

# WOODWORKING CRAFTS

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Classic staked chair **Halloween lantern** Seed box **Balancing clock** Tool station  
**Cabinetmaker's buttons** Rebate joints **Scroll carving** Weed flask **Gilding**



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# WOODWORKING CRAFTS

Issue 70

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How has this year passed so fast? Perhaps there are some times we want to forget but if not we have help in this issue for the absent minded. If you are like me, you have far too many tools and probably spend a disproportionate amount of time looking for them. Sometimes I have even got to the point where I can't find a tool, so I end up buying another one! The solution to this could be the handy tool storage cabinet project by Andrea Zanini; the castors on it make sure you can have it right next to where you are working. Something else I always lose are my keys and we have an answer for that too, the cute key cabinet by Anthony Bailey that will look great in any hallway by the front door. The last thing I lose is time, and Paul Maddock helps us with that one with his ingenious counter balanced clock made from a recycled fence post.

When you are making stuff, it is useful to learn about the tools you will need. Lumberjacks have specific requirements for the tools they use, and we show what tools they have and why. For the rest of us less dramatic woodworkers we have a jigsaw masterclass, what to look for in

a backsaw, a lesson on abrasives, a mitre biscuit jig and we also feature some vintage scraper planes.

For the home-minded woodworker, there are plenty of projects to keep you inspired: we show how to turn a rectangular weed pot that is mostly round and has nothing to do with alternative medication. We finish our artisanal hall table, build some beautiful library steps and make a huge slab table that comes apart for transportation.

This year has been a stressful one due to the continuing problems associated with the pandemic, so with Halloween approaching it will be a good time to relax and enjoy the season. The autumn colours are always amazing and calming and our trees go through an incredible and beautiful change; we show you some examples from around the word and explain why it happens. For the kiddies, or our inner child, we have a Halloween lantern project that will lift the spirits, but hopefully not the other worldly scary spirits... All this and much more for you to enjoy.

Happy woodworking! Alan Goodsell



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Woodworking Crafts magazine (ISSN 1365-4292) is published every eight weeks by Guild of Master Craftsman Publications Ltd, 86 High Street, Lewes, East Sussex BN7 1XN  
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**Cover photograph:**  
Keith Smith/courtesy of Legno

**Welcome page photograph:**  
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Woodworking is an inherently dangerous pursuit. Readers should not attempt the procedures described herein without seeking training and information on the safe use of tools and machines, and all readers should observe current safety legislation.

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## WOODWORKING CRAFTS

If you would like to be featured in *Woodworking Crafts* please email [wwceditorial@thegmcgroup.com](mailto:wwceditorial@thegmcgroup.com)

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# CLASSIC CHAIR

Rick Rich makes a simple staked chair

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The first chair I ever made was during a very enjoyable week-long class I attended a half dozen years ago. It is a strong, light rocking chair in the classic Windsor style. Since then, I've made several rockers and side chairs. The chair design I prefer now has evolved to the simple staked structure shown here. I enjoy the hand work involved with shaping the seat and, of course, the lathe work for the legs and spindles.

I would be remiss not to acknowledge the influence of Christopher Schwarz in my chairs. His *Anarchist's Design Book* will provide any reader with a simple, effective method for staked furniture making. I recommend anyone interested in such furniture styles to sit down with his books for some enjoyable, educational and at times thought-provoking reading.

The chair seat I use is made of 8/4 (50mm-thick) poplar planed down to 45mm thick with a scrub plane because I do not own a power planer. I prefer alder, but it is nearly twice as costly per board foot, so poplar it was. The rest of the chair is made from red oak. Again, other woods such as maple or cherry might be my preference at times, but red oak is plentiful in 4/4 (25mm thick) and 8/4 (50mm thick) and





quite importantly, at a very reasonable cost. The backrest spindles are 19mm red oak dowels which are readily available at home improvement stores. I take the time to choose straight grained dowels so my spindles don't crack along runout grain. Two 915mm dowels are cut in half to make four backrest spindles. All of the wood used is kiln dried and was purchased locally at my favourite lumberyard.

My goal was to make a chair that is sturdy, light, comfortable and aesthetic enough for my wife to want a set of them in our dining room. The challenge is drilling the angles correctly, and with Windsor/staked chairs, getting it close is generally good enough! The only speciality tools used were the Veritas tapered reamer and tenoner. I purchased them from Lee Valley Tools and have not seen them for sale anywhere else. I have been impressed with the quality of Veritas tools, and these are no exception.

This chair took me about 10 hours over the course of a few weeks to make (it's for pleasure that I build, not production). The finish I use on most of my furniture, this chair included, is simply a sealer coat of thinned dewaxed shellac and several coats of boiled linseed oil mixed with equal parts of polyurethane and mineral spirits.

