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ISSUE #124
FEBRUARY/MARCH 2020

CANADIAN Woodworking & HOME IMPROVEMENT

Make a Windsor Chair

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editor's letter

Making a Windsor chair is one of those projects that most woodworkers would love to take on. The graceful curves and visually strong lines of the different Windsor chair styles, as well as their incredible strength and lasting charm, makes them the obvious choice for a true heirloom project. But let's be honest; it's not an easy project. Many techniques are coming together during the build. Working with curves, sculpting and shaping solid wood, dealing with parts that aren't flat and fitting multiple parts together accurately come into play here. All this, while having to consider more angles than a grade 6 math teacher. It's certainly a challenge.

Tony Pierce does a great job at walking you through the steps to build the first half of a continuous arm Windsor chair. If you feel this chair might be beyond your skills, though you really have the urge to try it, you may want to make a practice chair out of cheaper wood. This will allow you to work through all of the steps, learning while doing, becoming more confident with all of the steps. You may surprise yourself and end up with a strong and beautiful chair. You may not. But this approach may just take some of the pressure off, and allow you to not get too worked up about having to be perfect the first time.

We have a couple of other projects in this issue I'm sure will also stand the test of time. A blanket box will provide storage and a place to momentarily sit over the years. Mark Salusbury leads you through the steps involved in creating one for the foot of your bed. Or, if you're an outdoorsperson, and can't wait for fly fishing season, Steve Der-Garabedian shows you how to make a super functional fly-tying cabinet to store and organize all your gear.

If a simpler project is what you're after, I'm sure you'll have the energy for a phone charging station. With a few slots for holding phones, tablets and the like, this station will likely become the 21st century water cooler, with everyone meeting around it to chat.

We have more than just great projects in this issue. Our regular *Know Your Tools*, *Canadian Quotes*, *Home Improvement*, *Finishing Touch* and *Top 10* columns are all packed with useful tips and information which I'm sure you'll enjoy.

— Rob Brown



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CANADIAN Woodworking & HOME IMPROVEMENT

Issue #124

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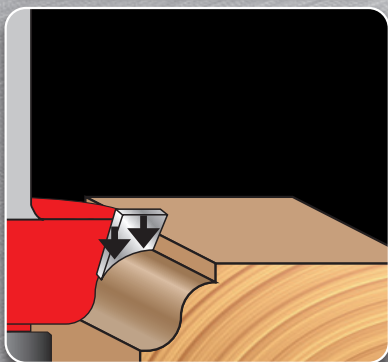
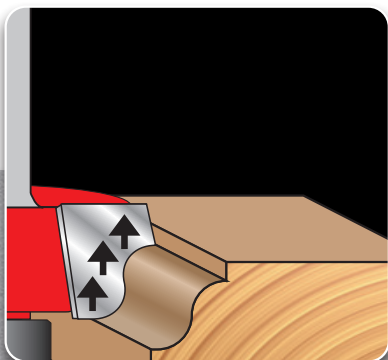
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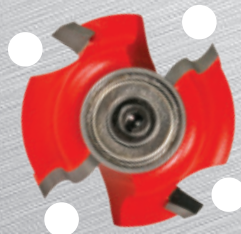
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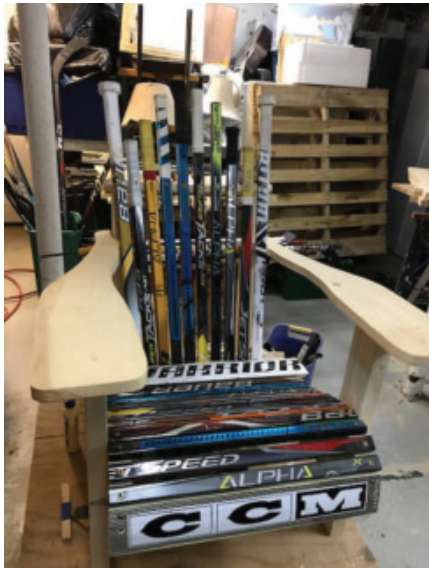
I thought you might be interested in this Centre Block bed I built for my three year old daughter. By no means a serious piece of woodwork, but very Canadian all the same. Features a staircase, slide, play area underneath, library of parliament, gargoyles, prime minister, and Canadiana safety bars.

Got attention from CBC, CTV, and Global.
Rob C
Via email



Hockey Stick Chairs

A couple of years ago I downloaded a set of Adirondack chairs written by Denis Roy. After making a dozen chairs, I now feel compelled to contact him and send thanks. I've made three for myself, two for a couple who married and seven more that went to silent auctions. The chairs I made for auction are where it gets interesting. A friend of a friend saw I made some for our family and asked if I could



make some more. I got bored after a few traditional ones and offered to make some from hockey sticks. This person said "Yes! I'll get the sticks!" Delivered to my house were nearly 100 broken sticks from the Boston Bruins. The seven chairs raised nearly \$3000 for suicide prevention, Toys for Tots, and a family who suffered a tragedy.

Best,
Michael D.
Westford, Massachusetts
Via email

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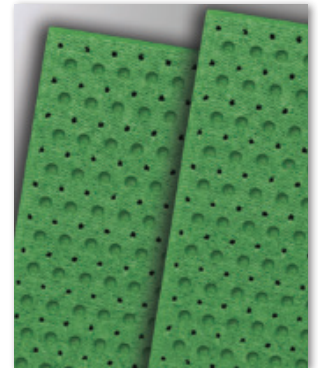


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Product Watch

SONopan Soundproofing

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Best Build

Check out the **Woodworking** section of our forum for our latest "Best Build" thread – a butternut chest. This month's winner, Danny Belley, wins a **\$75 Gift Card** from Lee Valley.



To find out more about this project, go to: forum.canadianwoodworking.com or simply go to CanadianWoodworking.com and click **FORUM**.

Free Plan

Build a Queen Anne Side Chair This challenging build will reward you with a gorgeous set of dining chairs that will be cherished family heirlooms for generations to come.



Video Links

www.canadianwoodworking.com/videos

Canadian Quotes:
Bruce Stuart

Power Carving Wheels for Grinders



Forum Thread

Check out these home improvement threads and many others at forum.canadianwoodworking.com

- **Wood fence boards on metal posts** – When a forum member bought a new house, but wanted to update the metal fence to include horizontal wood boards, our members offered up some great ideas.
- **Condensation in garage vapour barrier** – Unwanted moisture can wreak havoc on a home. Deal with it properly before it becomes a serious problem.

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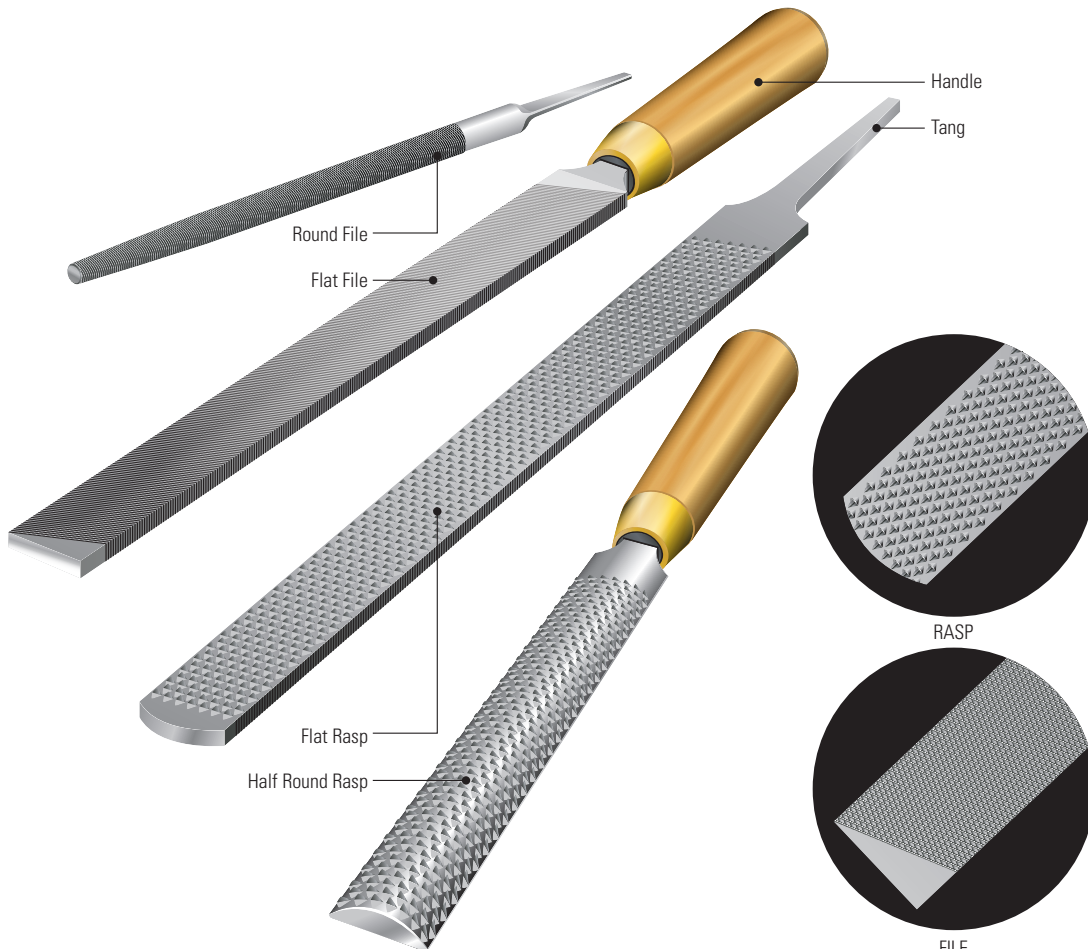
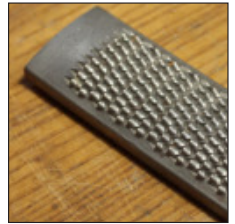
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Rasps and Files



Rasps are more aggressive than files, and can shape wood fairly quickly. **Files** remove wood more slowly, and leave a smoother surface. They all come in a variety of lengths, cross section shapes and levels of coarseness. Used freehand, they are mainly used to shape wood into three dimensional shapes, like a cabriole leg or a chair back. Rasps are 'stitched', either by hand or by machine, to create the small individual cutting teeth. Hand stitched rasps are better, as they cut smoother and faster, but they are much more expensive. Wood rasps are the most aggressive general category of rasp, followed by cabinet rasps and patternmakers' rasps. Within each of these categories are three levels: bastard (the roughest), second cut and smooth. When dealing with files the same levels are used to rate their level of coarseness. Shorter rasps and files tend to be less aggressive than longer versions.

Lengths: About 4" to about 12"

Common Shapes: Flat, half round and round

Price: Rasps \$15-\$125;
Files \$5-\$40

Get the Most Out of Your Rasps and Files

Low Pressure

Don't press too hard when using rasps and files. Letting the teeth do their job will allow for better cuts, and are less likely to clog the teeth.

Protect It

Don't allow rasps and files to come into contact with each other, as this will quickly dull the teeth.

Clean Them Up

A clogged rasp or file won't work great. A file card is a specially designed brush that will remove wood dust from a rasp and file.

Add a Handle

If your file or rasp didn't come with a handle, add one to it. It will be much easier on your hands during use.

Buy a Few

There are many variations of rasps and files. From different shapes to varying levels of coarseness, having a few available works out nicely.



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Top**10** Most Dangerous Woodworking Machines and Tools

We all strive to make working wood as safe as possible, but we can never truly make it safe. All machines and tools should be respected, but be extra careful around these ten.

BY ROB BROWN

- 1 Table Saw** — Partially because they're everywhere, partially because there are so many ways to use them, a table saw likely accounts for more serious woodworking accidents than any other machine or tool. Do your best to learn how to use a table saw before flicking the switch.
- 2 Dull Chisels** — A sharp tool is a safe tool. This goes for every hand tool, but I find it especially true for chisels. A dull tool needs extra force to use, and the moment it gives way the chisel will go flying. Chances are pretty good you've injured your hand.
- 3 Disc / Edge Sander** — Everything goes smoothly with these sanders, until it doesn't. I've had workpieces kickback the moment I got too comfortable. I've also skinned my knuckles pretty bad a few times. Not fun.
- 4 Drill Press** — A pretty innocuous machine, which is why so many of us let our guard down while using them. Small- to medium-sized workpieces are harder to control by hand, and if a drill bit catches the workpiece it can immediately spin out of control, injuring a hand.
- 5 Router** — Almost everyone has a router or two. Since routers rotate sharp cutting edges at such high speeds, and they're often used freehand, things can get out of control very quickly if they're not used with great care. This is especially true when you make a climb cut.



- 6 Thickness Planer** — Though generally thought of as pretty safe machines, in the unlikely event that something does go wrong, it can be ugly. For one of many reasons, workpieces can be shot out the infeed end of a thickness planer. This usually isn't the end of the world, unless you happen to be standing directly in-line with where the workpiece is being shot. Moral of the story: don't stand directly behind a thickness planer.
- 7 Jointer** — It's rare something goes wrong while jointing, but if it does the results can be gruesome. Forget hoping the doctor can reattach a finger, as a jointer will be all too happy to eat any that comes its way. Push sticks help keep hands away from the rotating cutterhead, but safe usage also plays a major role. Keep your hands away from the cutterhead at all times.
- 8 Finishing Rags** — Oil-soaked finishing rags can be extremely flammable if not disposed of properly, and a fire can damage more than just your workshop. The simplest approach is to lay rags flat on the floor so they can dry out before they're disposed of.
- 9 Random Orbital Sanders** — Most woodworkers don't protect themselves from airborne dust created by random orbital sanders, even though they create some of the finest, most dangerous, dust around. Wearing a proper mask or respirator when sanding is always a smart idea, as they will protect your lungs for the long term.
- 10 Angle Grinder** — Whether you happen to be using a wood power carving disk, or are grinding metal, an angle grinder sends debris flying. There's also the potential, especially when working with a wood cutting disc, for it to kickback, so watch out for your hands. Also protect your eyes and lungs during usage.



ROB BROWN

rbrown@canadianwoodworking.com

Photo by Rob Brown

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Mostly self-taught, except for Windsor chairs. I spent some time learning the craft of Windsor chairmaking with renowned chairmaker, Curtis Buchanan. I also spent a week at Rosewood Studio to learn how to use and sharpen hand tools. The rest of my education has been through books, magazines and observation.

Bruce Stuart

...on canoeing, losing track of time and the importance of straight grain wood.

BY ROB BROWN



How long have you been building furniture?

About 30 years.

What sort of furniture do you specialize in?

I like simple, functional furniture, though my specialty would be Windsor chairs.

What are the three most important items in your shop apron?

Block plane

Mechanical pencil

4" Double square

Do you prefer hand tools or power tools?

Hand tools.

Solid wood or veneer?

Solid wood, but I'm not against veneer. I just don't have a lot of experience with it.

Figured wood or straight grain?

As most of my focus is on Windsor chairs, straight grain is a must.

Inherited Vintage Stanley Sweetheart or fresh-out-of-the-box Veritas?

I have a mix of both old and new but there's something about the old tools that I really enjoy. I also like to refurbish Stanley bench planes.

Flowing curves or geometric shapes?

Certainly for chairs, flowing curves.



Comb-Back Windsor Chair – The most distinctive feature of a comb-back Windsor chair is the fact that the back spindles are all the same length, and are capped off with a top rail. The look is similar to a hair comb. This is one of Stuart's chairs.

Photos by Bruce Stuart

quotes

My shop is a 1200 sq ft pole barn constructed building with a board & batten exterior and a tin roof. I heat it with a cast iron wood stove in the winter and can easily get it up to T-shirt temperature in no time.



I usually get into the shop as early as I can and the first order of business is to assess the level of messiness. I can work in the mess until a certain point, but when that point is reached, everything stops until it's tidied up. I do often work at night and sometimes completely lose track of time, only to finally turn the lights off in the wee hours of the morning.



My favourite tools are definitely the tools specific to chairmaking, such as the scorp, the travisher and the drawknife. I often use my Great Grandfather's bit brace to drill many of the holes for legs and spindles and I'm sure it works as well today as it did over 100 years ago. I enjoy every aspect of chairmaking, but shaping the seat is one of the most enjoyable.



I mostly find inspiration from books or magazines. The need for something to fit a certain space pushes me to figure out how to make it work, which in turn leads me to the design.



In addition to furniture, I also build canoes and canoe display shelves. I love canoeing so it hurts a little bit to cut what was once a perfectly functional canoe in half. Although once in their new home, they really do look fantastic, and it's a great way to re-purpose a canoe that can't swim anymore.

