dados, grooves and rabbets

If you are working with material that doesn't correspond exactly in thickness to the width of your cutter then you'll need to make the cuts in several passes and sneak up on the perfect fit. When possible, I

Stopped Grooves and Dados on the Router Table



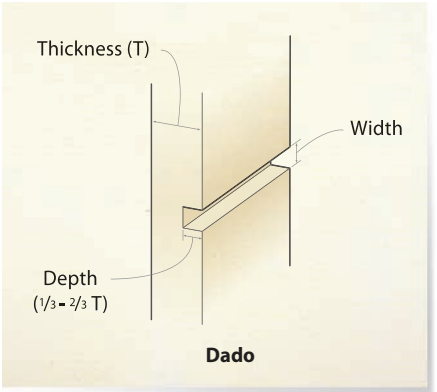
Most times, stopped slots will be cut with a handheld router. In this case it is a simple matter of plunging the bit to depth, running it along a guide until the end of the cut and then raising the bit out of the material. When cutting a stopped slot on a router table you will need to lower the work piece onto a spinning bit. This is not as difficult as it seems although to the novice it may seem rather intimidating. When the parts I am working with are small enough to comfortably handle on top of the router table, I prefer the accuracy and repeatability that using the table and fence allows. A few simple precautions make this a safe and simple procedure. Learn to anticipate which direction the bit will pull the material. Always be sure to brace the material in every direction but one; as you move the piece you will only ever have effective control in one direction at a time.

For example, to cut a stopped groove in a stile or rail for a panel, set the distance from the fence and control the horizontal travel with two stop blocks secured to the fence. While it is possible to do this with a straight bit, a carbide spiral bit will cut the groove to full depth in one pass. A straight bit does not clear the chips very well and can sometimes clog, so it is best to make the full cut in several increments. Whichever method you choose, set the projection of the bit above the table. Run the router at a high speed; this makes it less likely that the bit will take a deep enough bite with each revolution to grab the work piece. Brace the material against the fence on one side and the end stop on one end before you lower the piece onto the cutter. When you stand in front of the router table holding the piece, it should be located between the bit and the right side end stop and fed toward the left hand stop after lowering. If you reverse this and brace the material on the left side end stop, as the material is lowered onto the bit the rotation will naturally want to pull it to the right and away from the fence. Neither of these two directions offer any support for the material, fed from right to left, the rotation of the bit will naturally push the material to the end stop first and then into the fence. With the material braced against both of these as you lower it, it will have no place to move but the one direction you want; to the left. When braced and fed properly, only light pressure is required for a perfect cut as the rotation of the bit naturally forces the material into the fence.

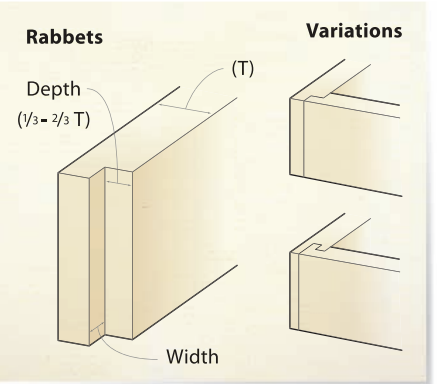
prefer to cut my dados and grooves to size with a spiral Onsrud bit, leevalley.com, which makes a very smooth cut. I've found that most of my dados and grooves are for stock ⅝" thick and narrower. To cut these I use a solid carbide ⅜" bit.

If you use a T-square guide to cut your dados, moving the guide every time as you widen the cut can lead to the possibility that the two sides of the groove will not be perfectly parallel. To keep the original reference edge in place until the cut has been completed to the full width, follow this simple process. Ensure that the bit you are using is less than the full width of the cut. Mill a strip of wood to the exact same width as the bit, and attach it to the edge of the guide. Line up the edge of this strip with your layout lines and make the cut as usual. Don't forget to allow for the setback from the cut to the edge of the guide when setting the guide, or your slot will be in the wrong place. After the cut, remove the strip of wood, replace it with a strip that is the exact thickness of the material you will be housing in the joint, and make the cut. If you are using plywood, simply rip a strip from the edge of your sheet and use this to set the width of the cut. The result is a groove that fits your undersized plywood perfectly every time without the need for specialty bits.