## YOU WILL NEED

### Tools:

- Bandsaw
- Lathe
- Workbench with vice
- Lathe tools:
- $\frac{3}{4}$  spindle roughing gouge
- $\frac{3}{4}$  skew
- $\frac{3}{8}$  spindle gouge
- $\frac{1}{8}$  parting tool
- Callipers with rounded ends
- Scrub plane
- No.4 smooth plane
- No.5 Jack plane
- Block plane
- Spokeshave
- Pencil callipers
- Protractor
- Veritas Pro Taper Reamer & Tapered Tenon Cutter.
- Brace with  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{5}{8}$  and  $\frac{3}{4}$ in bits
- Flush cut saw
- 2½ pound hammer
- Various clamps
- 6in sliding square
- Sliding bevel
- Ruler
- Wood glue and small brush

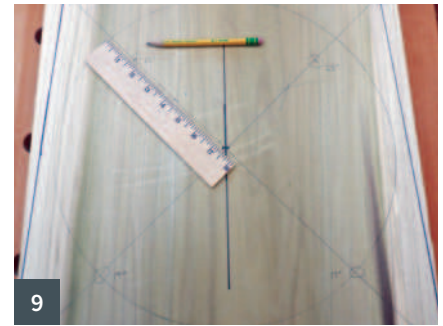
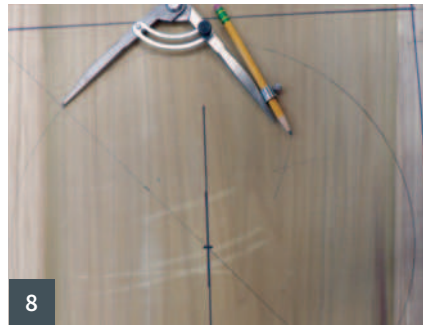
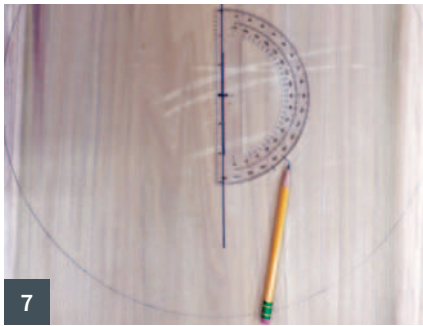
## Preparing the timber

- 1** I gathered together all the wood I would need for the chair. For the backrest, a piece of 4/4 red oak was cut to 430mm along the grain by 85mm in width. The backrest spindles started as two 19mm dowels, 915mm long, in red oak, which were cut in half to 460mm each, giving me four backrest spindle blanks. I also had a piece of 6mm



red oak dowel cut at 165mm long. This would be further cut into 38mm dowels for pegging the backrest spindles that go into the backrest itself. It serves as extra insurance for the spindles to stay in the backrest as most people will pick up a chair using the backrest. From an 8/4 piece of 510mm-long red oak, I cut out the leg blanks on my bandsaw. The final cut blanks were 45mm square by 500mm long. I would also need eight 16mm wide by about 3mm thick wedges for the leg tops that come through the seat and for the backrest spindles coming through the underside of the seat. These were cut from the waste pieces of red oak when ripping the leg blanks.

- 2** I found an almost 430mm wide 8/4 poplar board in my lumber stack. If I added another small piece to the edge, it would be plenty wide for a seat blank because I need a full 430mm. In the spare pieces bin, I found a poplar piece about 45mm by just over 25mm. I was happy to see that this piece somewhat aligned on the grain, with the goal being to hide the glue joint with similar grain lines. I confess that it is top grain (smaller piece) glued to radial grain (large blank) so we shall see in a year or so if it matters in this situation!
- 3** First the 8/4 piece was brought down to 45mm thick with a scrub plane. The scrub plane is quite satisfying to use with a razor-sharp blade. Cutting across the grain at a slight skew leaves a textured surface with some tearout and lots of wood curls.



- 4 I then used a jack plane to smooth the waves left by the scrub. After jointing a flat edge on each piece, I glued them together for the seat.
- 5 After the glue dried, I used the jack plane to get both pieces of the glue-up to the same thickness. The jack plane is capable of both heavy and fine shavings, but the No.4 smoother really made the seat shiny and flat on top and bottom.

## The seat layout

The seat layout I used is seemingly complex, but in reality, it's quite simple. I started with first deciding what face will be the top and laying that on the bench so the bottom face was up. Then with the end grain at front and back, I bisected the blank at the top and bottom and marked the middle connecting the marks with a light pencil line.

From the middle mark at the front edge, I used a yard stick to put pencil tick marks at 0 and 430mm on the right and left edge by putting the 215mm ruler line on the middle mark. I did the same for the back edge by putting the 190mm ruler line on the middle mark and ticking a pencil mark at 0 and 380mm. When I connected the front and back tick marks, the seat sides were defined and tapered with the back edge 25mm narrower on each side. The front and back edges were marked in roughly the same fashion to ensure parallel lines so the seat is 417mm long.