Know your material and its limitations.



Since focusing my attention on traditional Windsor style chairmaking over the last number of years, I now use hand tools and green wood almost exclusively.



Tom Fidgen has an immense knowledge of hand tools and how to use them. I would love to meet him and just talk wood and tools over coffee. Michael Fortune, Vic Tesolin, Garrett Hack, Christian Becksvoort, Gary Rowgoski and many others have influenced me too. Being self-taught, these guys are really all my instructors and I'm very thankful to them even though I have never met many of them.



Working with my hands and with tools has been in me ever since I was young. I remember presenting a coat rack to my parents cobbled together from some scrap wood my dad had in the basement.



I like to be creative in my work, but originality or the artistic nature aren't a high priority.



To me, good design means strong joinery, good proportions, pleasing to the eye and if you're going to sit in it, comfort.



The simpler the piece, the less of a design is needed. The design is usually a rough sketch with a few dimensions worked out, from there things most often evolve as I go.



Canoe Display Shelves – Stuart enjoys working with old canoes. He cuts them in half, modifies them to hold items, and refinishes them.

Identifying as a woodworker is important to me. I like being a guy who can make things with his hands.



If you can, go to a good woodworking school and save a lot of time learning by trial and error.



I think studio furniture will become more and more in demand in the years to come as people become more dissatisfied with the quality of mass-produced furniture.



I think the Birdcage Windsor chair is the piece I'm most proud of. Windsor chairs are fascinating and fun to make. A lot of very precise work goes into making a Birdcage Windsor chair comfortable, as well as look good.



Woodworking can be so much to so many. To me it is a built-in passion that I don't think I'll ever get tired of and also offers a lifetime of learning. It can be building a slat box to hold kindling by the fireplace to building a Federal sideboard. If it brings you joy, do it.

ROB BROWN
rbrown@
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Our staff writers review new tools and products on the market that are ideally suited to the woodworker and DIY'er.

SawStop JSS-120V60 Jobsite Table Saw
SawStop keeps the jobsite safe

Laguna Revo 12/16 Lathe
Laguna lathe is turning heads

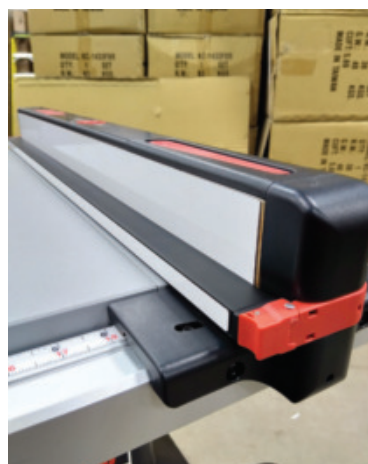
Auto Jig by Armor Tool
Auto Jig sets the new dowelling standard



(Photo by SawStop)

SawStop JSS-120V60 Jobsite Table Saw

SawStop has produced a job site saw as part of their line up for some time, but recently it got some updates and I was able to check it out first hand. The first feature that anyone would notice about the saw of course is SawStop's patented safety technology that stops the blade within milliseconds on contact with skin preventing serious injury. The natural question that most people want to know is; is the saw still a good saw outside of the contact detection safety feature, especially given the high price point of the saw? Even if you can't cut a finger off, you still need to be able to use the saw. SawStop I believe has done an excellent job of



A Low Fence – The SawStop Jobsite saw has a unique low fence that can be added or removed very quickly, making thin rip operations safer.



Hidden Storage – An inboard storage drawer keeps often needed items not only safe, but nearby, reducing the chance that these critical items get lost on a jobsite.

constructing the saw outside of the stop mechanism.

The SawStop jobsite saw weighs in at 113 pounds with the cart, which seems like a lot, but it is actually not far off of the current Bosch and DeWalt models at 92 and 90 pounds respectively. The wheeled cart makes the saw easy to move around on site. The table top on the SawStop is a generous 24-1/2" deep. The fence has been revamped with a removable low side to make cutting thin stock safer and easier, giving your hands more room to grip the work piece. The low fence can easily be removed and reinstalled when needed. The fence slides easily and locks firmly. SawStop uses an easy to push lever on the top of the fence to control the locking and although it doesn't require much effort to lock and unlock the fence it holds quite well. One difference between SawStop and a lot of

other job site saws is the fact that the fence only locks at the front of the saw. Some people don't like the fact that the rear of the fence can deflect during a cut, however, it should be noted that most stationary saw fences are constructed this way. It is safer to have the fence able to give slightly at the rear if a board is seriously twisting during a cut. This small movement could help prevent a kickback. Hiding under the right side of the saw top is a storage container for the guard, riving knife, wrenches, and an extra blade brake cartridge.

The blade can be raised with one full revolution of the hand wheel at the front, and tilting the blade is accomplished by squeezing the back of the blade raising the hand wheel and sliding it right or left which is fairly easy to do. The angle of tilt can be further fine-tuned with a large knob on the front, right of the saw. The controls are easy and intuitive to use, although I am not head-over-heels in love with the speed of the blade rise/fall. I would like to see it go a little slower so it can be set more accurately when needed for dados, but most of the cuts on this saw will likely be through cuts, so this isn't a big deal.

One thing that I don't think I've ever mentioned in a review before is the quality of the instruction manual. SawStop actually produces a really good manual with this saw, and they also have several instruction sheets stuck to the saw in key places. The instructions for installing and removing the low fence are on it, and instructions for replacing the brake cartridge are on the onboard toolbox. Right from the moment you open the box, the instructions guide you through unpacking and assembling the saw in a simple and straightforward manner.

The guard on this version of the saw was upgraded to include a vacuum connection point. The saw can be hooked up above and below the table. The dust collection does work decently if you have a sizeable vacuum connected, but I think that most small portable vacuums will struggle to provide enough suction when split to two different collection points to do a really good job.

Overall the saw is easy to set up and use. Outside of the stop mechanism, the saw is well made and quite user friendly which makes it a pleasure to use. If you are in the market for a new jobsite sized saw, I would have a close look at the SawStop.

SawStop JSS-120V60 Jobsite Table Saw

MSRP:\$1850

Website: www.SawStop.com

Tester: Rich Keller



Shown with Optional Accessories (Photo by Laguna)

Laguna Revo 12|16 Lathe

I got a chance recently to take the Laguna Revo 12|16 lathe for a test spin, and it has a number of good features going for it. There are a lot of little details on the machine that make it stand out to me in the category of bench top lathes. Everything about it is beefy. All the castings are nice and thick, and the top of the bed was very wide. This will help the banjo and tailstock lock in place firmly and not slide given the amount of friction on such a wide surface. The finish was not ground, but somewhat textured, and this also increases the grip between the bed and the banjo and tailstock. The tailstock has a holder for a couple of different centers, which is handy. I liked the feel of the banjo and tailstock sliding on the bed, and the smoothness of the locking levers. Placing a live center in the tailstock and a drive in the headstock, I slid the tailstock up to check the alignment between the two centers and I was glad to see that they were perfectly in line on this machine. It's common to see centers not line up on some of the thriftier machines out there.

The headstock has a tapered nose like Laguna's larger floor model machine, which allows the spindle to stick out quite a bit and give good access to the headstock side of a turning. There are

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Precise Alignment
– Known for their quality, Laguna didn't disappoint here. Keller placed a live center in the tailstock and a drive in the headstock. Once the two were brought together they aligned perfectly.

Many Great Options – The Revo lathe is available as just a benchtop machine (shown above, \$1099), or with additional accessories like a double arm light (\$175), extension kit (\$199), wheel kit (\$175) and stand (\$449).

easy to open doors for the belt compartment and a quick release tension lever which makes changing speed ranges quick and easy. I also liked that there was a window on the end of the headstock which allows the operator to see the index position numbers engraved on the pulley inside. The controls for switching the unit on and adjusting speed are located conveniently on the top of the headstock. The buttons and knobs are large, and the speed display is easy to read. The stand has a number of spots to store your lathe chisels close at hand.

Overall, I like the drive system used on the Laguna lathe. They use a fairly wide serpentine belt. Serpentine belts transmit power much more efficiently and smoothly than a conventional V-Belt which also helps the lathe run quieter. The lathe was very quiet running. With a small piece fixed between centers, you could hardly hear the machine when I was not cutting wood. The machine has a fair bit of weight to it, which is very beneficial. I fixed a piece of oak about 3" square and 12" long between centers, and had it off center about 3/4". I was surprised I could run the machine between 750-1000 RPM and there was very little vibration. I rounded out a few pieces like this with a 3/4" roughing gouge and then planed them smooth with a skew chisel. Using moderate cuts, I had no issues with the power of the machine, but I did find that a heavy cut would start to slow the machine a bit. Compared to other

machines that are this size, I would say it is more powerful. Even though many bench top lathes are using a 1HP DC motor these days, Laguna uses different electronics for their machine, giving a better torque characteristic and lower speed range. At low speed the lathe still had lots of torque. Most machines start to lose significant amounts of torque in the bottom 25% of the speed range. It's still designed as a bench top machine of course, so it wouldn't be fair to expect it to have the power of a full size machine.

There are a couple of small points with the lathe that I did not like. The window for the indexing numbers is nice, but the numbers are upside down if you stand in the normal operator position. When first using the machine I also found that the tool rest would pivot when I was working on the outer ends. I did find this problem went away when I tightened the lock handle significantly more, but I was tightening the handle to a point that I would be concerned about breaking it in time. The Laguna banjo uses a large boss with a split, and the lock handle squeezes the split closed rather than the end of the lock handle driving right into the tool rest post like most lathes. Before running the machine, I expected that this system would have a better grip on the tool post as it contracts pressure evenly around the post, but in the end I found that I had to tighten the handle more than I would with other machines where the end of the lock handle simply drives right into the tool post. Neither of these problems is a deal breaker in my opinion. The Revo also has a fairly short distance between centers, at 15-1/2" it is one of the shorter machines out there, but on the positive side it is one of the few bench top lathes

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that can turn on the outboard end of the headstock, allowing you to turn up to a 16" bowl with the optional outboard tool rest and bed extension. The same bed extension can also be used on the other end of the lathe to increase the distance between centers.

Laguna Revo 12|16 Lathe

MSRP: \$1099 (optional accessories extra)

Website: www.LagunaTools.ca

Tester: Rich Keller



(Photo by Armor Jig)

Auto Jig by Armor Tool

Pocket hole joinery has been around for a long time, but I'm always interested to see a new idea for a pocket hole jig.

Pocket holes can be finicky to set up for different thicknesses of material, and the AutoJig from Armor Tool is a well-constructed jig. The jig feels heavy duty with all the parts being thick and sturdy. The biggest feature of the jig is the fact that it adjusts for different thicknesses of material quickly and easily. By sliding a handle at the front of the jig, the clamping thickness is adjusted along with the height of the drilling guide. There is also a thumb wheel under the clamp handle to control clamping pressure. The jig clamped the material securely and I had no issues with the wood moving while I was drilling. The movement of the slide handle also moves a holder at the side of the jig which holds the drill bit and depth stop collar. This allows the depth stop collar to be set to the right position quickly and easily.

The jig also has a handy chart on the side which tells you what length screw to use for the material thickness the jig is set to. Armor uses a colour coded system to make it easy to select the right length of screw. Based on the thickness of material, the chart tells you what colour screw to use which will be the correct length. For example, 3/4" thick material requires 1-1/4" screws, which are yellow according to the chart. If you happen to be using fasteners from a different company, the chart on the side of the jig does tell you what length to use. One thing I've found over the years with other screws is that sometimes an 1-1/2" screw will get mixed in with 1-1/4" screws, and without being colour coded you won't realize this until the end of the screw is poking out somewhere it shouldn't.

The drill guide on the AutoJig is adjustable for two different hole

Colour Coded – A simple chart on the side of the jig will keep screw selection simple. This chart also provides a bit of information on which thread type to use.



Narrow or Wide – By loosening the thumb screw and turning the drill guide around you can quickly and easily change between two different boring widths.



center spacing applications. Changing the spacing is easy; just loosen a thumb screw, flip the drill guide around, and re-tighten. The jig also has a vacuum connection point, which will help drill bits last longer and drill quicker by removing sawdust. I found that the included drill bit drilled quickly, though some of the holes were a little fuzzy around the edges. This seems to be a common problem with pocket hole jigs. I never put a pocket hole where it can be seen, so this isn't an issue for me.

I was impressed by the quality of the jig. It's well constructed, and the adjustment for the clamp is smooth and easy to operate. Underneath the jig, the mechanism that makes it all work is heavy gauge steel, while the colour coded screw system makes it easy to pick the right fastener. I found the included driver bit wasn't the best quality, but this isn't a deal breaker. As Canadians, I expect most of us already have a handful of #2 square drive bits around the shop. I would recommend the AutoJig if you are in the market for a pocket hole jig.

Auto Jig by Armor Tool

MSRP: \$185.39

Website: www.Armor-Tool.com

Tester: Rich Keller



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Build a

BLANKET BOX

Offering much needed bedroom storage space, and a place to sit for a moment, this blanket box design is fun to build, and very customizable to your décor.

BY MARK SALUSBURY

The commission was to design a pair of cases to store linens. They were to sit side by side at the foot of a bed, be no wider than the bed width, double as bench seating and match the decor and colour palette of the existing cabinetry. On a budget!

After visiting the space, I got my direction and created my response, which the client was thrilled with. As I was making the boxes I realized a box like this can be easily scaled up or down and used to store linens, toys, games, clothing...almost anything. It can be stationary on feet or mobile with added casters. It can have an added cushion for seating, or left plain for simple storage.

Photos by Mark Salusbury Illustration by Len Churchill

Materials can be left natural or stained then clear-coated or can be painted for added colour. To match my clients' decor I went with poplar hardwood for the corners and Baltic birch plywood for the panels, finished with three coats of decorative colour. My only other design element was to provide adequate airflow to within, so if a blanket box became a hiding place for a youngster (remember "hide-and-seek"?), they could breathe easily.

K.I.S.S.

By keeping construction simple, based on dado joinery and sound adhesion, accuracy and precision can become the focus as parts are crafted and assembled. The method is just like making a small box; assemble the case, cut the lid portion off, add the details, finish the box inside and out and apply the hardware.

Outside dimensions of each case are 30" wide, 22" tall and 18" deep. Each leg is from stock milled 2" square and the Baltic ply stock is just under 1/2" (nominal 12mm) in thickness. From these dimensions, all other sizing can be calculated.

I milled all dados with a 3/8" bit in a table-mounted router, taking multiple passes to achieve crisp depths, followed by adjusting the fence to craft a snug fit for the panel stock. As all parts are multiples, a setup can be repeated for each dado in all parts. I find a Vernier caliper indispensable for measuring plywood thickness, as well as dado width and depth. It's also a good idea to use an off-cut of the plywood stock being used, sanded just as the project stock will be, to get an accurate fit of the stock within the dados; test fitting unsanded stock as I adjust for final dado width is like squeezing a size 10 foot in a size 9-1/2 boot; I can force it to fit, but "ouch".

From my experience, for the precise fit that glue prefers, it wants to be snug but not tight when the parts are mated under firm hand/arm pressure. Clamps should only be necessary to draw the assemblies to seat fully over the final millimeter of depth and to hold the assembly as the glue cures.

Legs first

So now that we know the direction we're heading in it's time to mill the leg stock and cut it to final length, followed by routing dados in it. I also chamfered the inner corner of each leg to make the box friendlier inside; the chamfer was shaped after routing the dados, maximizing the working surface and stability during dadoing.

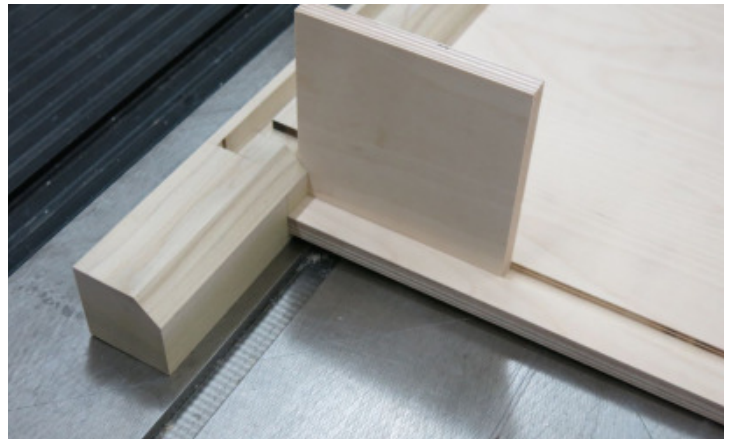
I prefer routing over using a dado set on a table saw; the joinery will be fully exposed when the lid is opened and saw-blade dado sets are notorious for producing uneven surfaces at the bottom of the joint.