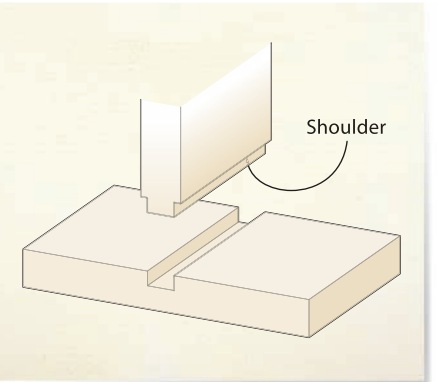
Rabbets are often cut after a piece has been put together, such as for the glass in a rail and stile door or a picture frame. If the pieces are small enough they can easily be cut on a router table after assembly. For larger projects it can be better to cut them before assembling the pieces. Using a hand-held router balanced on a narrow edge to cut rabbets will leave you with less than stellar results and should only be your last resort. If you have no other option than to balance the router on edge I



Dado anatomy



Rabbet anatomy



Shoulder

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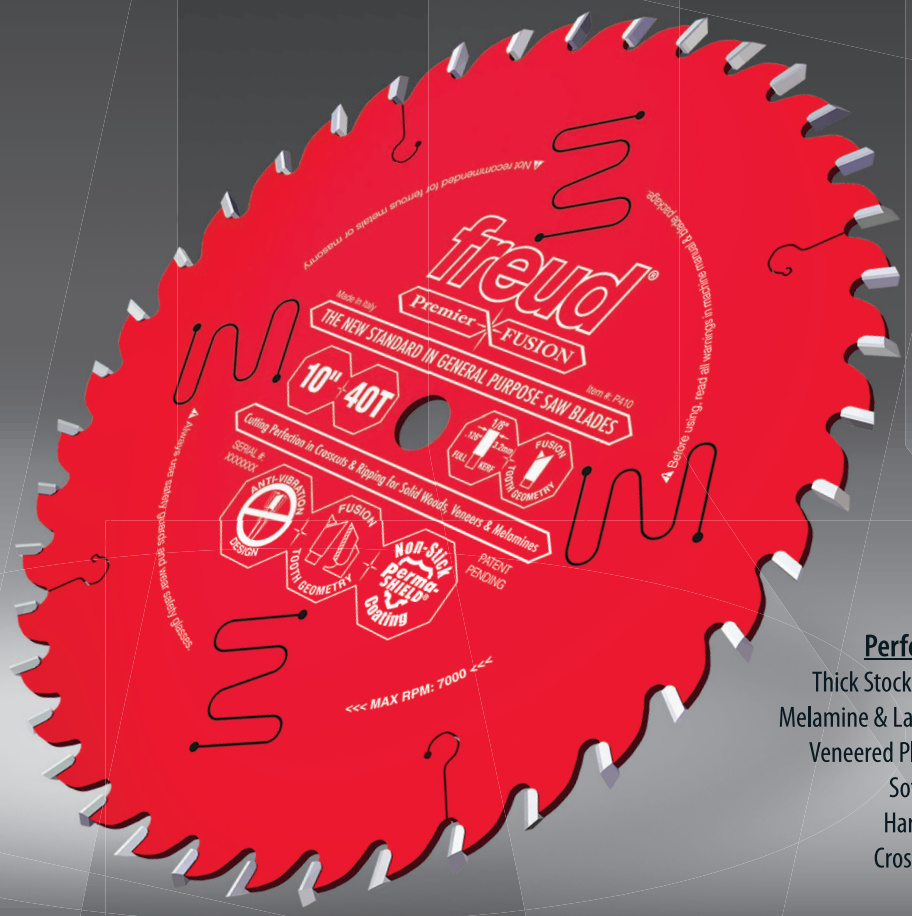

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T-Fence

Here is how to make a T-square to guide the router using a couple of strips of plywood.

- Draw a square reference line on a piece of plywood and fasten two guide pieces together with some glue and clamps.
- Place one screw in the center of the overlap and then true the guide with the line on the plywood.
- Tighten the screw to lock the pieces in place and then apply the clamps until the glue cures.

Before using the guide, place it on some material and rout a slot, allowing the bit to cut into the guide arm on the jig. As long as you always use the same size bit and the same router, the cuts in the cross fence will define the edges of the slot. This makes it easy to line up the jig with your layout lines. To use the guide, draw layout lines on your stock, lay the square on the material, lining up the edges of the cut in the cross piece with the layout lines.

recommend clamping an extra strip of wood to the side of your material. This will provide additional surface area for the router to run on, making it easy to keep it perpendicular to the work piece.

Because the rabbet is cut on the edge of a board, the material can pass the cutter both vertically and horizontally; this means you can use a straight bit, spiral bit, slot cutter or rabbeting bit to make the cut. Take a look at the tooling you have at hand and the characteristics of the wood you are using to determine your best choice. If you are using a cutter without a pilot bearing you will need to use a fence to set the depth or width of cut. In most cases though, you'll find it best to cut rabbets with a bearing guided cutter. The guide bearing runs on the uncut section of material under the rabbet and this leaves you with a clean edge and a consistent depth. These can be used on inside edges allowing you to rout into an inside corner. Afterward you will either need to round off the piece to be inserted or square off the opening. If the structure of the corner joint is likely to suffer from some chisel work then it may be safer to round the incoming parts. Rabbeting bits are available in sets that have one cutter with several interchangeable bearings. This gives you the ability to cut rabbets of several different dimensions with one cutter simply by changing the bearing and varying the projection of the bit.