- 6 I set pencil callipers to 190mm and with the point set at the blank middle mark, I drew a complete circle.
- 7 Along the front to rear middle line, I placed a plastic protractor and made a tick mark at 45° and connected that tick mark with the middle mark making a long line.
- 8 I stretched the callipers out a bit and placed the point on one of the 45° intersections and drew a slight arc estimating where the other 45° line would be. I confirmed where it would be by putting the callipers' point on the other intersection and drew another arc connecting with the previous. I'm not a mathematician, but this simple geometric trick gave me leg hole drilling sight lines 45° from the seat middle.
- 9 The front edge intersections of the 45° lines and the circle were marked for front leg drilling points, which would be drilled at 19° along the sightline. The rear leg drilling points were placed 38mm in from the circle intersections. I wrote 25° on each rear leg intersection, which would be the drilling angle of those holes.
- 10 The front edge gets a radius. I measured 12mm up from each side and used two thin sticks taped at the ends with a piece of scrap in the middle to hold the slight curve making it easy to draw.
- 11 After bandsawing the tapered sides, removing the waste at the back edge and cutting out the front edge curve, the bottom seat layout was finished.





**12** The top of the seat now only needed the spindle drilling points marked. I located the centre of the back edge and placed the ruler at the 150mm mark on the centre. I made ticks at 0, 100mm, 200mm and 305mm. I measured down from the back edge 22mm at each tick. Those marks were the spindle drill points.

## Turning the legs

**13** I wasn't sure how I wanted the legs turned, as I like to have a small detail of some kind instead of a straight uninteresting dowel. I had some 2x2 alder scrap about 200mm long and turned a few samples. I liked this one the best and made a story stick for turning the four chair legs. The largest diameter at the top of the half bead is 45mm.

**14** I marked centres on each end of the leg blanks and centre punched them. Once the leg blank was mounted on the lathe, it was an easy thing to rough turn it round. I typically keep the top of the leg at the tailstock, and these were no different.

**15** While the toolrest was at the headstock end, I parted the foot to 22mm round.

**16** Once the blank was rounded, the story stick was used to transfer the parting marks, using the leg top edge as a reference for the end of the story stick.

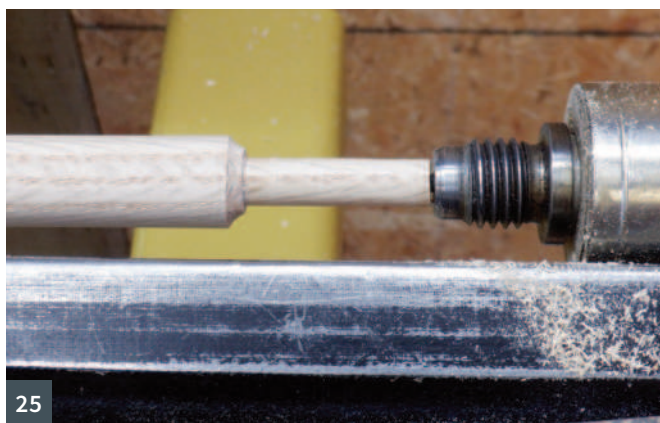
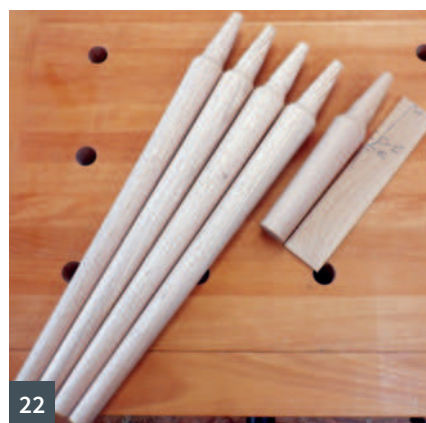
**17** The leg top was parted at 16mm for the bottom of the tapered tenon



and the top of the taper was parted at 30mm. A short continuation of 30mm flat area for the tenoner tool was necessary to add just below the half cove detail. The top of the half cove was parted at 38mm diameter.

**18** Here the details came together as I used a spindle gouge to form the half cove ...

**19** ... and a skew to form the half bead.



**20** I used a skew to taper and smooth the leg down to the foot. Even though the leg is somewhat thick, I had to use my hand to keep the spindle from vibrating to get an even finish cut.

**21** Even though the tenon was turned close to size, the Veritas Tapered Tenon Cutter was used to get a precise and perfect 12.8° tenon.

**22** All four legs turned and tenoned. The trial piece and story stick are also shown. I was satisfied that I had turned each one very similar to the trial piece.

## Turning the spindles

**23** The spindles required a homemade spindle driver jig to easily turn. With a 38 x 38 x 100mm piece of poplar cutoff, I measured and turned an MT 2 taper between centres and placed it into the lathe spindle. Using a drill chuck in the tailstock, I started with a 3/4 bit

and then a 5/8 bit a little deeper in the 3/4 hole. This allowed me to first place the 3/4 end of the spindle in the driver jig and turn a 22mm long 16mm diameter tenon on the end.

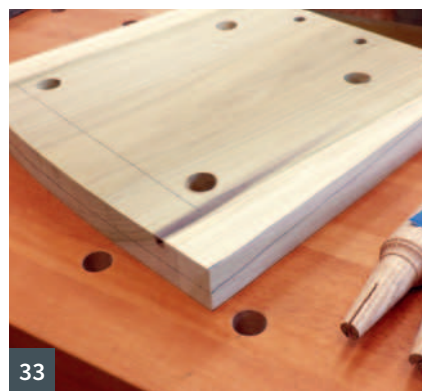
**24** The spindle was turned around and the 16mm end was placed into the driver jig, allowing me to turn the top end of the spindle.