All the dados are stopped at the lower ends, so a stop-block gets clamped to the router table fence. I find ripping the long dados first makes crosscutting the short dados easier by providing a void behind the cut.

The dados that accept the top and bottom are the same, short of the fact that the dados for the bottom will be cut well in from the bottom end of the legs. The top dados will be machined at the top ends of the legs.

Panels are next

Once I routed the joints and squared up the stopped dado ends with a chisel, I took an accurate measurement of the dado depths



A Scrap Helper – A scrap of sanded plywood is perfect for checking dado width. It will also make shaping the relieved corners of the bottom panel easier, as you can determine the correct shape with the scrap, then transfer that shape to the bottom panel.



Careful Notches – Salusbury bored a hole in the inside corner of the notch in the bottom, then used a band saw to make the straight cuts. This notch will fit around each leg.

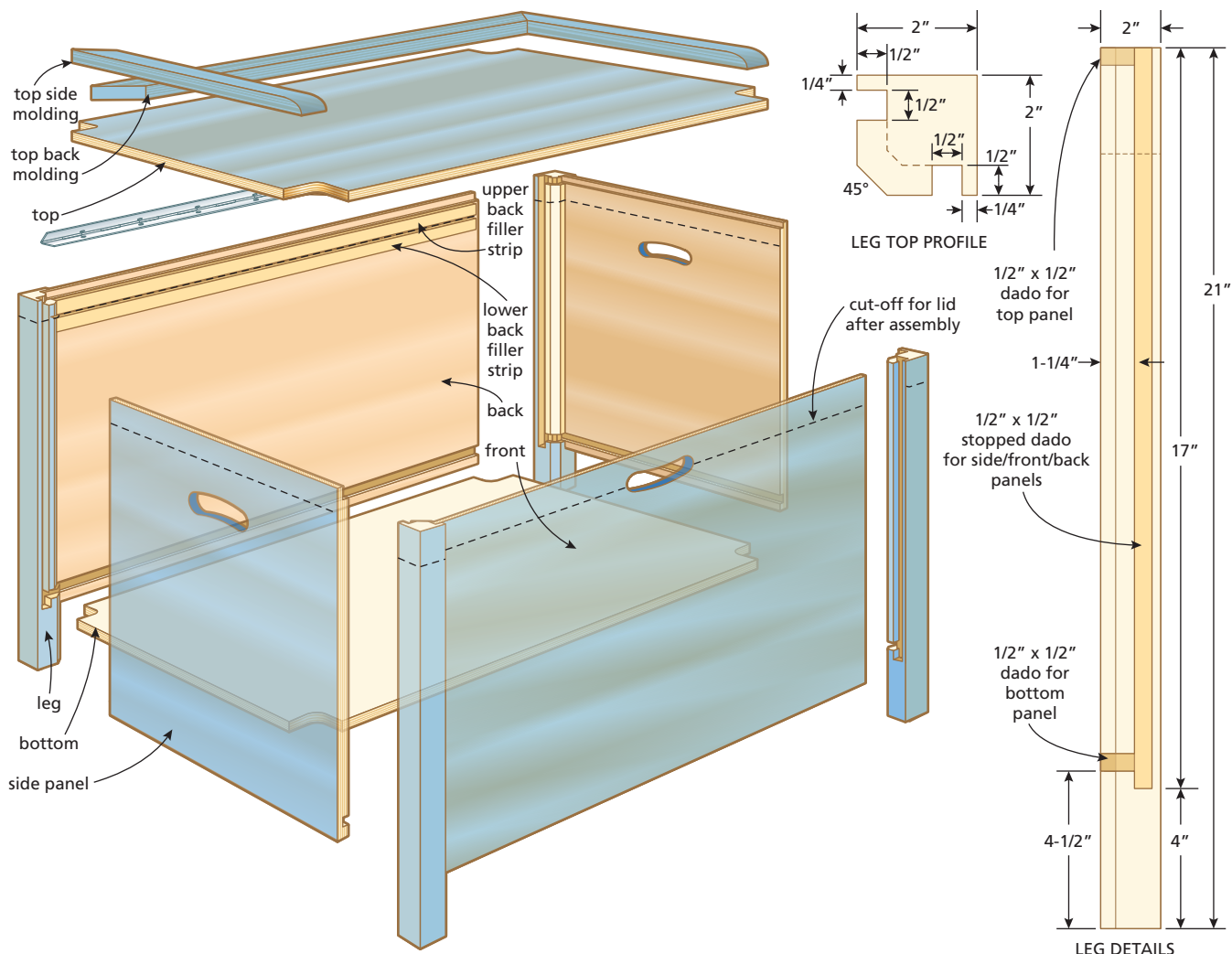
so final panel widths can be determined for exacting overall project width and depth. If the joints are routed exactly they should match the project drawings and calculations. If not, by final sizing the panels after the corner joinery is machined I've left myself an easy "just-in-case" fix.

With the panels cut to final size, I refined the corners of the bottom and top panels to fit around the legs inside the dado, sanded the panels to P220 grit and eased the edges so they shoehorn into their respective dados firmly, yet effortlessly. The joints at the four corners of the top are not going to fit perfectly, but the three top trim pieces will eventually cover up any gaps that are visible.

Rabbets in the top edges of the two side panels, one front panel and one back panel now need to be cut to accept the top panel. These rabbets are cut the same width as the top panel is thick, and to a depth of half the thickness of the side, front and back panels.

After dry fitting the assembly and making the inevitable little tweaks, it's time for glue-up.

I located and shaped the hand holds in the case using a hand-held router with a router template I made while the case was curing; end handles for lifting the box and one up front to raise the



Materials List

Part	Qty	T	W	L	Material
Legs	4	2	2	21	Hardwood
Side Panels	2	1/2	15	17	Baltic birch plywood
Front / Back Panels	2	1/2	27	17	Baltic birch plywood
Bottom	1	1/2	29	17	Baltic birch plywood
Top	1	1/2	29	17	Baltic birch plywood
Side Cushion Moulding	2	1	2	18	Hardwood
Back Cushion Moulding	1	1	2	30	Hardwood
Hinge Filler Strips	2	3/4	1 1/2	26	Hardwood

Hardware List

Name	Qty	Size	Details	Supplier
Piano Hinge	1	To Fit		Misc
Lid Stay	1	To Fit		Misc

lid. Alternately, hardware handles could be applied later to suit the application and decor. Regardless, accurate location of the cut separating the box lid from the box base needs to be determined at this point.

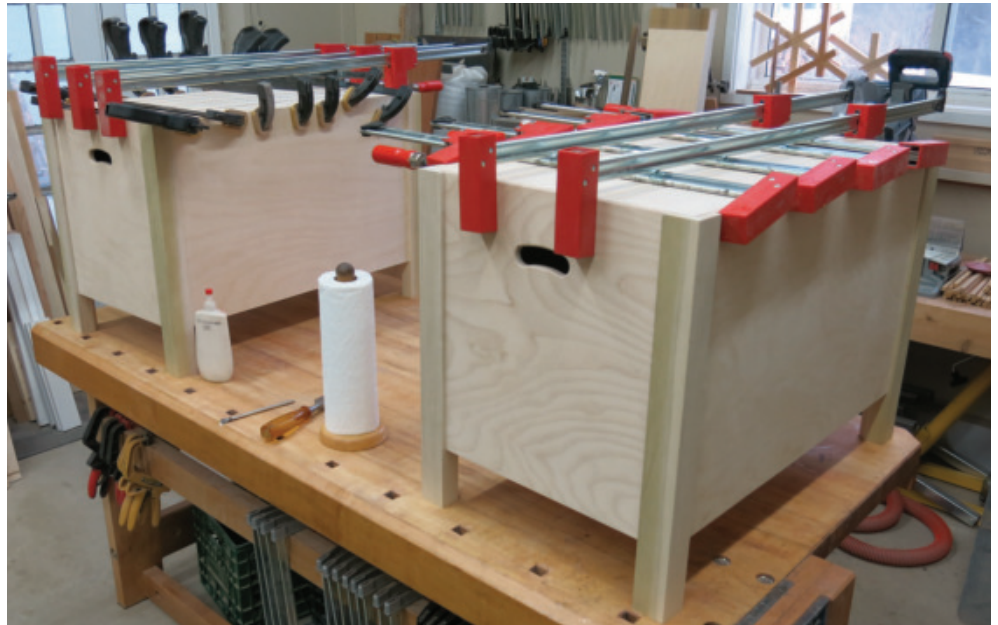
Glue it up

To assemble the box, I begin by lightly sanding all parts to remove any fuzz and gently ease all edges so the panels will slip unimpeded into the dados then dry-assembling to make sure of fit and alignment. Next, this time with glue, sides get joined to legs first. I align the dados by inserting a scrap plywood block within the joint as the parts come together. Once dry, these subassemblies are united with the back panel, top, bottom and front panel. Band clamps can be useful here to surround the assembly while checking for squareness and any other unexpected surprises.

Working steadily, it's time to stand the case on



Mating Grooves – The grooves cut into the inside surfaces of the legs will accept the bottom panel, and are aligned with the grooves in the panels.



Time for Assembly – Assembly happens in stages to make the process simpler and less stressful. Start with bringing a side panel together with two legs, and repeating the same process on the second side. When dry, bring those two assemblies together with the remaining parts and clamp everything together.

its feet on a known level surface and apply clamps, checking for square-ness all the while, making adjustments if required. If the millwork, joinery and panel dimensioning were cut exactly, the assembly should self-square perfectly.



Plan Ahead – The handles were cut before the lid was cut from the base, so accurately locating the handles is important. The front handle straddles the lid and base, while the two side handles are completely in the base.

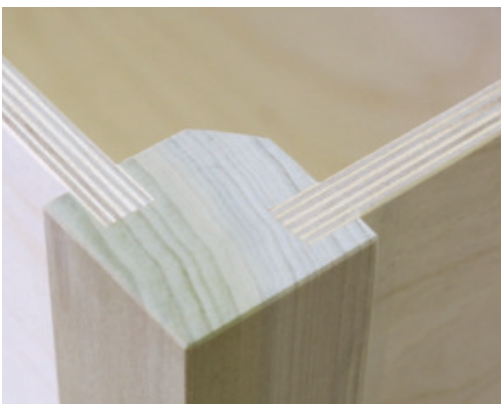
Remove the lid

Next, having set the saw's fence firmly, I separated the lid from the box at the table saw with a "fine finishing", "thin kerf" blade raised just enough to cut the legs halfway through in one pass. I cut the ends first and secured a filler strip within the kerfs to hold the gap when making the next cuts. Now raising the saw blade so it will cut through the legs fully, I carefully made my cuts through the front and back surfaces, leaving a clean surface at each corner. Alternately, if there's any concern about the lid and box shifting during the last cut, by sawing only halfway through the legs during all cuts, a stub would be left at each corner, supporting the lid, which can be cut free then planed/sanded flat after the lid is apart from the box.

Sanding, finishing and hardware

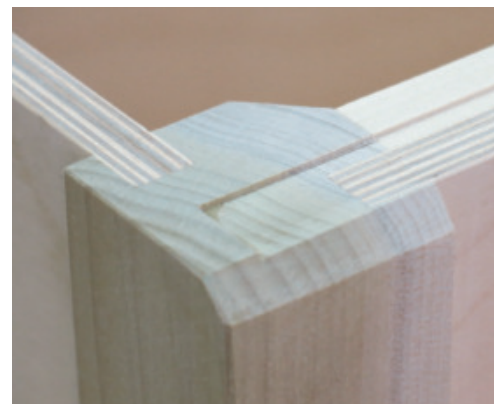
With the lid and box now separated I added the two hinge support strips to the inside of the box, that was glued to the back panel. This gave the hinge screws more meat to bite into. Once installed I ensured it was flush with the edge of the plywood panel on both the base and lid.

Next, I planned for the long recess to accept the piano hinge. I used a flat-bottom mortising bit in my trim router, and with the help of an edge guide, and a pair of stop blocks to limit router travel, I



Simple Joinery – Flat-bottomed grooves make for an even look once the piece is assembled, and the lid is removed. These are also strong joints that will stand the test of time.

Hinge Details – A recess to accept the long piano hinge was cut into the top of the back, and underside of the top. You can see the applied solid wood moulding on the inside of the cabinet in this photo. This piece provides material to support the piano hinge screws.





Top Trim Pieces – Three trim pieces were cut and installed around the perimeter of the top, completing the look and providing assistance to keep a cushion in place.

machined the recess. I referenced off the back of the blanket box, but had to temporarily install a filler strip between the two back legs with double sided tape to create an even surface for the edge guide to run on. Once the piano hinge was installed it became obvious

the back, outside edges of the legs needed to be chamfered so the lid could open properly.

It was now time to sand smooth all the cut surfaces, ease all edges, do any rounding and shaping to routed handles/lifts and



Lid Stay – There are a few types of lid stays available for purchase that will hold the lid in place when in the open position.





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Properly Installed – With the piano hinge properly installed you will need to attach a bumper of the same thickness as the hinge to the underside of the front corners of the lid.

surfaces. A clear coat, or a stain then clear coat, would also work very nicely with this project. The choice is only determined by personal preference.

Hardware and hinges were applied once the finish fully cured. Here I used a piano hinge at the rear of the box/lid and bumpers of the same thickness as the hinge, where the lid contacts the front legs to maintain the gap between the elements. I also added a friction lid support to hold the lid open when needed. Lastly, glides were installed on the bottom of the legs to ease movement and provide visual lift for the completed boxes.

Side-by-side they offer comfortable seating and generous storage at the foot of a bed; one day they'll become heirlooms for another generation.



MARK SALUSBURY
salusbury@nexicom.net

prepare to finish the parts overall. It's at this stage that I added the cushion moulding on the rear and sides of the lid to register a seat cushion to be added after delivery.

I finished the interior of these blanket boxes with a water-borne alkyd varnish. Once dry, I applied three coats of durable Benjamin Moore "Advance" waterborne alkyd to the exterior



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How to Install a Beam to Replace a Load-bearing Wall

With a little planning and research someone with reasonable carpentry skills should be able to remove a load bearing wall and replace it with a beam. Regardless of the size of opening you want, the process is very similar.

BY RON NORTH

As you sit there sipping your morning coffee you decide it has got to go. That wall. That pesky divider between the kitchen and living room. You've been thinking about it for years, and now you're finally going to tackle this project. It's doable for a reasonably talented woodworker or DIY'er. There are however some important aspects to be aware of.

This article uses information from the 2018 BC Building Code, which is available online for free. It's based on the 2015 National Building Code, which is widely adopted across Canada. Local conditions such as the snow load need to be considered. A building permit would generally be required for this renovation, so it would be wise to talk with your local building official when planning the project.

Load bearing?

Firstly, is it a load bearing wall? If not, it could save a tremendous amount of work and cost. The age of the house should give some clues. Roughly speaking, if the home was constructed during the 1960s or before, it was likely "stick framed". If so, it means many of the interior walls, parallel to the roof ridge carry some load. Possibly just ceiling joists but also an actual roof load may be supported by the wall(s) in question. A home built in the 70s and beyond often employs manufactured trusses that typically span

Photos by Ron North. Lead photo by Supernatros | Dreamstime.com

from outside wall to outside wall, meaning there would be few if any interior load bearing walls. Note, that if the wall is supporting a floor, there would be the load from that floor but also any additional loads imposed by possible roof loads.

Now that you've determined the wall you want to remove is load bearing, for simplicity, let's assume the wall is supporting a roof load only. You will need to decide on the type and size of beam to support the load. The span of the opening will have the greatest impact on beam selection.

In general, built up beams using lumber could work for spans up to about 4-5 meters (13'-16'). See building code span tables. Steel beams can span considerably farther. However, there is only one span table in the code and that is for the support of floors. If the specified snow load in your area is not greater than the floor load (1.9 kPa or 40 psf) then a beam could be selected from the span table. If the snow load is greater, then an engineer will be required to size the beam.

Another possibility is Laminated Veneer Lumber (LVL). There are no span tables in the building code for these so an engineer will be required. Typically, the manufacturer will provide the engineering for the beam. This would be for a simply supported beam with no point loads or other complicating factor. Otherwise an engineer would be required to size the beam, and possibly its support.

There are other beam types such as Glu-Lam, Parallam or a girder truss. I have not included these as they are not typically

used in this type of alteration.