Dados, grooves and rabbets are staple forms of joinery that every woodworker should feel comfortable in using. They are among the easiest joints to cut using the router and they are found in almost every project. Like all woodworking tasks, there are often many roads to the same results; consider your material, the construction process and your tooling when deciding which method to choose. Slot cutting bits are great for slots that run off the edge of the material, but will leave a ramp at the end of a stopped cut; these bits cut quickly, cleanly and are not that expensive. When your project calls for a stopped slot away from the edge of a panel then a spiral Onsrud bit is a better choice since the cut will be made with a jig and a hand-held router. For cutting slots for box bottoms, nothing beats using the box-slotting bits, leevalley.com, on a router table. A modest investment in a variety of good quality bits and some time spent making a few jigs in the shop to guide the router will reward you with flawless slots and rabbets for your projects for years to come.

MICHAEL KAMPEN
mkampen@canadianwoodworking.com

Forrest Blades

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Combination Saw Blades

When it comes to a general purpose, workhorse saw blade, you can't go wrong with a combination blade.

To achieve the best cuts possible on your table saw, you need the best blade you can afford to buy. We've always recommended that woodworkers have, at a minimum, three types of blades: a rip blade for ripping lumber along the grain, a finish crosscut saw for making precise, splinter free crosscuts, and a dual purpose combination blade, for everyday sawing. By far, the most widely used of the three is the combination blade. Fortunately, there are a number of very good blades to choose from. A little saw blade 101 will help make the choice easier.

Carbide Composition

Carbide teeth are, so to speak, at the cutting edge when it comes to saw blades. Carbide comes in different grades and grinds. By varying the size and composition of the carbide in the teeth, one blade can be designed primarily to maintain a fine edge while another blade can be designed for maximum impact resistance. Impact resistance in this case refers to the ability of the carbide teeth to absorb and distribute the forces they encounter during a cut without damaging either the very rigid tooth or its connection to the saw plate. Different materials present different impact loads to a saw's teeth and the combination of materials used to make the carbide can be varied to tailor the final result for each type of material. Cutting a non-ferrous metal such as aluminum would present a much different load to the tooth than cutting cedar or pine, which might contain very hard knots.

Tungsten, cobalt and titanium are mixed together in various proportions to achieve the final balance of qualities needed for the intended use. Cobalt is used for its impact resistance, tungsten for its hardness, which gives it the ability to hold an edge longer, and titanium for its anti-corrosion properties. A piece of wood exhibits the least movement and the greatest strength along its length and it should come as no surprise that ripping a piece of wood presents the greatest impact load to the teeth. The cobalt content continues to drop and the tungsten content increases for general purpose blades; these try to strike a balance between the impact resistance of the cobalt and the hardness of the tungsten. For crosscut blades where maintaining a sharp edge means crisp detail and accurate cuts, manufacturers increase the tungsten content. Carbide with the highest tungsten content is used in blades that are specifically designed for cutting man-made materials like melamine, laminates and solid surface materials.

The size of the particles in the composition of carbide is as important as the material used. For a carbide edge to maintain its surface for a long time it must not only be

hard and resistant to impacts, but it must be made of extremely fine particles. As the blade is used, pieces will begin to break off the edge of the tooth. If the powder used to form the carbide is made of very tiny pieces, only the very smallest sections of the teeth will break away with the result that the edge will remain serviceable for a longer period of time. If the carbide was made with larger particles then as each one of these breaks away, more of the cutting edge goes with it. All of the combination blades in our chart use C4 carbide, the finest micrograin carbide used in the saw blade industry. The finer the composition of the carbide and the larger the individual teeth, the more times you will be able to re-sharpen the blade before it needs to be replaced. The Infinity and FS Tool blades come with the longest teeth at 13/32", while the Bosch has the shortest at 10/32". The extra 3/32" will give you an extra sharpening or two before the blade needs to be replaced.

Tooth Patterns and Angles

Three other factors affect the quality of a blade: the tooth pattern, the tooth bevel angle, and the tooth hook (or rake) angle. The tooth pattern will define how the tooth breaks the surface and what the bottom of the cut will look like. One of the more common tooth patterns on combination blades is ATB or alternate top bevel. All the blades in our chart have this basic grind pattern. The teeth are ground on a bevel with one side of the tooth a little higher than the other. These bevels alternate on every other tooth and this helps the tooth define a clean edge to the cut. A common variation on this theme is the ATB-R (Bosch, FS Tool). Typically there will be groupings of five teeth separated by a gullet. The first four of these teeth are alternately ground with an alternating left and right hand bevel (ATB), while the fifth tooth is a flat topped raker tooth (R) that cleans up any slight irregularity left in the cut.

For most ATB and ATB-R blades, the teeth are ground at a 15° bevel angle. When sharp, this is an ideal blade for the majority of table saw tasks. However on some blades (Freud, Infinity) the teeth are ground at a much steeper 30° bevel angle. This higher angle increases the knife like action of the teeth, reducing tear-out and contributing to a much smoother finish cut, particularly in sheet goods. However there is a greater chance of chipping the end of the teeth.