**25** The top end, which will go into the backrest had a 38mm-long tenon turned 10mm diameter. Once the spindles were completed, the turning for the chair was done.

## Making the backrest

**26** The backrest was cut to 430mm long by 90mm high. I selected a top edge and front face. On the bottom edge, the centre was marked allowing me to locate the spindle drilling points at 0, 100mm, 200mm and 305mm on the ruler by using the same method as with the seat spindle points.





**27** I used the same thin strips of wood jig to draw the curve of the backrest top. I made a mark on each end 38mm down from the top, put the curved jig with the top at the centre and the curve neatly wrapping down similarly on each side and drew the curvature.

**28** I did a test fit of the spindles into the backrest.

**29** Once I was satisfied with the spindle fit, the backrest was smoothed and finished with hand tools.

## Joining the seat and backrest

**30** To me, the drilling of the seat and backrest is the most daunting of all the steps involved. Careful attention to detail here will pay dividends later! The seat was clamped to the bench with the drilling points overhanging and a piece of scrap placed underneath to prevent blowout of the seat top grain.

**31** For the front drill points, I set the sliding bevel to 19° for the front leg holes and 25° for the rear. I used a 5/8" bit and brace to drill the leg holes through. Keeping the drill bit and sliding bevel in line with the

drawn sight line helps keep drilling at the correct angle.

**32** Once the leg holes are bored through with the 5/8" bit, I used the Veritas 12.8° Pro Taper Reamer to precisely shape out the leg holes for the tenoned legs to fit into.

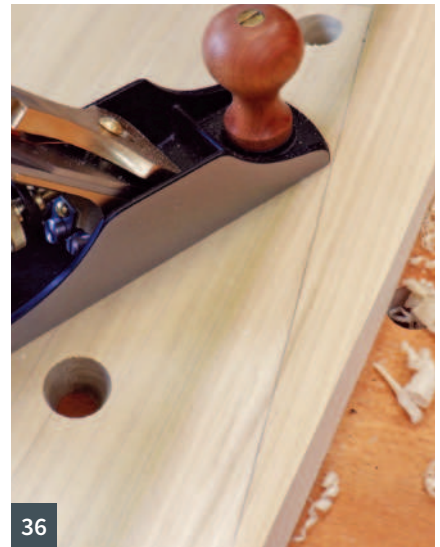
**33** The spindle holes in the seat were drilled in two parts, with the first drill bit being 3/4" and bored down 25mm. The 3/4" bit was retracted and a 5/8" bit put into its place and the remainder of the hole was drilled through. This gave a step in the hole so that the spindle would have a mechanical stop. I also measured down 20mm along the front edge from the top face and drew a line across the front. Marking 12mm from the front and sides of the front leg holes (on the bottom face), I drew lines from the back edge corners to the marks just made. The front line was drawn across 12mm in front of the drilled holes. The sides were marked with a line drawn from the same back edge corner down to the line drawn on the front. The material inside of these lines would be removed for a neat, tapered look.



34



35



36



37



38



39

- 34** With the seat clamped securely to the bench, I used the scrub plane to rough out the waste material on the sides and front between the drawn lines.
- 35** When removing wood at the front edge, I found it helped substantially to angle the scrub plane towards the edge giving sometimes long peelings of pure end grain!
- 36** The smoothing plane made short work of cleaning up the tapers on the sides and front and a few final passes on the seat top and bottom. The end grain at the front and back of the chair was cut clean with a freshly sharpened block plane.
- 37** I like to have end grain at the front and back of my chairs as it has an almost silky feel after final wet-sanding with oil.

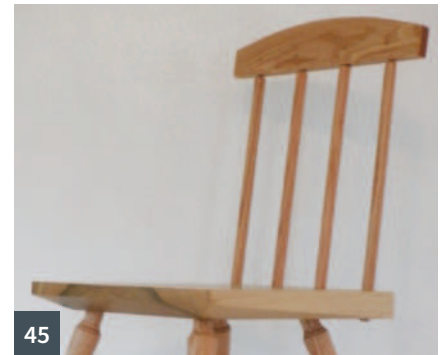
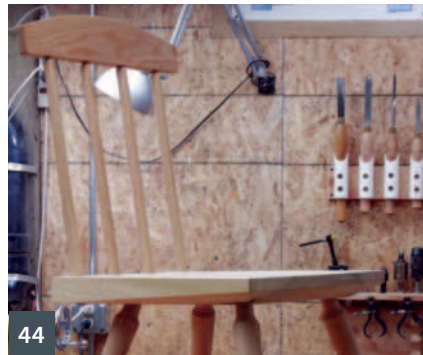
## Assembly

- 38** The pieces were now ready for final assembly. I put the chair together without glue to make sure everything fit just right, which it did. I used Titebond III wood glue, which has a relatively short open time, so it pays to be prepared with everything ready to go during glue-up.
- 39** First, I was supposed to swab glue into the backrest spindle holes and drive in the spindles then glue the spindle holes in the seat

and place them in to the mechanical stop. Oops... I did the opposite and one of the spindles didn't fully seat leaving it about 3mm high. This caused the backrest to sit a little high on the rest of the spindles when it was levelled by measuring on each side from the seat. I would say 'live and learn', but I know better! Oh well... we'll see if anyone notices.