There are advantages and disadvantages to each type of beam;

Built up lumber beam

- Pros**
- Likely the cheapest. (2x12x16 SPF approximately \$34)
 - Convenient, bought off the shelf at a lumber store.
 - Engineering not required. Use the span tables in the

building code.

- Cons**
- Limited on the maximum span.
 - Sometimes the materials are inconsistent.
 - All lengths may not be available.

Steel beam

- Pros**
- Moderate cost. Approximately \$10 per foot (W150x22, W6X14)

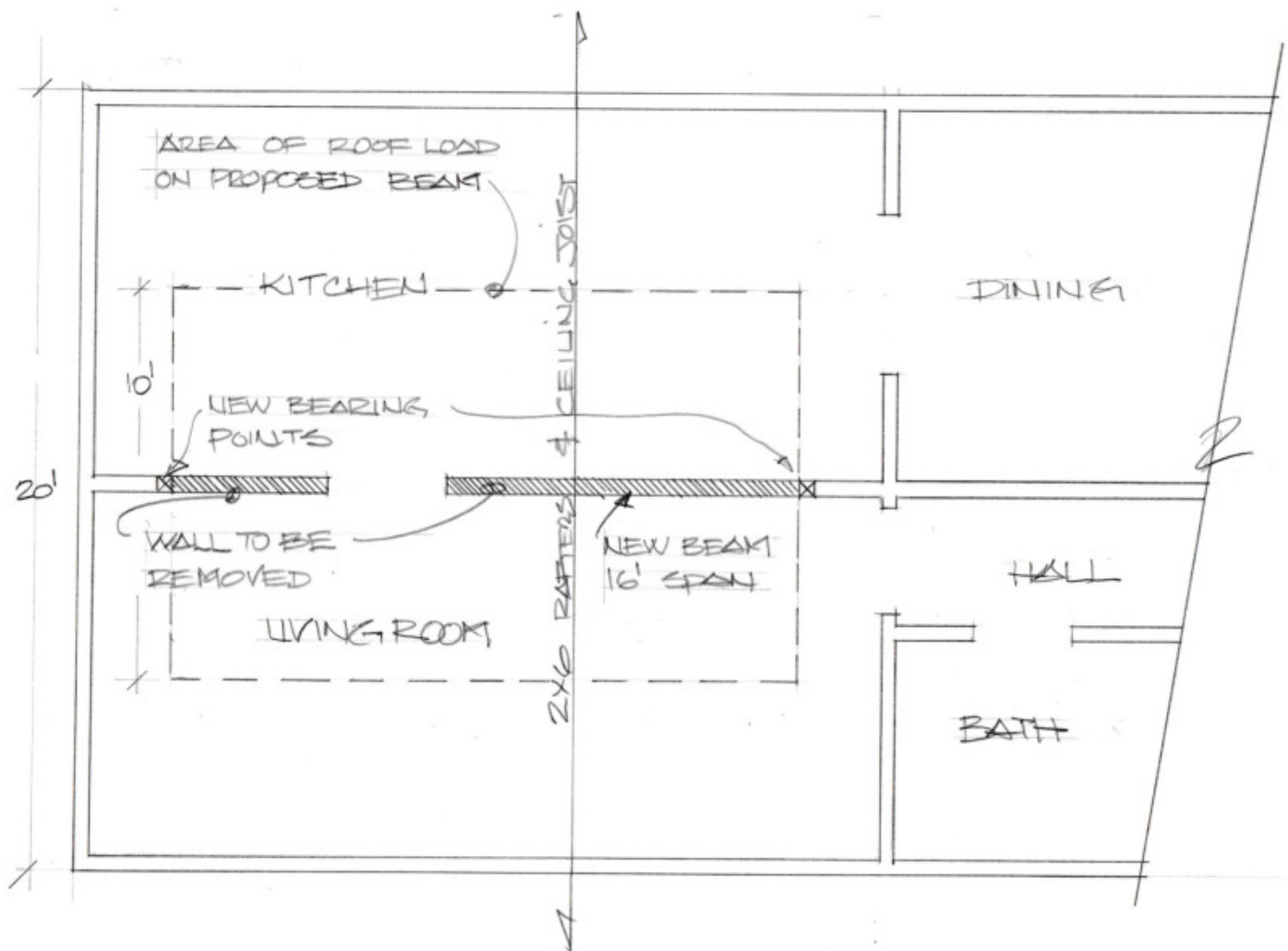
- Long spans possible, within the limits of the span table.
- Low profile, relative to the span.

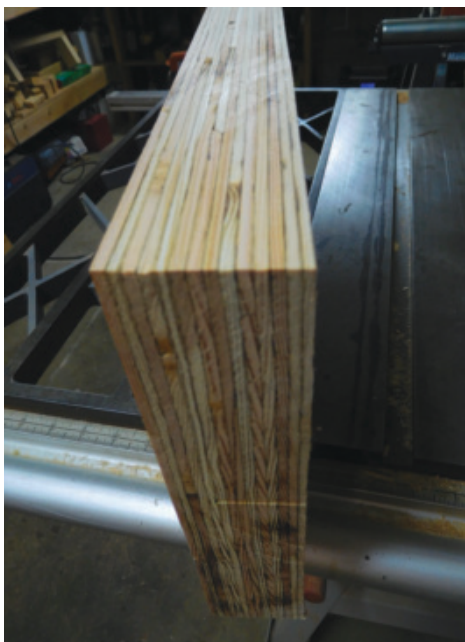
(Could be important if trying to hide the beam in a floor).

Cons

- Requires lumber bolted to the beam so joist hangers can be installed. If the beam is to be exposed (hang below the floor or ceiling) it would still require lumber added to act as a nailer for the installation of the final finish.

- Heavy. Even the smallest beam is 22 kgs per meter (15 lbs per foot). A 6 meter beam would weigh 135 kgs. At least three or four people will be needed to place the beam.





Think Thick Plywood – Laminated Veneer Lumber (LVL) is essentially very thick plywood manufactured in a variety of dimensions.

Laminated Veneer Lumber (LVL)

- Pros**
- Long spans possible.
 - Lighter, easier to install.
- Multiple plies can be installed separately.
- Engineering usually done by the manufacturer, supplier.
- Cons**
- The most expensive option.
- Approximately \$11 per foot per ply (1.75 inch × 14 inch).

Time for an example

We will make some assumptions for our example project. The opening in the wall we want is to be 16' (4.8 metres). The width of the building is 20' (6 metres) and the specified roof load is 30 lbs/sq ft (1.5 kPa).

The Specified Snow Load (SSL) is calculated using the ground snow load and the rain load for the location of the building. E.g. the ground snow load is 2.1 kPa. The rain load is .3 kPa. The roof factor is .55. Therefore, the SSL is $[2.1 \times .55] + .3 = 1.45\text{kPa}$. (30.4 lbs/sq ft).

The span tables, no matter what type of beam you choose, are all similar. Just use the SSL, the type of beam (sawn lumber or steel) and check the maximum allowable span.

For our example, we'll start with a built up wood beam to see if that works. It can be seen from the span table that the largest span possible under the 1.5 kPa specified

Maximum Spans for Built-Up Ridge Beams and Lintels Supporting the Roof and Ceiling Only, No. 1 or No. 2 Grade

Commercial Designation	Beam or Lintel Size, mm	Maximum Span, m				
		Specified Snow Load, kPa				
		1.0	1.5	2.0	2.5	3.0
Douglas Fir — Larch (includes Douglas Fir and Western Larch)	3-38x184	2.65	2.28	2.03	1.85	1.71
	4-38x184	3.06	2.64	2.35	2.14	1.97
	5-38x184	3.43	2.95	2.62	2.39	2.21
	3-38x235	3.25	2.79	2.49	2.26	2.09
	4-38x235	3.75	3.22	2.87	2.61	2.41
	5-38x235	4.19	3.60	3.21	2.92	2.70
	3-38x286	3.77	3.24	2.88	2.62	2.43
	4-38x286	4.35	3.74	3.33	3.03	2.80
	5-38x286	4.86	4.18	3.72	3.39	3.13

Maximum Spans for Steel Beams Supporting Floors in Dwelling Units

Section	Supported Joist Length, m (half the sum of joist spans on both sides of the beam)						
	2.4	3.0	3.6	4.2	4.6	5.4	6.0
One Storey Supported							
W150 × 22	5.5	5.2	4.9	4.8	4.6	4.5	4.3
W200 × 21	6.5	6.2	5.9	5.7	5.4	5.1	4.9
W200 × 27	7.3	6.9	6.6	6.3	6.1	5.9	5.8
W200 × 31	7.8	7.4	7.1	6.8	6.6	6.4	6.2
W250 × 24	8.1	7.6	7.3	7.0	6.6	6.2	5.9
W250 × 33	9.2	8.7	8.3	8.0	7.7	7.5	7.3
W250 × 39	10.0	9.4	9.0	8.6	8.4	8.1	7.9
W310 × 31	10.4	9.8	9.4	8.9	8.4	8.0	7.6
W310 × 39	11.4	10.7	10.2	9.8	9.5	9.2	9.0

snow load would be 4.18 metres (13.7 ft). Therefore, a built-up wood beam won't work in this case.

Next check a steel beam. The table below, 9.23.4.3. is typically used for floor beams. However, since the assumed floor load of 40 lbs/sq ft (1.9kPa) is actually more than the specified roof load applicable to our project, the table can be used to select a beam. From the table we can see a W150 × 22 beam will span 5.2 meters (17.06 ft). Therefore, we could use a steel beam to span the 16' opening.

We know an LVL beam will be able to span the 16' opening because the manufacturers' engineer will design a beam specifically for the project. It was decided to use the LVL because it will be easier to install. Two people can carry and lift each piece of the three-member beam into place. The steel beam, while cheaper, would be harder to handle, even with assistance. Typically, the beam will be manufactured 150mm (6") longer than the span to allow for a minimum bearing surface of 75mm on each end. The beams are



Add Two Temporary Walls – Temporary walls in place on either side of the existing load bearing wall supporting the ceiling joists and roof rafters.

made (and priced) on 600mm (2') increments, so the beam will be 5.5 metres (18') long and cut on site.

Getting to work

Temporary walls are constructed on both sides of the existing wall that is to be removed. Build the walls using stud spacing the same as the spacing for the supported roof rafters and ceiling joists. A single top and bottom plate is sufficient.

Now the existing wall can be removed and the joist cut to accommodate the new beam. Cut the joists such that the beam will be centered on the ends of the existing wall. (Depending on the width of the new beam, the wall may need to be widened at the bearing points by adding studs to the side of the existing wall.) The individual pieces of the LVL can now be installed.

The remaining two plies of the LVL are installed (nailed or bolted, as required by the engineered detail) and hangers nailed in place. The temporary walls can then be removed.

Points to remember

Get the building permit that indicates the specifications for the beam you have chosen before ordering the beam.

Take your time with the construction of the temporary wall. Double check you have everything supported properly.

Confirm the walls/foundations below are aligned correctly to support the new point loads at each end of the new beam. Plumb a line down from the center of the bearing for the beam on to the floor. Drill a hole through the floor, and then see below where the hole is in relation to the walls/foundations.

The space between flooring and the walls below must have solid blocking installed to transfer the load to the wall below. The blocking (and the studs in the wall below) must be as wide and as long as the bearing point above.

The individual pieces of the LVL may need to be clamped temporarily to ensure they are tight to each other before nailing. Clamping may not be required if they are to be bolted.

Nails (or screws) specifically designed for hangers must be used. Standard nails and screws likely won't have the sheer strength to meet the design specifications for the hangers.

With a little planning and research a person with reasonable carpentry skills should be able to accomplish this alteration.



Position the New Beam – The first ply of the LVL is in place above where the now removed bearing wall was located. Each ply is about 56 kgs (123 lbs) so it is manageable for two people.



Secure it in Place – The installed LVL beam. In this case each ply is nailed to the next. Some designs may require the pieces of the beam to be bolted together.

Regardless of the size of opening you want, the process is virtually the same. Support the floor or roof, install the appropriate beam with adequate bearing and then remove the temporary walls. If you want to tackle the install, most building inspectors will be happy to help with advice.

Ron North has been involved in the construction field for over 45 years, most as a building official. Good heavens, retire already! His book "Building Inspector Memories" tells tales of some not so successful renovations.



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PHONE CHARGING STATION

A simple station will go a long way in keeping your family's collection of smart phones organized.

BY GEOFF COLEMAN

This project grew out of a simple request for somewhere to put a smart phone to charge. But then the “andits” started. And, it should cover the outlet. And, it should hide the tangle of cords. And, it should be removable so if a charging cord fails, or you purchase a new brand of phone, you can easily swap them. And, it should be attractive in any room.

The solution was to make the shelf with a hidden cavity where the plugs and cords reside, and to hang it on the wall using a French cleat.

The shelf can take all manner of shapes and sizes depending on the shapes and sizes of your own devices, but the cavity where the charging happens is consistent.

How big?

Outlets with the trim plate removed measure $2\frac{5}{8}'' \times 1\frac{1}{4}''$ so that - plus a quarter inch for wiggle room - is the minimum inside width of the cavity. From there, things are less definite. If you use an older charger, it may extend out from the wall as much as $3\frac{1}{2}''$ with a cord inserted, so the depth needs to be greater than it would

if you have installed an outlet with dedicated USB ports built right into it. And, if you want to use both receptacles for charging, yours will require a higher cavity.

For the purposes of this article, we assume that you will break down and spend ten dollars on a charger with two USB ports that will go in the upper receptacle. With that expense out of the way, you probably have the rest of the required materials in your shop.

After prototyping numerous designs from simple to sophisticated, I settled on the one you see here. It's large enough for more than one device, and since it's laminated from solid wood pieces, it lends itself easily to custom sizes and wood types. If you don't love my design the only limiter is your imagination. My design will give you a good idea how I engineered the basic necessities, but the final look can be quite different.

Milling and gluing

Start by milling your lumber. The size can obviously be as big as needed to meet your needs, but the first stop after the gluing station is the band saw, so make sure it is not too big to fit in the saw vertically. My saw topped out at about 6", so my block measured $5\frac{3}{4}'' \times 5\frac{3}{4}'' \times 6\frac{1}{2}''$. After ripping the individual pieces to width, I used a

All Glued Up – Once the center sections have been notched to fit around the plug and the wall-mounted French cleat, glue them together, making sure to keep them aligned.

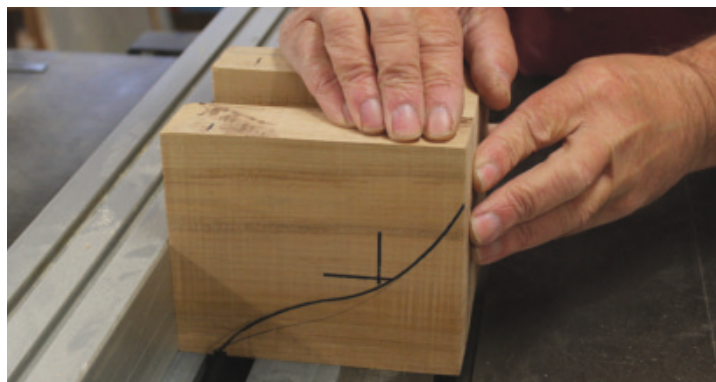


Curved Template – It's easy to make a paper template that will help you draw the same curve onto the workpiece, but you can also use masking tape, and some careful pencil marks on a French curve to help keep the curves consistent.

cross cut sled and stop block to ensure they were a uniform length.

The cavity where the plug and excess cord will go measures 2-1/2" wide × 4" high × 2-3/4" deep, and it's easy to create by removing material from your center laminations. The middle ply or plies will be notched to create the opening. Regardless of the size of the wood, the notch must be at least 2-3/4" × 4" so the charging plug and cord can fit. Notch as many pieces as it takes to have at least 2-1/2" in width of negative space.

Glue them together, being careful to keep the top edges perfectly aligned. Clamps with a screw handle, have a tendency to twist things slightly out of alignment as they are tightened, so with each lamination, you may choose to drive a finishing nail in a carefully chosen location (that won't find a saw blade in later operations) to help register the parts.