The teeth are also set at a specific hook angle and this plays a large part in the finish of the cut and the power required of the saw. The hook angle is the angle the face of the tooth makes with a line projected radially from the center of the blade and essentially defines how far forward the tooth leans into the cut. Teeth with an aggressive hook angle require less power from the saw but they leave behind a rougher surface at the edges of the cut. Teeth with a reduced or negative hook angle will require more effort from the operator and more power from the saw; they meet the material at more of a right angle and scrape the material away instead of aggressively carving it out. The combination blades in the chart all have a hook angle between 15º and 20º, which makes for cleaner, crisp cuts.

The number of teeth on the blade also determines the material the blade is suitable for. When ripping material you want fewer teeth spaced further apart for a quick feed rate and good chip clearing capacity. As you move to crosscut blades the number of teeth increases dramatically. With the teeth closer together, the gullets become smaller, reducing their chip clearing ability. Crosscuts generate less material, and because of the cross grain nature of the cut, there is no chance of producing longer fibres that will clog the gullets when cutting. Combination blades strike a balance between the two extremes with between 40 and 50 teeth.

For a blade to provide a smooth cut it must have sufficient mass to remain stable under load. Full width blades result in a kerf of 1/8" and the saw plate must be slightly narrower than this to provide clearance for the sawdust generated when cutting. The thicker the blade, the more rigid it will be. The Infinity blade comes in with the thickest plate in our list at 7/64" with the Bosch being the thinnest at 5/64". The teeth are ground to cut a kerf slightly wider than the saw plate.

A flat blade provides a clean accurate cut that needs little if any clean-up; on the other hand, a blade that does not stay perfectly flat as it cuts will leave you with a rough cut showing saw marks that will need to be removed. Several manufacturers also pre-tension the blades to help counteract this expansion as well, and this can be seen as a faint line around the blade several inches in from the outside edge, just below the expansion slots.

To further reduce heat caused by the build up of pitch and resin, some manufacturers (Bosch, Freud, Infinity) apply a proprietary

BLADE SPECIFICATIONS

	Bosch Pro1050	Forrest Woodworker II	FSTool L55250	Infinity Super General	Freud P410
Price	89.99	115.00	90.00	109.90	99.00
# teeth	50	40	50	40	40
Pattern	MCT*	ATB	ATB+R	Hi-ATB	Hi-ATB
Tooth width (kerf)	1/8	1/8	9/64	1/8	1/8
Tooth length	15/64	18/64	18/64	17/64	20/64
Plate thickness	6/64	6/64	6/64	6/64	7/64
C4 micro grain	✔	✔	✔	✔	✔
Bevel angle	15°	15°	15°	30°	30°
Hook angle	15°	20°	15°	18°	18°
# expansion slots	0	4	0	16	8
Coated	✔			✔	✔
Laser cut	✔	✔	✔	✔	✔
Storage case	✔				
Contact	boschtools.com 800-387-8304	forrestblades.com 800-733-7111	fstoolcorp.com 800-387-9723	infinitytools.com 877-872-2487	freud.ca 800-668-8802

* multipurpose carbide tipped – the same as an ATB+R

coating to their blade. This coating acts like the Teflon coating in a non-stick frying pan; it keeps the bulk of the pitch from sticking to the blade. The build up of resin on the blade will marginally increase the width of the teeth and plate causing more friction with the material being cut and by keeping this material off the blade, the result is less heat build-up and a cooler blade that runs true and stays sharper longer. The coating also makes it much easier to remove anything that does adhere to the blade.

Gullets

The area in front of each tooth is called the gullet. This space helps clear the chips from in front of the tooth. The size of these gullets will depend on the use of the blade. Rip cuts produce more shavings and trap them within the cut longer. As a result rip blades have gullets that are much larger than on other blades. With some wood species, making a rip cut can produce longer fibres which can clog the cut easily and result in extra heat. Without proper clearance for the sawdust, the blade will run hot and the heat will cause the blade to expand and begin to warp under heavy continuous use. When you are ripping a board, the blade will be buried in the material longer than when cross cutting and the teeth are spaced further apart with larger gullets. For a fine crosscut, to maintain the same number of teeth in the cut, the teeth will be much closer together and the gullets will be much smaller, as they are not expected to carry as much material on the tooth's short passage through the board. Combination blades attempt to reach a compromise between these two options.

Laser Cut Expansion Slots

As the blade cuts through the material it heats up, and as metal heats up, it expands. Because the cutting occurs at the circumference, the blade will heat up more at the cutting edge than the center. To counter this manufacturers have introduced laser cut expansion slots around the circumference of the blade. As well as providing space for the metal to expand into as it heats up, keeping the blade flat, the slots reduce the noise a blade produces.

Cleaning Blades

Clean blades cut better, run cooler and last longer. Before you grab a brush and cleaner inspect your blade. If you find any broken or missing teeth have these replaced by a saw filing service. When cleaning your blade you should only use a brass brush, anything harder and you risk damaging the teeth and cutting edges.