Once the spindles were home into the seat, the seat was turned upside down with the backrest top on the floor and the wedges hammered into the kerf. I enlisted my wife to help me and her assistance was invaluable in these and the leg top wedges. One of the more challenging aspects of glue-up is driving the wedges home on the leg tops because of the angle of the legs. Don't try to hammer them at an angle as it will likely end in a broken wedges. If the leg is placed on a scrap block (the pounding will dent your bench top – guaranteed) straight up and down, the wedge can be safely and more easily driven home. Again, get some assistance holding the chair. Doing it all yourself is achievable, but cumbersome and error prone.





**40** Leg levelling was completed by levelling the chair so the sides of the top face of the seat were level. Because of the differing leg splay angles, the rear was slightly lower than the front, which is what I wanted. I used wedges to get the seat level and a pencil taped to scrap at the height of the largest gap and marked around every leg at that height.

**41** I then cut off the portions below the marks, set the chair on a level surface (my bench) to check for any rocking. There was a slight bit and some rubbing on 80-grit sandpaper with the offending two leg bottoms made it solid in no time.

**42** Once the glue was dry, I drilled 6mm holes through the backrest partially into the spindle tops going into the rest. I measured 25mm up from the bottom edge and sighted alongside where the spindle went in to determine where to drill. The object is to have the 6mm dowel 'grab' a part of the spindle, making a mechanical lock to prevent the spindle from ever coming loose in the mortise. I cut the 6mm dowel into 38mm-long pieces, put a little glue in the hole and hammered the dowel in, stopping when the lead end came out the other side.

**43** I used a flush cut saw to cut off the protruding ends of the leg top and wedge on the top face of the seat. To allow some of the spindle and wedge to extend past the bottom of the seat, which I hope

will give the spindle bottom a bit more holding strength, I used a scrap about 6mm tall to rest the flush cut saw on while cutting off the remainder.

**44** Here is the chair without any finish applied right after final cutting off of the wedges.

**45** Here you can see the chair after I applied a seal coat of shellac and a few rubbed-on coats of oil/polyurethane mix.

## Slip-ups

**46** I accidentally bored too deeply with the tapered reamer leaving a tapered hole much too large on the first hole. That's what I get for hurrying! After much anxiety on my part and considering making another seat for this project, I decided to try and fix it and even document my mistake.

**47** I turned a tapered plug-in spindle orientation to fill the hole and glued it in. In retrospect, I could have turned the fix in faceplate orientation to better match the grain, but it wasn't so oversize that I thought it would matter. In the end it didn't matter, although to bore through the end grain, I used my cordless drill and a spade bit! The hole was then carefully reamed to the proper size as were the remaining holes.

# SEED BOX

Kevin Alviti makes a  
simple storage box  
with carved detail

Being organised in the workshop is one thing, I'm really proud of how well set up my workshop is, everything is in its own storage box and grouped together. But my garden shed always needs a bit more organisation, especially when it comes to seeds.

This isn't helped by the fact I'm an avid seed saver and collector. Seeds are an essential part of how we live on our smallholding and the fact we're always striving for self-sufficiency (and never quite getting there) so we end up storing quite a few.

Each year I also grow seeds for our local seed swap and help run the event in the local city of Hereford. And every year, I come back with new and interesting varieties to try. I also seed swap with people from around the world, having seeds sent to me from eastern Europe and America.

So, I really felt like it was time to do my seeds justice and make them some storage that they were worthy of – they do help provide a lot of food for my family after all!

I decided to make this simple seed box from softwood and plywood. This gives it a nice look but also makes it fairly low cost.

Now I'm sure I don't need to say that not all wood is created equal. I have 'unsorted redwood' come as a delivery every other week to my



workshop to make the items I sell. I get these as sawn boards and as I've ordered them in, I don't get to pick through the shelf to select just the good stuff. What I do is grade the boards as I take them and save the best (with the least amounts of knots or defects) and use them where they will be seen the most. When you're buying the wood for this project, I'd recommend you spend a bit of time looking for the right boards, especially where the carving is going to be. Try to go to a timber merchant rather than a DIY shop if possible – good timber makes everything easier.

Using a softwood isn't ideal for carving the lettering, it might be worth practising first on a piece to see how you like it. A harder wood like oak would possibly be easier as it accepts detail well.