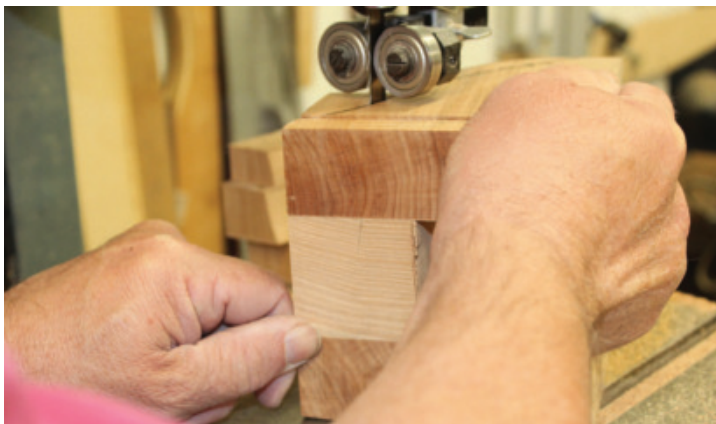
Dado Will Hide Mistakes – Coleman machined a 1/4" wide dado in the three visible faces of the base, so if the bandsawn curves were uneven they wouldn't be as obvious.

Add some curves

With the glue dry, it's time to lay out the curve. To avoid cutting into the cavity, use an adjustable square to measure and mark the edges of the hidden opening on the side of the block. Draw your curve, staying shy of the cavity by 1/4". The same arc will be drawn two more times, so a template from thin plastic or 1/4" Baltic birch plywood is worth making.

The line will be cut at the band saw, but before you do, put a 1/4" wide dado blade in the table saw and centre it on the point where the curve leaves the block at the top. Use it to cut a 1/8" groove around the block. If something goes wrong and your band saw cut is not perfectly parallel to the top edge, any evidence will disappear in the slot.

With that insurance in place, it's off to the band saw. Place the block on its side and make the front cut first. Then, you can mark



First Things First – The first bandsaw cut is made with the workpiece rotated onto its side.

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Cut the Side Curves – The next two bandsaw cuts are made with the workpiece on its back.



Machined and Sanded – The curves on this base aren't so tight they're hard to sand. You might want to keep this in mind when laying out your curves.

and execute the two side cuts. I was able to make the cuts using a 1/2", 3 TPI blade.

After careful cutting with a well set-up saw, there shouldn't be much sanding to do. Start with 100 grit on your random orbit palm sander and graduate to 220 and finer if necessary. The radius used in the project can be worked effectively with a palm sander, so minimal manual touch ups will remain.

Route slots

I chose to match the actual shelf to the centre lamination of the support structure in both the examples shown here, and I routed slots to hold my devices vertically. This offers more security and more efficient use of the surface area.



Simple Router Jig – Coleman used two long, straight pieces of MDF on either side of the router's base, and two short pieces towards either end of the long pieces to make a jig to guide his router. The two long fences trapped his router, and ensured it wouldn't stray from the intended path while routing the grooves with multiple passes.

While it was tempting to reach for the standard edge guide that came with my plunge router, I chose to repurpose a router-specific jig I made for routing dados in cabinet sides. Basically, a frame made from two short and two long 3" wide strips of 3/4" MDF. The long pieces are screwed to the short ones at 90°, and separated by the width of the router. They corral the edges of the router to keep it

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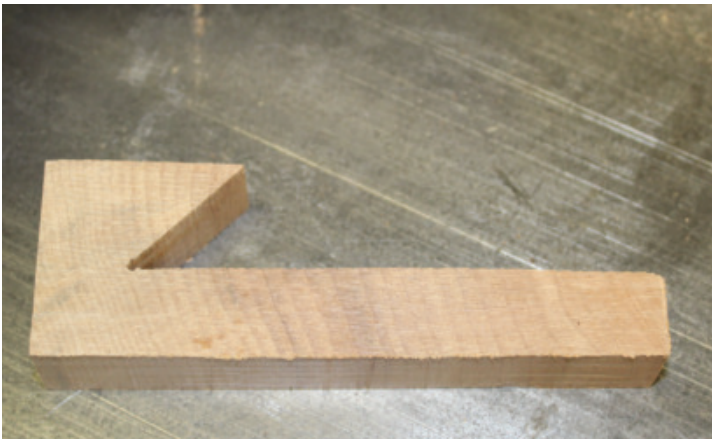
Rout then Cut –

Coleman routed the grooves in the top before cutting the top from the board. This was safer and easier.

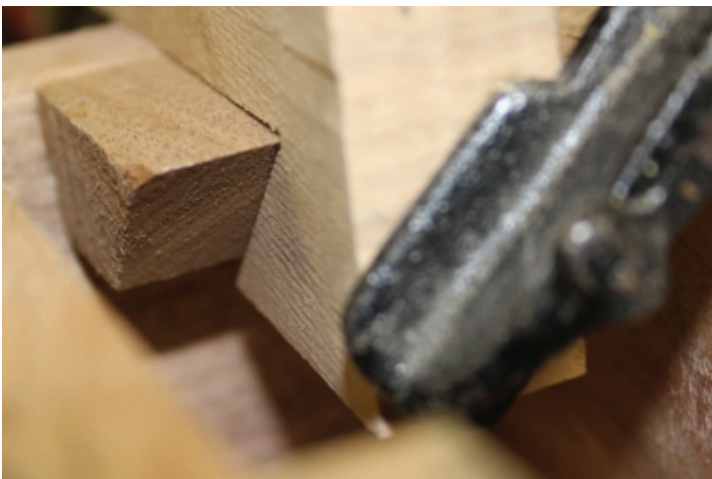
Two Options –

A strong option is to cut the French cleat in an L shape, then attach the vertical portion of the cleat to the stud (left).

This ensures the project is fixed to the wall very firmly. If you want a narrower center cavity you can use a drywall anchor directly above the electrical socket, and screw a narrow French cleat into it (right).



Gluing an Angled Cleat – Because the portion of the French cleat that will get glued to the underside of the top is angled, a simple angled caul is needed (above). It will provide a perpendicular face for clamping, and also grasp the French cleat properly so it can be attached for good (below).



from wandering, while the short ones keep everything square when tight to an edge of the board you're working on.

I clamp the jig to the shelf top and make progressively deeper passes – controlled by start/stop blocks – along my guidelines, assured that an unexpected patch of gnarly grain couldn't push the bit awry like it might with an edge guide. Think of it as a shelf improvement guide.

For best results, consider cutting your slots before you trim the shelf to its final dimensions. The extra surface area makes operating the router safer and more accurate.

I'm an iPhone user, and a 1/2" bit makes just about the perfect cut to house my phone and Lifeproof case.

Mounting

After cutting a notch at the table saw for charging cords to pass through, it's time to get to the clever French cleat. Nothing more than two pieces of wood cut with opposing 45° bevels. When interlocked they create a strong, stable hanger.

You have two options for mounting the wall portion, and which you employ is based on how wide the cavity is. If you opted for a narrow shelf – and assuming you are installing it in drywall, use one or two hollow wall anchors directly above the outlet. If you have made a wider shelf, and have an opening 5" or more to work with, take advantage of the stud that outlet is attached to.

Put the 45° angle on one edge of a 4"× 6" piece of 1/2" to 3/4" thick material, and then cut an L-shape from it, and screw that to the stud. Glue the mating part to the bottom of the shelf.

Lastly, glue on the top, apply your favourite finish, “and it's” time to charge the phone so you can always keep current with the latest web content from *Canadian Woodworking & Home Improvement Magazine*.

Geoff concedes he has used the level app on his phone to hang a cabinet, but insists he didn't use the tape measure app to build it.



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FLY-TYING CHEST

If you're a fly fisherman and a woodworker, there's no better project than a fly-tying chest. With lots of storage for smaller items it will make your fly-tying easier. And mix it up with some colourful woods for drawer fronts, and you have yourself a trophy project.

A fly-tying chest was one of several things that pushed me into a career of woodworking back in my early 20's. I had just taken up fly fishing and was on a trip to Montana. I came across a show where a gentleman was selling spectacular tying chests for a hefty sum. Well, like most woodworkers, I knew I could build one for a lot cheaper. Sure, I had to invest a ton of money into new tools. Ahem. That first one was made out of popular core plywood and lots of screws and glue, plus the skills I had at the time.

I decided to tackle that fly-tying chest once more. While the first one served me well, there are things I wanted to change. The first and foremost of which was the size. Back then I envisioned tying every fly ever created and even dreaming up a few new ones. Sadly, the latter only caught fishing partners and not any fish. Grounding oneself does come with age and experience. A smaller chest makes it more portable so I can carry it a lot easier around the house or to store it. While not everyone will be tying flies, this chest can easily be adapted to suit other hobbies and crafts too.

Mocking it up

I always like to have the hardware on hand before starting a project as this will dictate various dimensions as a minimum or maximum. These included the piano hinges, Veritas insert knobs (Lee Valley Part# 05H3603) and Tansu handles (Lee Valley Part# 00D5546) to carry the chest. One of the best pieces of design advice I received in school was not to use standard thicknesses for my work such as 1/2", 3/4" or even 1". Our eyes develop a feel for those sizes and a slight deviation becomes visually appealing. For this project, I wanted to give it a "light" feel so all the main parts are 9/16" thick. Adjust this to fit your hardware requirements such as hinge screw length.

Using styrofoam, rough lumber, or in this case cardboard and hot glue, it is easy to mock up a design giving you a 3D model. I played with the overall size until I was happy with how it looked and felt. Part of the reason I chose cherry for the bulk of the carcass is that wide boards are readily available. If you need to glue up narrower pieces to fit the final size of the chest, glue them up at this point. In such circumstances I like to leave the pieces a little thicker so if the joints shift I have the room to flatten or flush them. While edge joints like these are very strong, using dowels or Dominos will help to keep pieces aligned during glue-up. Mill up all the pieces and let them sit for a while to see if they will warp or twist. In my case some did warp and couldn't be salvaged for this project.

Rigid construction

Since the chest will get moved I wanted to add some rigidity to it. I decided to glue the back panel in a groove set in the carcass. For this to work, I veneered a piece of 3/8" Baltic birch plywood that started off slightly longer and wider than needed. Using cherry veneer, veneer glue and a Roarokit vacuum bag, I pressed the veneer onto the plywood. Alternatively, you can achieve this rigidity without veneering and just use the Baltic birch on its own. Raw plywood will reflect light making it seem as if there is an interior light source. However, veneering is not difficult at all and adds a bit of refinement to any project. The veneer was pressed in the bag for five hours then left another 24 hours to fully cure.



Mock It Up – A simple approach of cardboard and hot melt glue will allow you to quickly and cheaply mock up the chest for size and looks.



Veneer is an Option – Although you could just use plain plywood, adding veneer to both surfaces of the back panel is a nice look for this very refined chest.



Lots of Options – Der-Garabedian chose a Roarokit vacuum kit to press his back panel, some cauls, a pair of platens and a bunch of clamps would have also worked nicely.

After cutting and marking all the pieces with a cabinetmaker's triangle, we can tackle the joinery. Splines are a good choice for carcass construction as this can lead to strong joints and doesn't require specialty tools such as a biscuit joiner, dowel jig or Domino,

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Materials List

Part	Qty	T	W	L	Material
Top	1	9/16"	9-1/2"	20"	Cherry
Bottom	1	9/16"	9"	20"	Cherry
Sides	2	9/16"	8-1/4"	12"	Cherry
Back	1	7/16"	12-1/2"	19-3/8"	Baltic Birch + Cherry Veneers
Drop Down Door	1	9/16"	12"	20"	Cherry
Swing doors	2	9/16"	9-7/8"	12"	Cherry
Horizontal drawer dividers	3	1/4"	5-1/2"	19-3/8"	Baltic birch + Cherry edging
Vertical drawer dividers - Top	2	1/4"	2-1/16"	5-1/2"	Baltic birch + Cherry edging
Vertical drawer dividers - Middle	2	1/4"	2-1/8"	5-1/2"	Baltic birch + Cherry edging
Vertical drawer dividers - Bottom	1	1/4"	3-1/8"	5-1/2"	Baltic birch + Cherry edging
Drawer top left	1	3/8"	2"	4-3/4"	Pau Amarello
Drawer top centre	1	3/8"	2"	8-7/8"	Mahogany
Drawer top right	1	3/8"	2"	4-3/4"	Cocobolo
Drawer middle left	1	3/8"	2"	7-1/4"	Black walnut
Drawer middle centre	1	3/8"	2"	3-7/8"	Box elder
Drawer middle right	1	3/8"	2"	7-1/4"	Black limba
Drawer bottom left	1	3/8"	3"	5-3/4"	Olive
Drawer bottom right	1	3/8"	3"	12-7/8"	Honey locust
Bobbin holders	4	1/2"	1-1/2"	8"	Cherry
Drawer sides and back			sized according to method		Poplar
Drawer bottoms			sized according to method		Cherry
Tool holder top	1	1/2"	1-1/2"	8"	Cherry
Tool holder bottom	1	1-1/2"	1-1/2"	8"	Cherry
Splines	1	1/4"	7/8"	35"	Maple

Hardware List

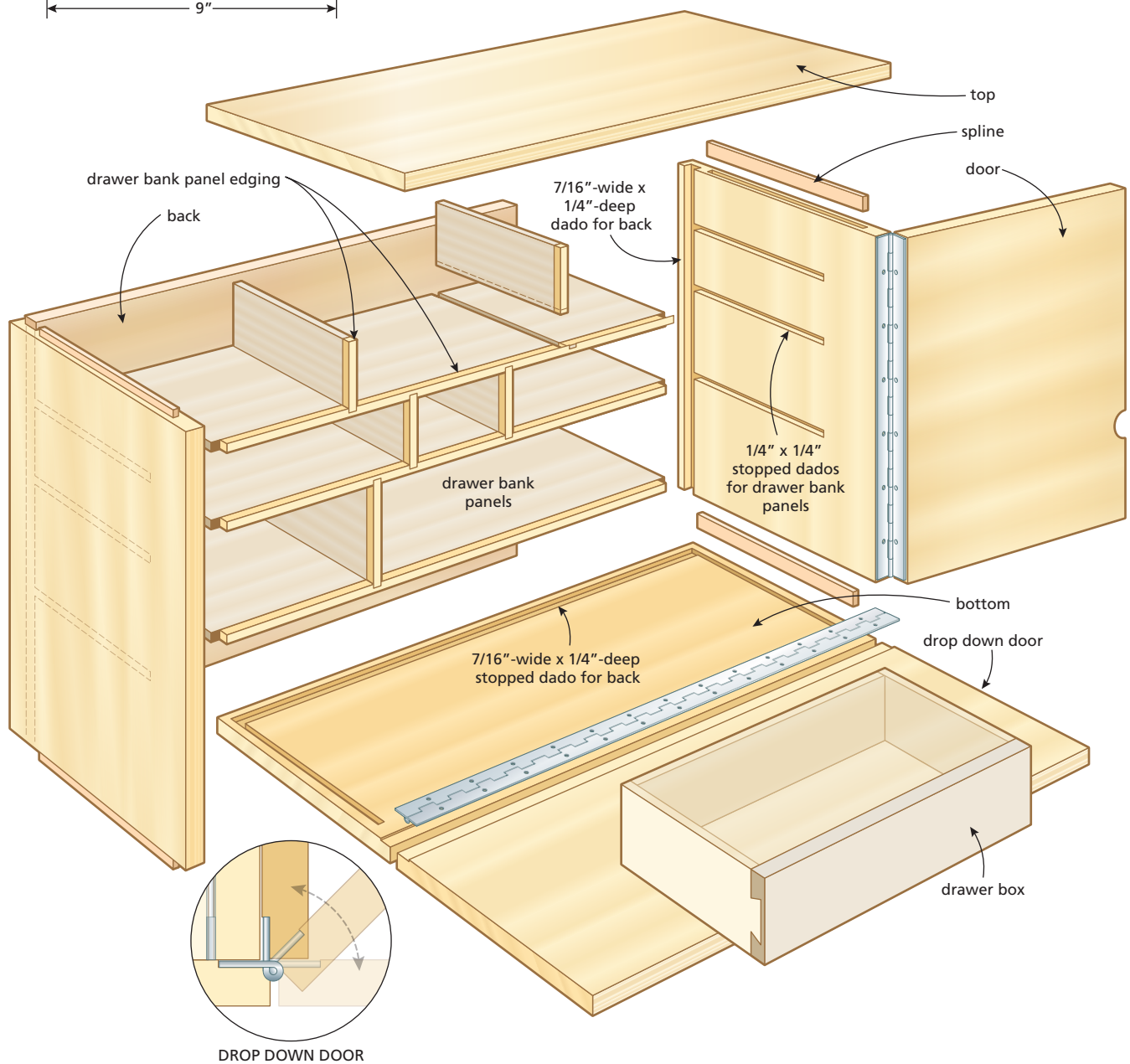
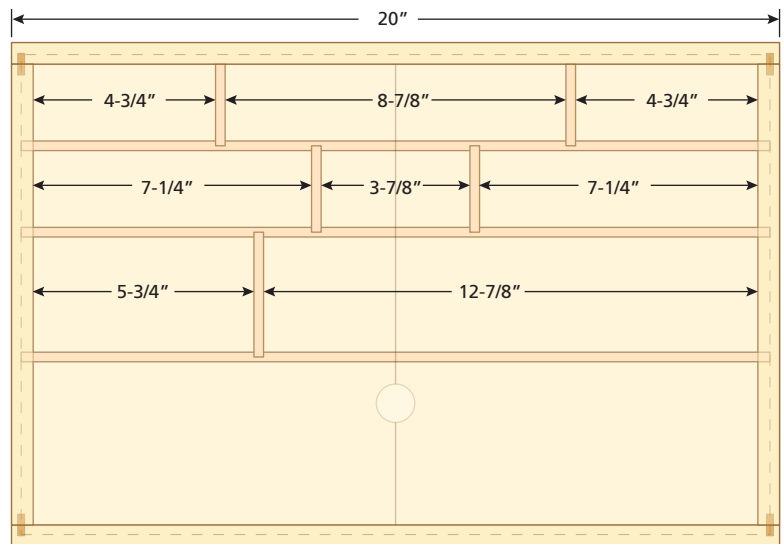
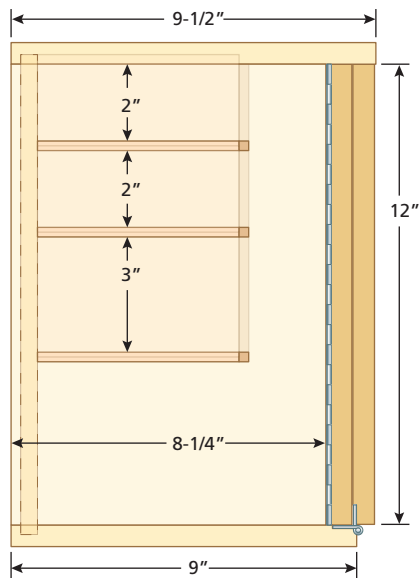
Name	Qty	Size	Details	Supplier
Piano hinge	2	24" x 1-1/16"	Nickel plated	Canadian Tire
Insert knobs	8	1/2"	Part# 16J8302	Lee Valley Tools
Small box lock with key	1		Part#17774	Rockler

but rather only a router. If you have any of the previously mentioned tools they will work just as well. Choose a method that you are comfortable with and have the tools for.