There are many commercial and homemade cleaning solutions available to choose from. If your blade has a coating, be sure that the cleaner you will be using is compatible with the coating. A longstanding home solution has been to use a spray-on oven cleaner to remove build-up and pitch. However, these cleaners are very caustic and studies by Freud have shown that these cleaners attack the binder in the carbide and the special brazing that holds the teeth to the plate, which could lead to failure of either at speed.

Teflon coated blades can usually be cleaned safely with most commercial products designed for the purpose; Freud has also found that on their coated blades, soap and water will handle light cleanups while a soak in kerosene overnight will loosen any stubborn pitch. Tests with Simple Green cleaner have also been effective. Purchase a round food container just slightly larger in diameter than your saw blade to serve as a soaking basin and permanently mark it for shop use so it is not inadvertently returned to the kitchen.

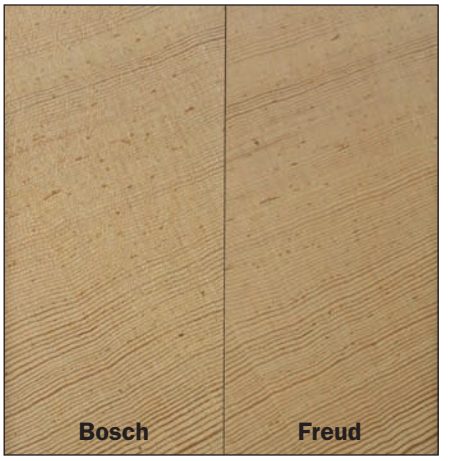
The Combination Blade

Crosscutting and ripping each require different carbide, gullets and tooth design. When building a project, changing from a ripping blade to a crosscut blade as required for every cut can be tedious. In recognition of this all blade manufacturers produced a combination blade as part of their blade line-up. By combining the best of both worlds they have created a blade that strikes a reasonable compromise between the two. These blades typically have from 40-60 teeth, more than the aggressive ripping blades, but not as many as the fine crosscut blades. The carbide used in these blades strikes a balance between a hardness that allows them to stay sharp when cutting manmade materials like laminates and melamine and the impact resistance required when ripping solid wood. Combination blades are a viable option for woodworkers who make cross and rip cuts in a variety of materials and do not wish to invest in a number of expensive specialty blades. Good quality combination blades such as those listed in the table will cost between $90 and $115. Because these blades strike the best compromise possible to deal with a wider range of cuts, keeping the teeth clean and sharp will go a long way in keeping these blades performing optimally.

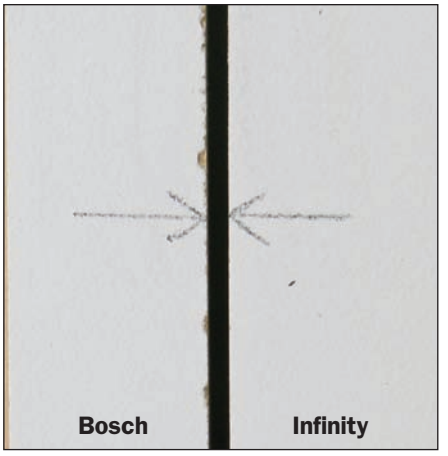
To make selecting a combo blade less onerous for you, we put five commonly available blades to the test. The Bosch and FSTool blades have an ATB+R tooth arrangement, with teeth in groups of five, separated by a deep gullet. Both use a standard 15° tooth bevel and hook angle. The Freud and Infinity employ Hi-ATB with a 30° tooth bevel and 18° hook angle. The Forrest ATB blade fits somewhere in the middle with a 15° tooth bevel and 20° hook angle. The Freud plate was 1/64" narrower than the teeth width, while the other plates were a standard 6/64" wide.

All these blades have thick C4 micro grain carbide teeth, and were laser cut. Except for the FSTool, which was 1/64" thicker, all the blades were a standard 1/8" thick. Tooth length varied from 15/64" on the Bosch to 20/64" on the Freud. Three of these blades were coated (Bosch, Freud and Infinity). Neither the Bosch or FSTool have expansion slots, while the Infinity has a whopping 16. Only the Bosch came with a storage case, which serves to protect the blade when not in use and when sent out for re-sharpening. We inspected the blades visually, and all appeared to be well made with clean laser-cut bodies and expansion slots. The teeth grinding looked accurate and consistent, and the brazing clean and regular. The arbour holes were precisely cut, as all the blades fit snugly on the