## YOU WILL NEED

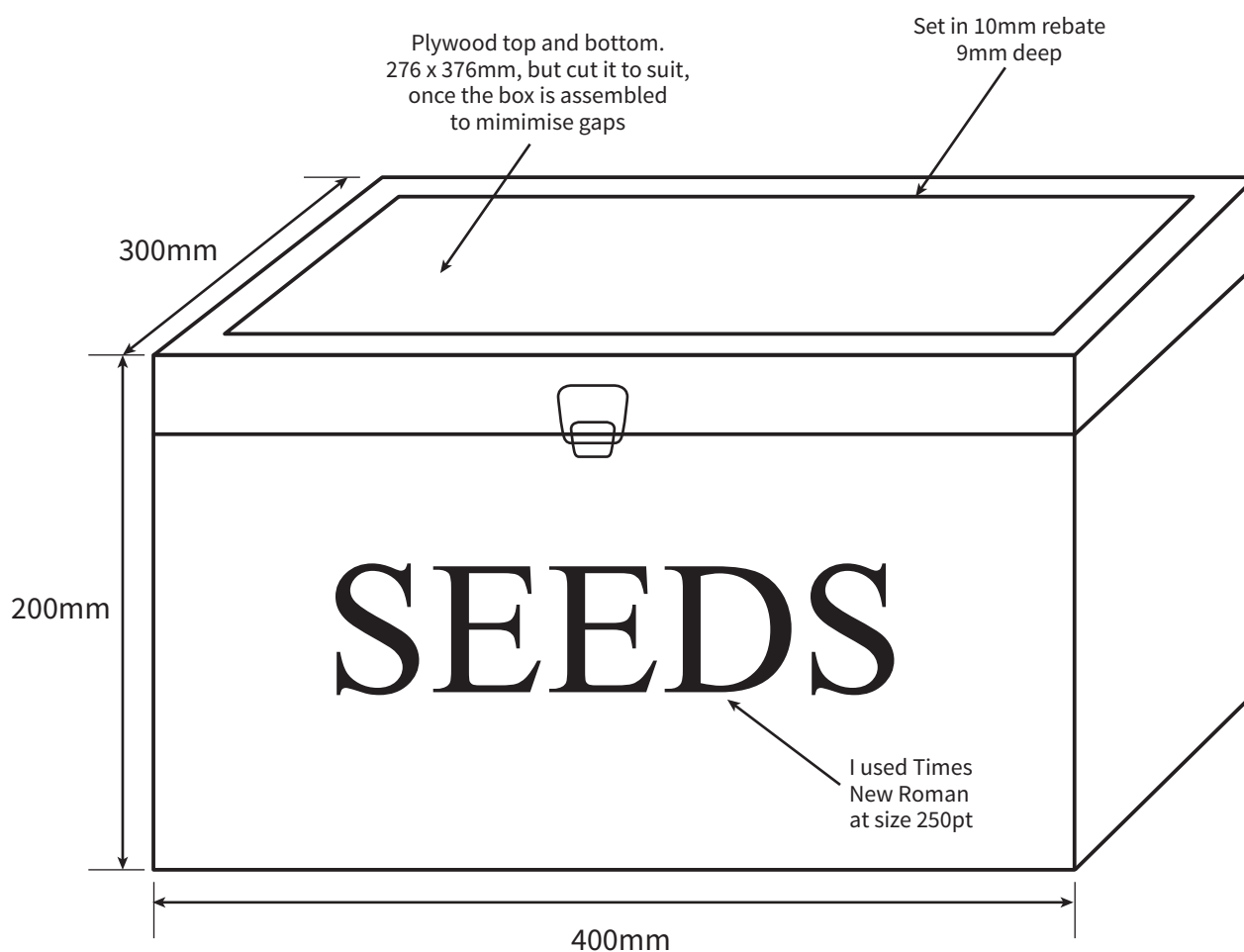
### MATERIALS:

- 1.5m of 200 x 20mm good quality timber
- 2 x 300 x 400mm 9mm ply
- 1 x 18 x 60 x 276mm pine
- 2 x No. 50mm butt hinges
- 1 x catch

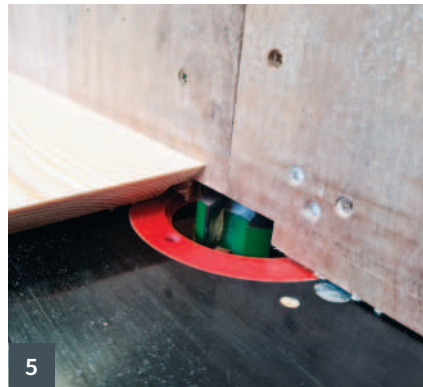
### TOOLS:

- Mitre saw (optional)
- Planer thicknesser (optional)
- Router table (optional)

- Sander (optional)
- Palm router (optional)
- Hand saw
- Carpenter's chisels
- Mallet
- Double-bevel straight chisel (ideally a few sizes but I used a 13mm quite comfortably)
- No.6 gouge, 13mm
- No.6 gouge, 20mm
- No.6 gouge, 30mm
- No.3 gouge, 13mm (fishtail would be better)
- Skew chisel