Plenty of router work

The cabinetmaker's triangle will keep your pieces in order and tell you where

the joinery goes, but as a double check I place a pencil line where the pieces need to be routed. At the router table, place a 1/4" Onsrud bit into the collet and set up stops to create the mortises for the splines. The mortises in the top and bottom of both side pieces are 1/2" deep and 7-1/2" long. For the top and bottom they are only 3/8" deep. Set up stops on





Draw it On – Adding pencil marks where joinery needs to be machined is a great approach to keeping all of the parts straight in your mind.



Case Grooves – A 1/4" diameter bit, chucked into the router table, will make quick work of the grooves that will hold the main carcass together.



Splines for Strength – Solid wood splines will locate the joint during assembly, and add needed strength to the case.

the fence to start these slots 1/2" from the back of all pieces.

Our groove for the back panel will eventually cut into these mortises. Making these slots almost the full width of the sides, and cutting the splines a little shorter, allows for some play in alignment when gluing the pieces together. Cut the slots, keeping the outside surfaces of the carcass against the fence. This ensures your pieces line up should you not have the bit perfectly centered.

Next, mill up some hardwood, maple is a good choice, that is 1/4" thick by 7/8" wide and approximately 35" long. This will allow for four pieces including the removal of any snipe at the ends from the thickness planer. It is important that they fit snugly along their thickness.

Going back to the router, chuck up a 3/8" Onsrud, or straight bit, to cut the groove for the back panel. This groove is 1/4" from the back edges and runs full length on the sides but stopped 5/16" from the ends of the top and bottom pieces. Taking a cut-off piece from the carcass mark it as a test piece and run it against the bit and fence, checking for proper width and position. If you did not veneer your panel, you might have to switch to a 1/4" bit, as Baltic birch typically comes in metric thickness and might be slightly thinner than 3/8". With either method you will more than likely need to adjust the fence at least once to accommodate the style panel you chose to use. Keep in mind that sanding during the clean-up will render the panel a little thinner.

Some assembly required

Square up the ends of the grooves for the back panel in the top and bottom pieces using a chisel. Dry assemble the pieces with clamps, making sure the splines fit properly in their slots. While the pieces are clamped, measure for the actual width and length of the back panel. Cut this to size and give it a light sanding to bring it close to its final thickness. Dry fit once more to make sure it fits in its own groove.

Next on the agenda is creating the drawer bank. These are nothing more than 1/4" Baltic birch pieces with 1/4" × 1/4" cherry edging on their facing edges. Cut the plywood to get four pieces 5-1/4" wide by 19-3/8" long. Mill up four pieces of cherry 5/16" × 5/16" and approximately 25" long. Thicker to allow us to flush them to the plywood, and longer to take care of any snipe from the thickness planer once more. Mark the back of three of the plywood pieces with the cabinetmaker's triangle and collect the supplies to attach the edging. Apply glue to the long edges not marked and clamp the cherry to all four pieces. Parts like these are sometimes too small for clamps. Using tape is more than adequate for the job. I find in these circumstances that 3M Binding Tape works really well, as it holds and stretches a bit more without breaking and peels away cleanly.

Back to the router

While the glue is curing on the plywood drawer shelves, it's time to cut the slots in the carcass sides for them. The shelves are spaced 2" from the top for the first two levels and 3" for the bottom. Keep in mind that these are final heights of the openings and the thickness of the plywood is added on (see side view on the illustration). Adjust these to fit your needs whether they be for fly-tying, sewing or another use. Place a 1/4" straight bit in the router and carefully set the distance from the fence for the top slot. These are stopped slots that extend 5-1/4" forward from the back panel groove and are 1/4" deep.



Perfect Fit – A test piece will allow you to dial in the correct width of the groove that secures the back panel in place.



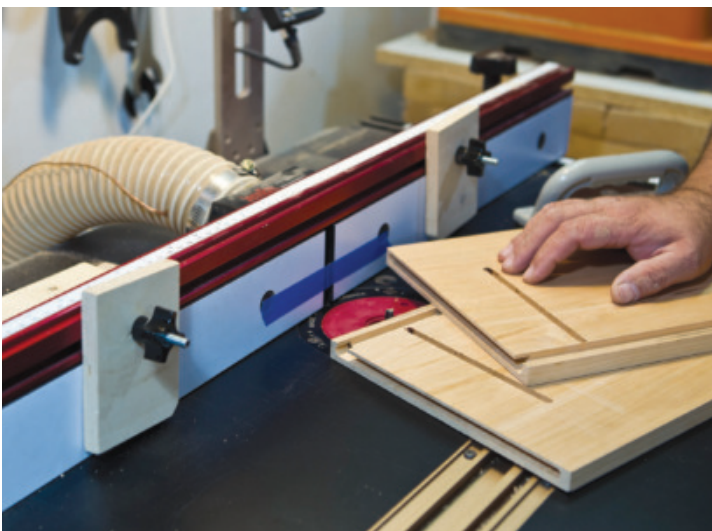
Square Them Off – These grooves will accept the sides, which will have 1/4" x 1/4" notches cut into their front corners.



Nice and Simple – Tape is perfect for quickly and simply holding thin strips of solid wood edging to the edges of the shelf material.



Tape to the Rescue – A bit of masking tape along the front corner of a block plane will help stop the blade from digging into the plywood's surface while trimming the solid wood flush with the plywood.



Grooves for Shelves – Similar to machining the grooves to hold the case together, grooves across the grain in the gables will accept the shelves.

You're going to need two sets of stops, one each for the left and right side members. A router in a table with a lift is perfect for this process, however, it is not the only way. A handheld trim router with stops and fences will also do the trick. Complete the task using what tools you have and are comfortable with. Once the top slots are cut, adjust the fence and cut the next set and finally the third. For the last set, I found it easier to work from the bottom of the sides adjusting the fence accordingly. If you're off slightly in your heights it doesn't matter as we will fit the drawers to the openings. However, it's very important that the mating slots on both sides are at the same distances from the top or bottom. Finally, square the front end of the shelf slots with a sharp chisel.

Creating the bank

Once the glue has set on the drawer shelves, take the three marked pieces and cut the cherry edging leaving 1/4" of plywood exposed on the left and right front edges. Using a right-angle guide will ensure you are cutting straight down. Stop these cuts when you



Small Notches – Der-Garabedian uses a saw guide to ensure his cuts are at 90° to the front of the shelf, then chisels away the waste. Most of the shelf will fit into the routed groove, while the end of the solid wood edging will sit flush against the main inner face of the gable.

reach the plywood and clean up any residual cherry with a chisel. Flush the cherry to the plywood using a block plane. I like to add two or three pieces of blue masking tape to the corner of the block plane to stop it from digging into the plywood. How did we ever work wood without masking tape?

Create the slots for the vertical drawer dividers using a mitre guide with a sacrificial fence. These slots are very shallow at 1/16"



Shallow Dados – Dados machined 1/16" deep help to locate the vertical dividers during assembly, and provide strength.

deep and are cut full width of the horizontal parts. These slots are just really place holders, as there won't be a lot of pressure put on them with such small drawers. Cut these slots on the router table with a 1/4" straight bit. We do not cut slots in the top, but rather tack the top two vertical pieces so assembly is not made more difficult.

Dry assemble the chest with the drawer shelves, then cut and fit the vertical pieces from the remaining plywood and cherry assembly. You can push these in from the front, right up against the back panel.

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Hinge Rebate – A router, equipped with a large straight bit, or in Der-Garabedian's case a rabbet bit with its bearing removed, makes quick work of the rebate for the piano hinge.



Closure Options – Although there are many ways to secure the lid in the closed position, Der-Garabedian chose a keyed lock that was mortised into the edge of the lid.



No Splits, Please – With the hinge rebate complete, Der-Garabedian marks the hinge screw hole locations, bores a small pilot hole, then uses an auger gimlet to pre-thread the pilot holes. This process helps protect against splitting the wood when all the screws are driven home.

Becoming hinged

Using a test piece once more, we will cut a shallow rabbet for the piano hinge. Cut this rabbet slightly deeper as it will get a little thinner during the clean-up with either hand planing or sanding. These rabbets are cut in the forward edge of the bottom and the inside edge of the drop-down door. They're also cut on the inside edges of the left and right swinging doors. Part of the reason to incorporate piano hinges is that they open up past 270°. For the drop-down door and bottom connection, I place the hinge with the knuckle facing down so it doesn't protrude into the working area of the chest. You might need to countersink the hinge screw holes from the back side. On the left and right swinging doors they are mounted traditionally.

When mounting the hinges, put them in place and mark for the screw holes. Drill them using the appropriate pilot hole bit for the hinges you bought. On small screws such as these it's a good idea to pre-thread them as well. Auger gimlets do a great job of this task. With both the pilot hole and gimlet, be aware of your maximum depth.

Trimming and fitting

Dry fit the carcase and attach the hinges using only three or four screws in each leaf. Start the final fit of the doors as you open and close them to see where they're rubbing. Using a sharp block plane will quickly fix any issues. Once the left and right doors are opening and closing perfectly, mark a spot near the bottom third of the pair for a finger hole. Using a pair of clamps, squeeze them together and use a 1" Forstner bit to drill an opening at your mark.

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Drawer Joinery – There are a lot of options, when it comes to what joinery to use to secure the drawer parts together. Dovetails are the traditional approach, and give the finished chest a nice look.

There are a number of ways to keep the chest closed during storage or travel. I chose a keyed lock that required a mortise. I wanted a clean installation, as the inside becomes a working surface and I didn't want any obstructions. If using a mortised lock, a brad point drill and small router plane will easily get the job done. Pre-score the area with a marking gauge and use appropriately sized blades, drill bits and chisels.

Drawers, drawers, drawers

Once more, dry fit the complete chest to obtain the proper sizes for the drawers. I normally don't like the use of more than two or three species of woods in a project. My preference is more calm pieces rather than lots of colours. However, I wanted to play a little with colours on the drawers. There are many colours that are associated with tying flies and since the drawers are small enough I didn't think it would look like a flashing neon sign.

I wanted this to also be about texture and grain as well as colour. Using my camera, I took pictures of the empty chest and then pictures of the individual woods and played with them on my computer. I printed a pair of arrangements that made me happy and eventually chose one. If you follow my path the woods from the top left and left to right are: pau amarello, mahogany, cocobolo, black walnut, box elder, black limba, olive and honey locust.

For the drawer construction I kept it simple with half-blind single dovetails for the front and full dovetails on the back with a single tail once more. The bottom was grooved using the box slotting bit. There are many options for making drawers, from drawer lock router bits, to rabbeted and pinned to mitred and keyed. Choose a method you have the tools to accomplish the task, or try a new method and challenge yourself.

For the drawer knobs, I picked the 1/2" Veritas insert knobs. I like these as you can add whatever wood you like to the centre. It's important to choose a size that will not interfere with the opening and closing of the doors. Another option I considered was recessing a magnet on the inside face of the drawer front and using a magnetic knob to open and close them.

Finish and assembly

Once everything is fitting, take it all apart and get ready to apply a finish. Using a hand plane or sander, clean up the surfaces and remove



Aligned Grooves – Dry assemble the drawer boxes, clamp them together and run them past a box slotting bit chucked in your router table. This method ensures the grooves in the box are all in alignment.



Small, But Positive Handles – Der-Garabedian chose a small handle that accepted wood plugs, in this case ebony. Whatever handle you select, make sure it doesn't interfere with the operation of the hinged doors

any pencil marks and scratches. Any finish will do the trick, but since the working surfaces will get a fair bit of use, I chose Osmo TopOil.

Once the finish has cured mount the carry handles on the side. I chose a spot centered across the width of the sides and the second level of the drawers. Recess the mounting bolts on the inside so it does not interfere with opening and closing of the drawers.

Complete a dry rehearsal of how the glue-up will go. We already have a rough idea of the process as we have taken it apart and put it together a number of times. Get all the clamps you will need, glue, brushes and even recruit some help for this process.

A few more details

To hold the bobbins of thread and silk onto the door, make four 8" x 1-1/2" x 1/2" shelves. By making these removable, we can space them closer together. To make this removable storage system we are going to use 1/4" dowels glued into the doors and protrude 1". When laying out, marking and drilling these holes use masking tape so as not to mar your finish.

The bottom holder is centered 1-1/2" from the bottom and each holder above is centered 2-3/4" above the previous. To make sure



Within Arm's Reach – Dowels secured to the inside of the hinged doors hold small removable shelves, with other dowels on them. Small, often used, items can be stored here.

any holder can fit on any spot we need to keep the spacing the same. The 1/4" holes in the door are 3/8" deep and are 5" apart. Find the centre on the door from the beginning of the rabbet for the hinge to the opposite edge of the door. Locate your holes 2-1/2" on both sides from this point. Centre the holes on the back of the holders 5" apart as well. To aid in getting them on and off, enlarge the hole up one size to 17/64". Next, drill the holes along the tops to hold the bobbins. Space these 1-1/2" apart. The dowels get glued into these 3/8" deep holes. Cut the 1/4" hardwood dowels to length, 1-3/4" for the bobbins and 1-3/8" for the holders. Glue these into their respective spots.

When making the chest smaller, I lost some space dedicated to tools in one of the drawers. I also felt that the inside of the right door was under-utilized in my original version. Much like the bobbins on the left door, we can make a tool holder that can slide on and off. Size these according to the tools you use and attach them the same way as previously mentioned for the bobbins.

This project more than likely gave your router and your routing skills a workout. I know it did for me. It gave me a challenge of



Get Creative – Any combination of storage devices that make it easier for you to store and access small items will make using the chest that much more enjoyable.

double checking my numbers and testing them with scrap pieces. There are lots of pieces in this puzzle and marking your work accurately will only help. I'm happier with this version as it is better suited to the type of fly-tying I actually do. Modify it to your style. Modify it to your craft or hobby. There is something about containers and keeping organized that's very satisfying. While this is no H.O. Studley toolbox, it certainly is nice to have little drawers to keep organized and a work surface to let me enjoy my hobby almost anywhere, including my workshop. Now where did I put my fly rod?

STEVE DER-GARABEDIAN
info@blackwalnutstudio.ca



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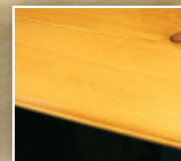
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Continuous Arm Windsor Chair Part One

An ultimate woodworker's challenge – to make a Windsor chair by hand using traditional chairmaking techniques.