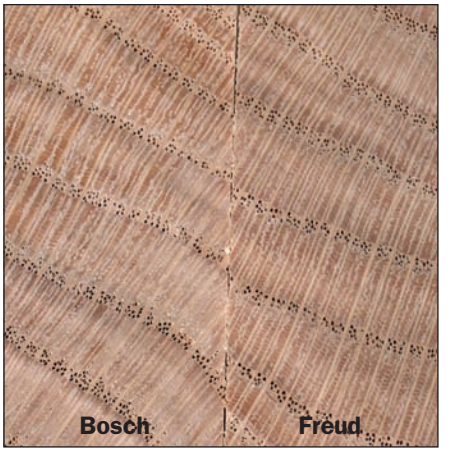
Oak rip cut



Douglas fir crosscut



Melamine, bottom side



Oak crosscut

EDITORS CHOICE

TEST RESULTS

	Bosch Pro1050	Forrest Woodworker II	FSTool L55250	Infinity Super General	Freud P410
Oak crosscut	Very Good	Excellent	Excellent	Excellent	Excellent
Oak rip	Good	Excellent	Very Good	Very Good	Excellent
Fir crosscut	Very Good	Excellent	Excellent	Excellent	Excellent
Fir rip	Good	Excellent	Very Good	Very Good	Excellent
Ply crosscut	Very Good	Very Good	Very Good	Excellent	Excellent
Ply rip	Good	Very Good	Excellent	Excellent	Excellent
Melamine	Good	Very Good	Very Good	Excellent	Excellent

arbour with no discernable slop.

The only way to tell how well a blade performs is to use it. We tested the blades on a SawStop contractor saw, which has a 1 3/4 HP motor wired for 220V. Before testing we checked the saw to ensure that the rip fence and miter fence were properly aligned and that there was no discernable arbour run out. The tail end of our rip fence is slightly toed out – the width of a couple of sheets of paper. We didn't use a zero-clearance insert (ZCI) when cutting the sheet goods, as the SawStop has a throat plate that has a very narrow blade clearance. However, if you have a standard throat plate on your saw we highly recommend that you make and use a ZCI when cutting sheet stock, or when ripping very narrow solid stock (see "Shopjig: Zero Clearance Insert", Feb/Mar '08, Issue #52.) We hand fed the stock as fast as the saw could handle it without taxing the saw. In our test we made each of the same cuts five times, selecting the final cut to examine. We opted to test the blades on 2" oak and fir, and ¾" birch plywood and ¾" melamine, four common shop materials.

We decided to rate the cuts in solid wood as follows: Excellent – minimal or no blade marks, leaving a silky smooth surface; Very Good – blade marks that would require very light sanding or hand planing to remove, or a quick pass with a card scraper, but still a very smooth surface; Good – blade marks that would require somewhat heavier sanding or planing, with a noticeably rougher feeling; Poor - a rough surface that would require a cleaning pass on the jointer.

For the sheet goods, our rating consisted of: Excellent – no tear-out on the top or bottom sides; Very Good - no tear-out on the top side and minimal tear-out on the bottom side; Good – minimal tear-out on the top or bottom sides; Poor – an unacceptable cut on top and bottom.

The Freud blade was clearly the most impressive blade in the group. It performed flawlessly on every cut, producing mirror like surfaces. And at just under $100 it gives great value for your money. It is no surprise that the Infinity fared almost as well as the Freud, as they have similar tooth designs. The finish left on rip cuts by the Infinity was only marginally inferior to the Freud. It's priced a tad over the Freud, and currently there are no Canadian dealers (you can order direct from Infinity Tools). Still, this is an excellent choice. The Forrest blade performed just as good as the Freud and Infinity in all cuts except on plywood and melamine where its results were only marginally less stellar. The FSTool and Bosch blades are similar in design, with the FSTool performing somewhat better than the Bosch, particularly in crosscuts.

When interpreting these test results bear in mind their inherent limitations. Your results with any of these blades should be relatively similar to our results but don't expect them to be exactly the same. The particular saw you are using, the material you are cutting, the length of the cut, and your comfort level are all contributing factors to the quality of the cut. Also bear in mind that the saw blade industry is very competitive. Leading manufacturers adopt the latest technologies and materials to maintain, and expand, their market share.

If you want a blade that gives exceptional results in solid stock and sheet goods, then look to the Freud or Infinity blades. If you don't use a lot of melamine, then the Forrest blade will give just as good results. If you're looking for a good economical blade, and can live with the occasional foray to the jointer for a bit of cleanup work, then either the FSTool or Bosch are good choices.

THE EDITORS

productnews

BY THE EDITORS

For indepth reviews of these new products go to canadianwoodworking.com/Newsletters/reviewindex.htm

Veritas Skew Rabbet Plane

If you make furniture or cabinetry, you likely cut a lot of rabbets. When you have a handful of them to process, it makes sense to mill them on the router table or table saw. More often than not you'll still need to fine tune the rabbet for a perfect fit. Rather than heading back to the router table, it's just as quick, and much more enjoyable, to use a rabbet plane. And if you've only a few rabbets to mill, then using a rabbet plane is just as expedient as using machinery. The new Veritas Skew Rabbet Plane, available in both left and right versions, is the perfect tool for cutting rabbets with or across the grain. The Skew Rabbet has an A2 blade slanted at 30º that makes a lovely shearing cut, regardless of the grain orientation. Two features that I particularly like are the adjustable scoring spur, which practically eliminates tear-out when cutting across the grain, and the flush orientation of the blade against the body of the plane, which results in clean, square corners. A fine blade adjustment knob, comfortable handles, adjustable shoe, and blade alignment set screws round out this top-of-the-line hand plane. $249, leevalley.com.