Divider inside, set in 6mm  
each side in centre 18 x 60 x 274mm



## Making the box

- 1 Select a good board for the box. Make sure that at least the front is free of knots to allow for the carving later.
- 2 Plane the board's surface and edges to make them square. This is essential with a project like this. If you don't own an electric jointer, this is a great project for a sharp No.7 plane.
- 3 Rip the board to width. Obviously, this can be done before planing the first two sides, depending on how rough sawn your boards are, but sometimes it's easier to run the boards through the saw with two smooth faces. I ripped mine to 205mm to allow 5mm to be planed off in the thicknesser.
- 4 Thickness the boards. I finished mine at 20mm but 18mm is also fine if you're buying ready planed boards. If you buy ready planed boards, make sure they are planed square and they are as flat as possible. Cut all the pieces to length. Make sure these cuts are square.
- 5 Set a router table to rebate the timber for the base and the top. I used 9mm ply so I set it for that thickness and then made the rebate half the depth of the timber. Use the largest diameter bit

you can, to prevent it splintering as you push it through the table. Push sticks and sprung clamps help to keep things safe and keep your fingers away from the business end.

- 6 The front and back need rebating to accept the sides. When routing these, it's essential to have a sacrificial strip tight against the end to prevent tear-out as it's end grain. It's also essential to have a sharp router bit.
- 7 Loosely assemble the box and decide which side will be the front and top, etc., and mark them accordingly.
- 8 Have the divider to separate up the seed box ready to hand. I used some spare 18mm pine. To create the housing for this divider I decided to simply use the router free hand and then tidy up the side with a chisel. I marked round the divider with a Stanley knife, the knife cut then gives a place for the chisel to start once the bulk of the waste has been routed out.
- 9 Carefully, using a palm router, remove the waste for the housing joint for the divider. This only needs to be about 5mm deep, keep slightly back from your line and then tidy it up with a chisel.





## Carving the lettering

**10** Now for the fun bit – carving the words out. I printed mine out from the computer and then positioned them with the hardware to make sure everything was spaced correctly. I also marked where the cut will be for the lid, at 40mm down from the top. I put a fold in the paper of the template and have marks to show where the edges of the paper will go to make aligning easier once everything is covered with adhesive.

**11** Use a photo mount adhesive to stick the paper down to the wood. Not all spray adhesives are the same and the first time I used this method I used one that did not come off easily and I spent as much time removing the paper as I did carving! Not fun at all.

**12** Simple lettering like this isn't too difficult. Start by marking halfway in each letter with a chisel and strike that in. A carpenter's chisel can be used for this bit but a double-bevelled straight edge carving chisel is the ideal tool as it provides so much more control.

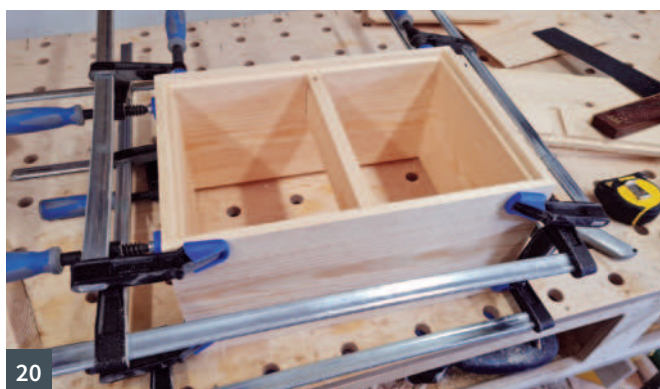
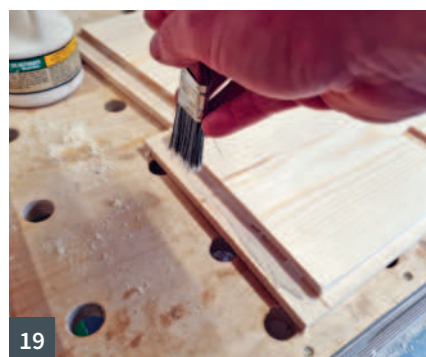
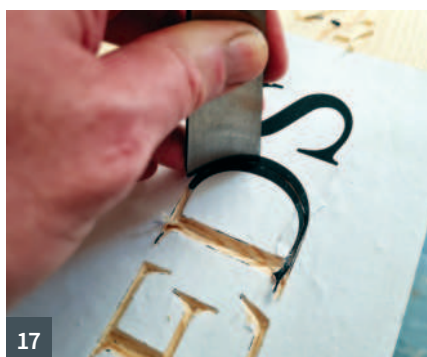
**13** Now using a double-bevelled straight chisel work from the outside of the letters to the middle at a 60° angle (roughly – although it can be worth making a gauge out of an offcut to see if it's somewhere near, if you struggle to keep the angle consistent). Do this from

both sides and it should be easy to remove the waste. My chisel is a bit short for this so I make an incision then a long slicing cut to the whole length, making sure the corner runs up the middle of the letter where the line was struck in step 12.

**14** Once the large easy straight sections are removed, start splitting the other straight sections of the writing down the middle. Here I used the double-bevelled chisel again and light taps from the mallet. The letter 'E' is the perfect letter to practise on and get your 'eye in' before carving the other letters.