The Windsor chair is a timeless classic that dates back to the end of the 17th century. No one knows for certain, but one tale is that a farmer, who lived near the town of Windsor in England, added a back to a stool thereby creating the “Windsor chair”. The design was quickly adapted in North America and a range of styles were developed throughout New England and what was Upper and Lower Canada. Though there are many varieties of Windsor chair, we’re going to build a continuous arm chair here.

Making the seat

The seat of a continuous arm chair is 17-1/4" long from the front to back and 19" wide. I use two pieces of 10" wide 8/4 clear rough pine or poplar cut from a 36+" long plank to make the seat. I dress the top and bottom using a jack plane. I then cut the plank in half and join the opposing edges with the jack plane followed by a smoothing plane. I “spring” the glue joint by passing the plane once through the middle two-thirds of the joint and then once more for the full length, then apply glue, clamp and allow the blank to cure overnight.

The seat template

I use a seat template to draw out the shape of the seat and to position the location of the chair legs, spindles and arm stump mortises. The template also has the positions of all the spindle mortise centers, the position and direction of sighting lines and the angles at which mortises are drilled in relation to the sighting lines. I use 3/16" melamine for my seat templates, but first I draw out the pattern on Bristol board. I draw the seat shape connecting the top of the center line with an arc and finishing the shield shape using a French curve, or by eye. I mark off all the measurements indicated along the center line as they will be used later to complete the template. Once satisfied with the shape, I cut out the paper template, trace it onto a piece of 3/16" melamine and cut out the pattern on a scroll saw or band saw. I pierce the Bristol board with an awl to accurately transfer the leg, arm stump and spindle mortise centers onto the melamine, which I drill out with a 1/8" bit, and I sand the edges of the template smooth.

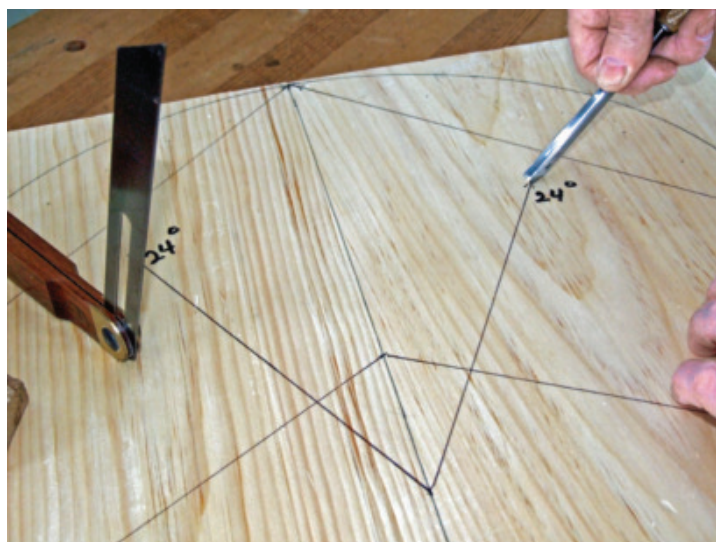
After curing is complete, I unclamp the seat blank and smooth its top and bottom. Using the template, I trace out the shape of the seat, mark the arm stump and leg mortise centers with an awl and draw the center line.

Drilling leg and arm stump mortises

The foundation of a Windsor chair is its seat. Unlike a traditional chair, whose back legs are also part of the back, the Windsor chair’s legs and back are attached to the seat independently of each other. This allows the chairmaker to adjust the angle of the back to suit the client’s needs. With the exception of the center spindle, all the angles of a Windsor chair are compound angles having both “splay” or a side to side component and “rake” or a front to back component. To simplify drilling, sight lines are used that are a combination of both the rake and splay in a single direction. Lines are drawn from the rear leg mortise centers to the mark on the center line 13-5/8" from the back of the chair. Similarly, lines are drawn



Leg Angle Sight Lines – Sight lines are drawn on the seat blank to facilitate drilling leg mortises by hand.



Mortise Dimple – Making a small dimple in the wood helps stabilize the spoon bit when the drilling begins.



Drilling Through – The mortises are drilled through the seat blank using a spoon bit and brace.



Scribing Saddle Platform – A compass is used to scribe a reference line for the spindle platform.



Drawing Platform Front – The front face of the spindle platform is traced out 1" from the center of the arm stump mortise.

from the front leg mortise centers to the mark on the center line 10-1/4" from the back along the center line. If done correctly, the lines form a diamond shaped trapezoid. Finally, lines are drawn from the arm stump mortise center marks to where the center line intersects the back of the chair.

Traditionally, all mortises in a chair are drilled using spoon bits, which are numbered in 1/16th inch increments. For example, a #10 spoon bit would be 10/16" or 5/8", which is the size used to drill the arm stump and leg mortises. Spoon bits allow the chair-maker to adjust the angle as the hole deepens, which is particularly helpful when drilling curved surfaces. I personally find it easiest to drill these mortises before I begin to shape and carve the seat. I drill from the top of the chair to the bottom in case there is any tearout, although this can be avoided by clamping the seat blank with wooden handscrews onto scrap boards where the drill bit exits. Spoon bits tend to wander, especially if one has never used them before. It is always easiest to make a start dimple in the center of the mortise marks to prevent wandering.

Using a bevel square, I set the angle of the mortise, align it with the sight line and using the sight line and the bevel square as guides, I drill the mortise. I always start at 90° to the surface I am drilling and as the tip of the bit penetrates, I "walk" it back to the appropriate angle. The front leg mortises are drilled sighting down the sight line towards the front outside edge of the seat blank at 16°. Similarly, the rear leg mortises are drilled sighting down the sight line towards the rear outside edge of the seat blank at 24°, and the arm stump mortises along the sight line towards the rear center of the seat blank.

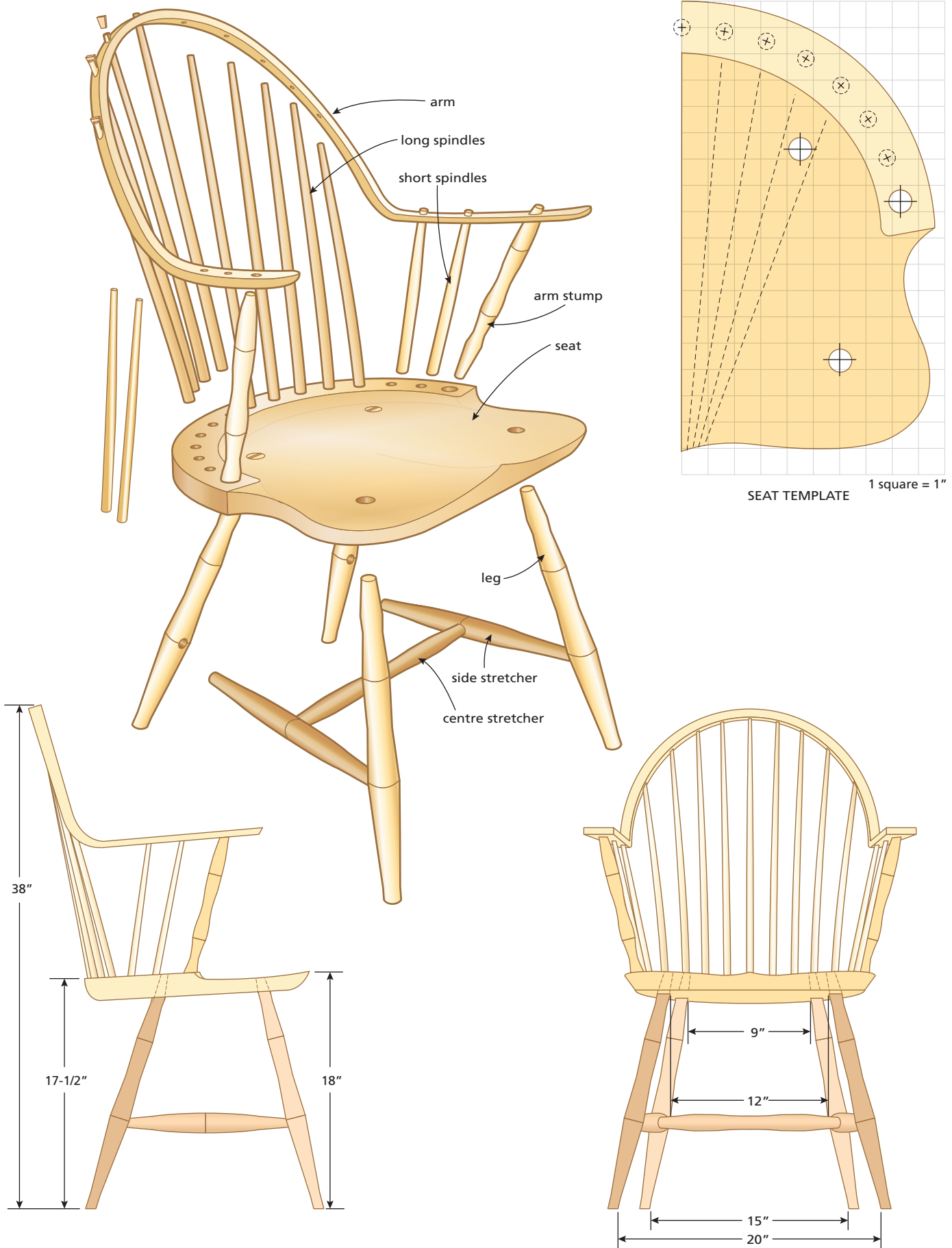
Cutting out the seat and shaping the edges

I use a band saw to cut my seat shape out of the seat blank. I scribe a reference line for the spindle platform and seat groove around the back using a compass set at 2". I then trace out a transition arc at the front of the spindle platform such that there is always 1" from the center of the arm stump mortise to the seat groove.

The seat edge is contoured so that it's both visually appealing and still provides maximum strength and structural support for the spindles and arm stump. To achieve this, the top one-third of the back and sides of the seat edge is initially left at 90°, the middle one-third is shaped to 80° and the bottom one-third is carved at 45° relative to the spindle platform. I place the seat blank in a bench vise and, beginning at the bottom, carve out the 45° angle followed by the 80° angle using a drawknife. I then smooth out and round over the back and side edges using a low angle spokeshave.



Smoothing Seat Back – The back of the seat is smoothed using a low angle spoke shave.





Seat Front – The seat front is carved flat using a drawknife.

To give the illusion of thinness, the front of the chair is carved away in a flat surface from the center high point of the pommel towards the bottom at an angle of 120° using a draw knife and bench vise. I have sliced away enough wood where the angle cut away from the bottom, which is flat across the front of the chair, intersects at a point at the top of the pommel. At this stage, I turn the seat over and draw a line about 1-1/2" wide outlining the transition carving from the back and sides to the front of the chair seat. A drawknife and spokeshave is then used to smooth out the transition from the side edges to the front face of the chair. To complete this stage of the seat preparation, the seat platform groove is then carved freehand using a 7 mm #11 straight shaft gouge or veiner.

Shaping the saddle

The seat or "saddle" of a Windsor chair is deeply sculpted and rises toward the front of the chair pommel. A series of curved tools are used to carve the saddle. As I progress from one to the next, the curve in the next tool is progressively flatter than its predecessor. Using a gutter adze first, I rough cut the saddle 1" from the sides of the seat platform groove and 3" from the pommel toward the middle of the seat. I then use a scorp to remove rough chips and to further carve out the seat, beginning 1/4" from the seat platform groove. I further refine the saddle shape using a compass plane starting 1/8" from the groove followed by a travisher to a maximum depth of 1" approximately four fingers width from the seat groove and rising to the top of the pommel. I use a straight stick placed across the width of the seat to ensure that the saddle shape is symmetrical, taking care the front leg mortises remain as close as possible to the same thickness as the spindle platform. I use the compass plane and travisher to carve material away from the front of the spindle platform and then "roll" the edges of the seat over from the leg mortises to the edge with a travisher and spokeshave to define the pommel. Once satisfied with the seat carving, I scrape the seat smooth and polish it with 150 grit sandpaper.



Pommel Defined – A pencil line is drawn to help define the seat pommel. The material above the pencil line will eventually be removed when the seat is dished out with an adze, scorp or other tools.



Transition line – A line is drawn under the seat outlining the transition from the back of the seat to the front face.



Completed Seat Transition – The finished transition from the back to the front face of the seat.



Using a Scorp – The traditional approach to shaping the seat starts with an adze. A scorp (shown here) is then used to start defining the curvature and deepen the saddle.



The Travisher – The travisher is used to remove additional material and further smooth the seat.



Reaming Leg Mortises – Leg mortises are reamed using a brace and tapered reamer to fit the legs.

Prefer Power?

Using hand tools to shape a Windsor chair seat is a very traditional approach, but one that some people aren't interested in. If you prefer using power tools to take care of removing most of the material for a chair seat, power carving might be for you. An assortment of power carving disks are available from different manufacturers (Kutzall, Arbortech, etc.) that attach to an angle grinder. These disks make removing wood in three dimensions fun and quick. For an introduction to power carving read "Power Carving" in our June/July 2011 issue. – *CW&HI* (Photo by Kutzall)



Legging up

The under structure consists of four legs and three stretchers, the latter of which form an "H" and support the legs under compression. There are many styles of Windsor chair leg turnings, the most common of which are the bamboo and Philadelphia style. I often make plain tapered legs, stretchers and arm stumps for clients who want more contemporary styled chairs. Every chair maker should develop their own style. I use air dried rived maple or birch for the legs and turnings are done with a roughing gouge and a skew.

Ream the leg mortises

The leg tenons are tapered, which require reaming the leg mortises. I clamp the seat in a bench vise with the bottom facing away from the bench and the pommel up with the front leg holes aligned parallel to the floor. I sight down a front leg mortise from the underside of the chair and, using a tapered reamer and brace, ream the hole slightly. I ream the second mortise slightly, lock both legs in their mortises and check the splay angles are the same using a bevel square. To check the rake, I place a winding stick across the legs at the bottom of the seat, a second stick across the leg at the leg mortise mark and sight down the legs to see if the sticks are parallel. Selecting one leg as the reference, I reset the tapered reamer by turning the brace backward, ream the mortise slightly further making the appropriate corrections to the splay and rake angles of the second leg. The mortises are reamed until the leg tenon protrudes slightly through the seat. I check the rake and splay as I progress and continue to make minor



Checking the Rake – Winding sticks are used to check the forward angle of the legs. If the sticks are not parallel, adjustment is needed.



Side Stretcher Length – The distance between the front and back legs is measured, which is used to calculate the length of the side stretchers.

adjustments until the splay is the same and the winding sticks are parallel. I then remove the front legs, turn the seat 180° and repeat the process for the back legs, taking care to avoid damaging the pommel in the vise.

Making the 'H' stretcher

After trimming the leg ends, I use a twisting motion to lock all four legs in their mortises, place the chair on the bench and

measure the distance between the front and back legs using a carpenter's rule. I measure and determine the average distance at the score between the front and back legs. Every stretcher tenon is 1-1/4" in length and, since there are two on each stretcher, 2-1/2" will need to be added to the stretcher length to accommodate the tenon at each end of the stretcher. The undercarriage of a well-made chair is held together with mechanical tension as well as glue. To achieve the tension, I add 1/4" to each of the stretchers, which makes them the average distance between the front and back legs plus 2-3/4". I divide this total by two, set a pair of dividers to this length and mark the stretchers using the dividers. I always compare the marks with the chair to see that they make sense. I then cut them to length on the outside of the marks, cut the tenon 1-1/4" long using a brace and tenon cutter and round the ends to the same shape as the tip of the spoon bit using a sweep gouge.

To determine the angles to the leg mortises, I attach winding sticks to the outside of the front and back legs at the leg scores. I then use bevel squares (one marked with an F for "Front" and the other an R for "Rear"), and set the bevel squares at the average inside front and back angles, which are formed at the intersection of the legs and winding sticks. I then mark the front legs, dismantle the chair and, using a number 10 spoon bit and brace, drill the front and rear leg mortises to a depth of 1-3/8" at the appropriate front and rear angles.

Once the leg holes are drilled, I dry fit the legs and side stretchers. I turn the seat upside down onto two scrap boards, allowing room for the end of the leg tenons to protrude. I then drive the legs home to fit snugly in their mortises. I turn the chair over and use the same technique described above to determine the distance between the side stretchers, then add 2-3/4". I then align the front legs with the front of the bench. Using winding sticks between the front and rear legs on the bench, I determine the angle of the center stretcher mortises. I disassemble the chair and use the angle locked on the bevel square as a guide to drill the side stretcher mortises to a depth of 1-3/8". I cut my 1-1/4" tenons using the tenon cutter, and round over the tips with a sweep gouge.