CarveWright

If you've ever thought that CNC (computer numerical control) routing is strictly for large commercial workshops, think again. The CarveWright is a compact (15" x 18" x 26") three dimensional carving machine that looks much like a portable planer. In place of a cutterhead it has a router, and a built-in computer interface. Stock is fed through the CarveWright via a traction drive belt, the same as found on a drum sander. The computer interface sends motion instructions to the router, which moves in an up and down, and right and left hand direction. When coupled with the movement of the traction drive belt, this enables the router to cut in multiple axes to produce the final carving. You can carve stock from as small as ½" thick by 1 ½" wide and 7" long, up to 5" thick, 14 ½" wide, and 12' long. An easy to use software program enables you to create original designs without having to use complicated CAD software. The designs are stored on a memory card, which you insert into the computer interface on the machine. You can scan your own patterns or photos, or download images and patterns from commercial vendors. The CarveWright produces carvings in three formats, from draft mode (low quality) to best quality. On the best quality setting the spacing between passes is .006". $2,199, carvewright.ca.

SawStop Contractor Saw

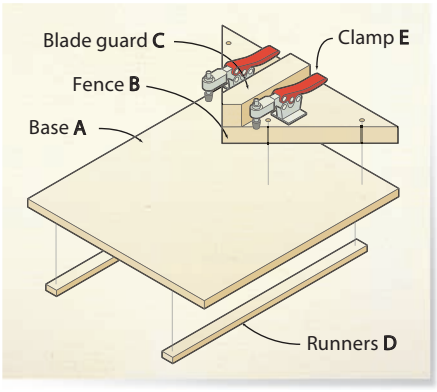
A table saw is one of the most important tools in any woodworker's shop. Picking the right one means that you'll enjoy using it for many years. For many hobbyist woodworkers and professionals who work in small shops, a contractor style saw is a sensible choice. It can be easily moved around the shop (or even taken to a job site), it takes up less room than a cabinet saw, and it's more economically priced. The new 1.75 HP SawStop Contractor Saw sets the benchmark against which other saws in this class will be compared. It not only includes SawStop's renowned 'blade stopping mechanism' (it stops the blade within 5 milliseconds of detecting contact with skin), but it has a host of high-end 'must-have' features: a precision ground cast iron table; large trunnions that help absorb vibration and maintain accurate blade alignment; quick tool-free change over for the riving knife and anti-kickback pawls; a superior dust collection system that is truly effective; and a superior zero clearance insert throat plate. Plus, there are a host of optional accessories that make the SawStop well worth considering. From $1,449, sawstop.com.

Miter Sled

With this sled you can quickly and easily make perfectly fitting miter joints.

One of the most common joints a woodworker might cut when building a project is a miter joint, such as when two pieces of trim meet at a corner or when making a picture or mirror frame. Cutting the two pieces so they meet perfectly is a simple matter of using a compound miter saw. However, using a compound saw requires you to set up the saw twice, once for each piece. If you are not exactly dead on with the angle setting, the two pieces will not meet at 90º. On a single corner this may not be as noticeable, but when you are building a picture frame, by the time you get to the fourth corner, there will be little chance of the pieces closing properly.

This jig employs the principle of complementary angles taught in junior high math class, and while not as exciting an addition to your shop as a nice new compound miter saw, we think it will become a favourite. By cutting a perfect square to act as the fence on this jig, the principle of complementary angles assures that when one of the pieces is cut on one side of the jig, and it's mating piece is cut on the other side, the two pieces will form an exact 90º angle. If the angle on one piece is not exactly 45º dead on, don't worry, the jig will ensure that the second cut is the exact difference between the cut you just made and 90º.



Illustrations by: www.JamesProvost.com

Making the Jig

• Cut the base (A) of the jig to size for your saw. This version is sized to fit a Delta Unisaw; you may need to adjust the base size and placement of the runners to suit your table saw.

• For this jig to be accurate the fence (B) that the material registers against must be cut at an accurate 90º. Use a cross cut sled to cut this piece (see "Cross Cut Sled", Feb/Mar '07, Issue #46).

• Set your table saw miter gauge to 45º and cut the fence diagonally to create a triangular piece.

• Place the triangular fence piece on the base and fasten it in place. If you choose to use brads or screws, ensure that they are not located in the path of the saw blade. Using glue alone ensures there is no chance of damaging the teeth of your saw blade by hitting a nail or screw.

• Cut a blade guard (C) and fasten it over the center section of the fence. This will ensure that the blade is completely buried in the wood after you make a cut.

• Mill two runners (D) and ensure that they run smoothly in the table saw miter slots.

• Attach the runners to the bottom of the base.

• Fasten a set of toggle clamps, leevalley.com, item #88F05.01, to the fence section close to the cut line to hold the material in place during the cut.