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Cutting the Tenon – A tenon cutter is used to make tenons on each end of the stretchers, which are held in a vise during the process.



Leg Mortise Angles – A winding stick is held with a string or elastic at the leg mortise marks on the front and back legs. A bevel square is then used to determine the angle of the front and back mortises.



Drilling Leg Mortises – Mortises to accept the side stretchers are drilled in the legs at the appropriate angle using a brace and #10 spoon bit.



Determining Center Stretcher Angle – The front legs are placed against the front of the bench and a winding stick between the front and back legs. The angle formed between the winding stick and the front of the bench is the angle that the mortises are drilled in the side stretchers to accept the center stretcher.

Assembling the undercarriage

I apply glue liberally to all the mortises, assemble the undercarriage ensuring that all the stretcher tenons are snugly in their respective mortises, and hammer the legs home. The leg tenon stumps are then cut approximately 1/8" above the seat using a coping saw. I then make wedges from scrap oak rivings using a draw knife, split the protruding leg tenons across the seat grain to avoid splitting the seat and glue and hammer the wedges into the tenons and seat. I know when I have gone far enough as the sound of hammering the wedge home makes a distinct pitch change.

The target height of the chair is 18" at the top of the pommel and 17-1/2" at the back of the seat. I first level the chair across the front of the spindle platform using wedges under the legs. I then measure the height at the front and back of the chair and determine how much needs to be removed from the front and rear legs to achieve

Assembling the Undercarriage – Glue is applied to all the mortises, then the undercarriage is assembled and the legs are driven home.





Leg Tenons are Split – The ends of the leg tenons protruding from the seat are trimmed and split with a hammer and chisel so wedges can be added.

the target heights. I set a compass at the amount to be removed and scribe a line on the legs parallel to the bench. I then trim the legs on the outside of the scribe line using a back saw or dozuki, check the level and adjust as needed. Using the sweep gouge, I then trim the outside of the bottom of the chair leg at an angle of approximately 60°, removing no more than 1/8". This is to prevent chipping a leg when someone sitting in the chair slides back and forth in it. Once the glue has dried, I trim the leg tenon stumps using a sweep gouge and mallet, scrape and sand the chair seat.

Making the back components

One reason handmade Windsor chairs last for generations is that wood for the back and the legs is rived from logs. Riving wood is to split wood so the grain is continuous from one end to the other. I rive in the direction from the top of the log toward the thicker bottom of the tree. I split the log with the aid of a maul and wedges. I often find any unwanted resistance during the process of splitting a log can be overcome with the help of a sharp axe. Once the log is split and quartered, I cut it to lengths and use a froe to rive out chair parts.

Starting to Rive – The froe is hammered into the end of the split log using a maul.



Leveling the Chair – The chair is leveled on the bench using thin wedges.

Marking the Leg Trim Line – The height of the chair is measured and a compass set at the amount to be trimmed off the legs is used to mark the cut line.

For the back components, I try to rive out "boards" roughly 1-3/4" thick and 60" long using a froe and maul. The process involves applying pressure to the froe, which opens the split and then working down the split incremental steps. I use a homemade support to brace the end of the log. When things don't go as planned and the boards taper off to less than 3/4" at the far





Roughing Out the Arm Blank – A draw knife is used to rough out the arm blank to approximately 1" square.



Planing the Arm Blank – A jack plane is used to smooth and square up the arm blank.

end, I saw them into 23 to 24" lengths for the spindles. I then rive these boards using a froe into spindle blanks approximately 1" x 1" x 24" long and the arm blanks approximately 1-3/4" x 1-3/4" x 60" long. I use veneer grade green red oak for the back components and either sugar maple or yellow birch for the chair legs, stretchers and arm stumps.

Gauges

I use two gauges to speed up the chair-making process. One is a squared up stick 13/16" x 13/16" x 10" long and the other a 1/2" thick piece of hardwood with 3/8", 7/16", 5/8" and 7/8" holes drilled into it. The first is used to facilitate planing the arm blank and the second to measure spindle diameters.

Shaping the arm

As it implies, the core of the continuous arm chair's back bow and the arms are made with one continuous piece. I rough out the arm blank using a draw knife and bench vise, roughing it out to approximately 1 to 1-1/4" square. When I use a drawknife, I always stand to the side with my right arm (I'm right handed) over the

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piece I'm working on. I've learned the hard way if I catch a pin knot and my vise is not as tight as it should be, the wood blank can be propelled and do the damage of a well-aimed punch to the solar plexus. I then clamp the blank on the bench between two bench dogs and smooth the blank "flat" using a jack plane. Note that I've placed "flat" in quotation marks for a reason. Green wood always has a natural curve to it. I place the wood with the curve up on the bench and use pressure to flatten it. As the piece is 60" long, I use hand screws at the far end to hold it in place against a bench dog and clamp the blank flat using hand pressure at the vise end. I then smooth the top flat, repeat the same process

rotating the blank 90° each time. This process ensures that the grain remains continuous from one end to the other, which would not be the case if the wood was joined in the traditional manner to remove the curve. Once two adjacent sides are planed flat, the arm gauge is used to scribe lines to help the planing process.

Having planed the arm blank 13/16" square, I trim it to 56" long. I always bend with the natural curve and one of the radial or edge grain faces against the main part of the bending form. In my experience, bending with the tangential or flat grain often results in breakage or tear out more. With this in mind, I mark the center and bending direction with an arrow in the direction I want to bend the wood. The arm blank becomes thinner at the transition from the arc or bow to the arm rest. To achieve this, I remove material from the underside of what will be the arm rest starting at 16" from each end and tapering down to 9/16" at 14" from the end. The wood I cut away is layers of the flat grain, which I mark on the underside of the arm and scribe a line from the 14" mark to the end. I then carve the transition with a drawknife and smooth it with a spokeshave and scraper.

Starting with the process of steam bending, the remaining portion of this article will appear in our Apr/May 2020 issue.



Marking the Thickness – A scribe is used to mark the target dimensions of the arm rest.

Tony Peirce has been making Windsor Chairs since 2000. He is an Instructor listed by Windsor Chair Resources and has been featured in the National Post, the Montreal Gazette, the Ottawa Citizen and a Mountain Lake PBS documentary.



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Penetrating Oil Finishes

Ease of application, lack of film build-up, a beautiful satin sheen, and no-fuss repair make these finishes ideal for projects that won't be subject to a lot of heavy daily use.

BY CARL DUGUAY

Film finishes are great when you need maximum durability, such as on table tops, floors, handrails, cabinet doors and countertops. They offer the greatest resistance to abrasion, wear, water, water vapour and heat. They cure hard, which makes them very durable. But they can be somewhat challenging to apply, and difficult to repair. They also dry slowly, making the work surface susceptible to dust nibs.

For woodworking projects that don't get a lot of daily wear and tear – picture frames, jewellery boxes, display cabinets, sculptures, turnings, trimwork and the like – penetrating oil finishes can be an excellent choice. They leave the wood looking natural, and do a good job of bringing out the detail in wood grain. As well, because these finishes don't crack or peel they're great for wooden objects that are in contact with food (such as cutting boards, salad bowls and kitchen utensils) and for toys that end up in children's mouths.

Another advantage of penetrating oil finishes is that they have very low levels of VOCs (Volatile Organic Compounds) or are VOC-free. Film finishes, on the other hand, typically contain petroleum- and chemical-based solvents, and usually heavy metal dryers.

All penetrating oil finishes permeate wood surfaces by means of capillary action and then self-polymerize (harden) by means of oxidation (exposure to air) through a reaction known as crosslinking. They don't cure as hard as film finishes, and some always remain soft.

There are three types of penetrating oil finishes: pure oil, polymerized oil, and Hardwax oil. Things can be a bit confusing when choosing one of these products, so read on.

Pure oil

Also referred to as raw, straight, true or 100% oil, pure oil can be made from linseed oil (derived from flax seed), tung oil (extracted from nuts of the tung tree – *Vernicia fordii*), or walnut oil (from the walnut tree, *Juglans regia*). These really are the only ‘natural’ oil finishes that are completely ‘chew-safe’, making them ideal for toys that can end up in children’s mouths. There are polymerized versions of these oils that we can also include in the natural finish category as well. (see ‘Polymerized Oil’ below).

Pure oils need to be applied on bare wood, allowed to sit for around 15 to 20 minutes, and then wiped off. You need to apply multiple coats to get any level of protection – 6 to 8 coats isn’t out of the question – with each coat allowed to dry between applications. Depending on the relative humidity in your shop this might take several weeks, or longer. All pure oils dry to a satin finish.

Linseed oil is the slowest to dry and it cures soft. It gives an amber hue to wood that tends to darken over time. It can also develop mold if exposed to humidity. Tung oil imparts a light golden colour, doesn’t yellow as much as linseed oil, cures harder, has better moisture resistance and won’t mold, which makes it a better finish than linseed oil. However if a tung oil product has a solvent listed on the container it won’t be pure tung oil. In fact, unless specifically listed as an ingredient, the finish may not contain any tung oil at all. Minwax Tung Oil Finish, for example, is

Mineral Oil

Mineral oil is a petroleum distillate that doesn’t oxidize, so it doesn’t dry. Some woodworkers use it to finish toys, kitchen utensils, and wood countertops, as it’s non-toxic, clear (non-yellowing), odourless and somewhat moisture repellant. However, it provides no abrasion protection, is easily rubbed or washed off and requires constant replenishing. Adding wax to the oil does little to improve its durability. Either tung or linseed oil offers better protection.

made from an oil (probably linseed) blended with varnish and mineral spirits, and doesn’t contain a drop of tung oil (see “Oil/Varnish Finishes” Sidebar). Walnut oil gives a finish similar to tung oil and is also moisture resistant. Of the three pure oils it’s the least used, likely because it’s not widely available, and provides no real advantages over tung oil.

Sources: LeeValley.com, SwingPaints.com

Polymerized oil

Pure oils polymerize on their own, but they do it slowly. To speed up the process manufacturers heat pure oil in an oxygen free environment that creates a chemical change – oils that undergo this process are marketed as Polymerized Oils. This somewhat increases the oils abrasion and water resistance and gives a high lustre and glossier sheen to the finish. Polymerized oils generally don’t contain metallic driers, so they can be considered a natural oil, making them food-safe. Some manufacturers add a wax to polymerized linseed oil to enhance the sheen of the finish. Once a polymerized finish has fully cured it is safe to use in contact with food (as are virtually all other wood finishes).

Not all polymerized oils are labelled as such. Tried & True’s ‘Original Wood Finish’ contains polymerized linseed oil and beeswax. Their ‘Danish Oil’ contains only polymerized linseed oil. Watco’s ‘Danish Oil’ contains a penetrating oil

Teak Oil

Teak oil doesn’t exist. The seeds and wood of the Teak tree (*Tectona grandis*) aren’t processed for oil. What you see advertised as Teak oil contains a mixture of some other oil (typically linseed or tung) mixed with varnish and possibly a metallic drier. Essentially these are oil/varnish blends, which you can easily and more economically make in your shop. For more information read “Shop Made Finishes” in our Feb/Mar 2019 issue.



Pure Oil – Tung oil, along with linseed and walnut oil, are the only three true natural pure oil finishes available. They tend to dry slowly, though polymerized versions of these finishes are available, which dry faster and have better abrasion and moisture resistance. (Photo by Lee Valley)

Safe For Everything – While you’ll find petroleum distillates, solvents or heavy metal driers in many finishes, Tried and True’s ‘Original Wood Finish’ and ‘Danish Oil Finish’ don’t have any of those ingredients, making them safe for all applications. (Photos by Lee Valley)

Oil/Varnish Finishes

Blends of oil and varnish have been around for quite some time. They're somewhat of a hybrid finish – part oil finish, part film finish. A blended oil/varnish finish consists of oil (usually boiled linseed or tung), to which is added mineral spirits (as a thinner) and varnish (or polyurethane) in a non-critical ratio of 1:1:1. It goes on just like a penetrating oil finish, but offers greater durability and scratch resistance (depending on the number of coats applied). It's easy to make your own oil/varnish finish – read "Shop Made Finishes" in the Feb/Mar 2019 issue.



New to Many Woodworkers – Hardwax Oil, which is what OSMO products are, have been around for a long time, but are still relatively new to most North American woodworkers and DIY'ers. These products have a lot going for them.

(probably linseed), mineral spirits, and naphtha. The Lee Valley polymerized oils don't contain any additives.

Sources: LeeValley.com, TriedAndTrueWoodFinish.com

Blended natural oil

Manufacturers add various substances to natural oils to enhance abrasion and water resistance, and speed up both drying and curing. Similar to Pure and Polymerized oils these can be considered penetrating oils. 'Universal Wood Oil' from Livos, for example, contains linseed oil, natural resin glycerol ester, orange oil, isoaliphates, silicic acid, micronized wax, dehydrated amino sugar, and lead-free drying agents.

Hardwax Oil is another type of blended oil. They're somewhat a new class of finish, at least for North American woodworkers, though they've been common in Europe for decades. They're made of vegetable oils that penetrate the wood surface, waxes that sit on the wood surface and produce a water resistant film, and mineral spirits as a solvent. Some contain lead and cobalt-free

metallic dryers. Saicos is a brand of hardwax oil that's available in Canada. For



Multipurpose Finish – Also available in many colours, 'Kunos' by Livos is a blended finish that can be applied to interior millwork, furniture, floors and more. (Photo by Livos)

Boiled Linseed Oil

Boiled linseed oil (BLO) isn't a pure oil, nor is it the same as polymerized linseed oil. BLO is made from linseed oil to which metallic dryers (ions of cobalt, iron, and manganese) or petroleum-based compounds (such as mineral spirits, naphtha, and dipropylene glycol monomethyl) have been added to make it dry much more quickly. It does emit some VOCs while drying, and isn't the best choice for children's toys or kitchen utensils.

Saicos Hardwax Oil – A natural plant oil and wax based finish that can be applied to many surfaces in a home and on furniture. (Photo by Saicos / Raincoast Alternatives)



more information on these finishes read "Hardwax Oil" in our Aug/Sept 2019 issue.

Blended oil finishes do emit some VOCs while drying. They dry fairly quickly and cure at about the same rate as polymerized oils, producing a highly durable, moisture resistant finish. While these aren't chew-safe finishes, once cured they are food-safe. Many of these oils are suitable for exterior use.

Sources: Livos.com, Osmo.ca, RaincoastAlternatives.com (Saicos products), WestWindHardwood.com

If you're looking for a finish to use on anything that will end up in a child's mouth and for kitchen utensils, then a pure or polymerized oil is a good choice. For anything else, it largely comes down to personal preference and experience – how much time you want to devote to finishing, the tone and sheen you want and the degree of surface protection you're looking to achieve. Where projects won't be subject to an excessive amount of wear and tear, a polymerized or Hardwax oil certainly is worth considering. If you're unsure about what's in any finish, check the ingredients on the label or, if available, read the product's Material Safety Data Sheet.



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RELATED ARTICLES: Hardwax Oil (Aug/Sept 2019), Shop Made Finishes (Feb/Mar 2019), Tung Oil: Debunking the Myths (June/July 2012)



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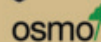
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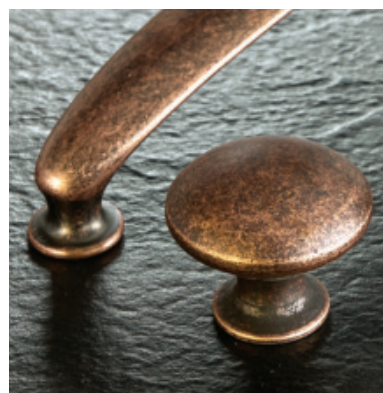
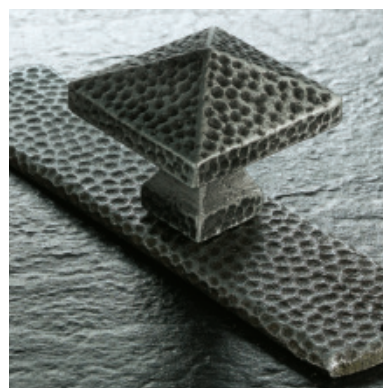
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Bruce Stuart

Birdcage Windsor Chair

Mixing comfort and style, a Birdcage Windsor chair has a double bow in the crest. According to Stuart, the most difficult part of the build was finding the angle and drilling for the top corner false mitres. Stuart made this chair for his wife's home office.

Turn to page 12 for more quotes.
(Photo by Bruce Stuart)