Using the Jig

To cut a perfect miter, lay your pieces out and mark one side of the joint with an 'L' and the other piece with an 'R'. When standing at the saw, place the 'L' piece on the left-hand side of the jig and make the cut. Place the 'R' piece, on the right-hand side and make the cut. The result will be a perfect 90º miter joint. Most miter joints will be cut on stock that will adequately register against a shallow fence as shown. If you need to cut a number of joints at the full depth of the blade you might consider building a jig with a taller fence.

THE EDITORS

MATERIALS LIST (All measurements in inches)

Part		Qty	T	W	L
A	Base	1	½	12 ⅜	13 ⅝
B	Triangular fence	1	1	9 ¼	13 ⅝
C	Blade guard	1	1 ⅜	1 ¼	6 ½
D	Runners	2	⅜	¾	13 ⅝
E	Toggle clamps	2			

COMING EVENTS

CHRISTMAS OPEN HOUSE
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St. George, ON
www.MorleyMillerMachinery.com

THE HAMILTON WOODWORKING SHOW
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Canadian Warplane
Heritage Museum
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www.HamiltonShows.com

LONDON WOODWORKING SHOW
See website for details

CHATHAM WOODWORKING SHOW
See website for details

For more woodworking events:
www.Canadian Woodworking.com
List your CLUB and event FREE.

A Woodworkers Christmas

Illustration by: Mike Del Rizzo

The Christmas season is often the busiest time of year for any company and a woodworking shop is no exception.

After establishing my shop in Whitehorse, I quickly learned to set aside most of December to do those little jobs that simply had to be completed for Christmas. There was always at least one, and often several people who would frantically rush into the shop on Christmas Eve and anxiously beg me to build them something – anything for their wife, girlfriend or significant other. And in one particular case, all three. It was no wonder he didn't have time to shop or do any woodworking himself.

Inevitably, because of everyone else's incredibly poor planning and procrastinations, my own Christmas projects would fall by the wayside while I assembled some poor schmuck's buffet or dining room suite. I often spent Christmas Eve, a good portion of the night and well into Christmas morning in the shop applying the finishing touches to a soon-to-be-treasured toy or jewellery box for one of my kids or my wife.

One year a particularly evil sister-in-law burst into my shop two days before Christmas to enquire about my progress on her queen-sized, Mission style, fumed, quarter-sawn, white oak bed that I was supposed to have completed for her husband. Try as I might I could not recall ever having promised to make her one. She eventually let me off the hook for another year by informing me that the bed had been promised, not to her, but to my wife several years earlier. I couldn't recall that either. (My wife eventually got her bed - 28 years after it was first promised. (Let no one say that Don Wilkinson ever forgets a promise.)

Another year, a valued customer commissioned me to carve a Mako shark to give to his brother. I thought it was a rather strange Christmas gift no matter how much he may have disliked his sibling, but I was just relieved that he hadn't required it to be carved life-sized.

After several years of missing Christmas Eve with my family, and as I wearily sat in my shop yet again, I came to the realization that there were two things that I should never have done. First, I should never have promised to build my Emergency-Backup-Daughter a manger scene for the front yard, and second, I should never have had children in the first place. To be fair, I'm not sure the kid had actually asked for it to be life-size but with her it's better to be safe than to apologize later.

Once the wee beasties were sound asleep, I dressed as warmly as I could yet still move around - this being the Yukon, after all - and went out into the -40ºC night. Several hours were spent dismantling the horse stable and reassembling it on the front lawn. My Number One daughter's horses were reluctantly transformed into cows with some basswood horns I had carved. Strangest looking cows you ever saw.

I cut up my wife's treasured wool bathmat and tied and hot-glued the pieces to the dogs. Voila! Instant sheep. My wife suggested I stay outside to represent the donkey that Mary rode in on. Mary, Joseph and the baby Jesus had proved to be a little more difficult and weeks earlier I decided not to carve the entire figures, but only their heads. The bodies would be made from old clothes stuffed with hay. A large stash of spruce burls harvested the previous fall supplied me with the raw materials I needed, and many a night was spent copying the head of Mary from Michelangelo's famous Pieta. Mike would have been proud. Joseph didn't turn out quite as well and had a distinct gnomish quality to his face. The baby was simpler, although I spent a lot more time perfecting him. I figured there was no sense tempting fate by carving an ugly deity.

I finished assembling the entire manger scene before the kids awoke Christmas morning – about 10 minutes before. Dyana excitedly rushed outside to see her manger scene. I knew the piercing scream that shortly followed was not one of delight. The rest of us hurriedly donned our coats and went out to see what the fuss was all about. The horse/cows had eaten the hay from the Holy family bodies and the dog/sheep were happily and cosily curled up on the empty clothing. All that remained were the three severed heads lying in the manger.

Admittedly, that was not my finest hour, but the half-sized trebuchet I had built for my son was a big hit and the kids spent many a happy hour hurling boulders over the hilltop and into the forest below. Now that's what Christmas is all about, at least for this woodworker.

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