**15** Also split the serifs with tapering cuts so when it's finished the end of the letter will slope in three directions here. Serifs are your friend when it comes to carving lettering, they provide an easy way to finish the ends of the characters.

**16** Using the corner of a shallow No.3 gouge, cut in the curves of the serifs to the mid-point. In all honesty, I could have done with a fishtail gouge here so it's one I need to purchase – no matter how many carving chisels you have there will always be more needed! Use the double-bevelled straight chisels for the straight parts and remove the waste. Clean the carving as you go so there is no fiddly bits to come back to.



**17** Now do the same for the curved letters. Try to find chisels to match the curve, especially when creating the centre line. Then use slicing cuts to remove the waste with a shallow gouge, taking care not to remove too much wood past what is marked on the paper. For the 'S' you will need multiple chisels to create the curves.

**18** The paper is easy to remove with the application of white spirits on a rag. This is also the first time you'll get to see what your carving really looks like. Any touching up needed is best done now, but remember it is hand carved and doesn't need to look like it came off a CNC machine. Aim for perfectly imperfect and it should be just right!

## Assembling the box

**19** Apply a good-quality glue to all the side rebates, making sure it is spread evenly.

**20** Clamp the box together. Use some scraps if you're worried the clamps will mark your work (this is best practice). Alternatively, you can just pin the piece together using 18g brads, but take care not to place anywhere you might cut them when you saw the lid off. Make sure it's all tight joints but also that

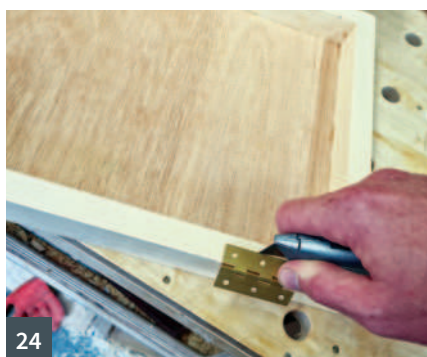
it is still square, check the diagonals with a tape measure or rod.

**21** Make sure the box is square and then cut the plywood top and bottom. Sometimes this is easier to do by taking marks straight from the box. Close one eye and line through where it will finish and put a pencil mark. Use a tracksaw or tablesaw to cut it accurately and cleanly.

**22** Then use 18g brads and glue to fix the top and bottom to the box. Fix one side first and use a wet rag to remove any excess, this obviously isn't possible when the second piece is fixed. Make sure the brads used aren't going to interfere with cutting the lid from the box, limit them to 30mm long.

**23** Once the glue is dry it's time to cut the lid from the box. Mark completely around the box, making sure the lines meet back up. Then find a good position to saw. I prefer to saw on sawhorses as I find it easier to saw lower down and use my knee as a clamp, but it might be easier for some to saw at the bench using a vice to hold it. Saw using a panel saw, keep the angle low and try to saw over a corner, keeping the saw in line with both sides and it should keep straight. Then rotate the box and continue sawing.





- 24** Plane and sand the inside edges to remove the saw marks then, making sure you have the lid and the base the way round they came off (so they match), it's time to add some hinges. Position the hinges 50mm in from both sides and then mark their position using a knife so they will line up. Mark round the hinge with a knife.
- 25** Use a depth gauge to mark how deep the hinges needed to be cut, in this case the same depth as the thickness of the hinge as when closed there is just enough gap between the leaves of the hinge to let the box close properly.
- 26** Using a chisel, strike round the outside, then make some relief feathered cuts with a chisel and mallet and clean out the waste with just hand pressure on the chisel. This could also be done easily with a palm router and tidy the edges out with a chisel.

Install the hinges, being careful to pilot the holes for the screws and getting them centred in the holes.

- 27** Once the hinges are installed, add the catch on the front. Then remove this and the ironmongery and give the piece a final sanding to your preferred grit – I went to 180g – taking care to remove any layout lines that were on the box.
- 28** Finish the piece with your preferred method. For this box I used two coats of Danish oil applied with a cotton rag. For each layer, I applied it thinly and rubbed it hard into the wood, I then left it for 15 minutes and wiped off the excess, then left it for eight hours to dry. It might be necessary to knock it down with some iron wool between coats if it's left feeling a little rough.

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# COUNTER BALANCED CLOCK

Paul Maddock, aka The Quirky Clock Man,  
recycles an old oak fence post  
to make an unusual clock

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I have been making 'quirky' clocks since 2014 and find them a fascinating pastime as they can be made using basic woodwork techniques, through to more complex turning and router work, as will be demonstrated here. The ideas for design and artwork on the clock face are only limited by your imagination. I like to use natural and recycled materials as much as possible knowing that each clock I produce is unique in its own right.

The aim of this project is to construct a clock from a piece of oak cut from an old fence post that I have had in stock for several years. I have called it a 'counter balanced' clock as looking at it raises the question 'that's strange, surely it should fall over?' I made my clock using a router, and a bandsaw to cut the timber to size which makes life much easier.

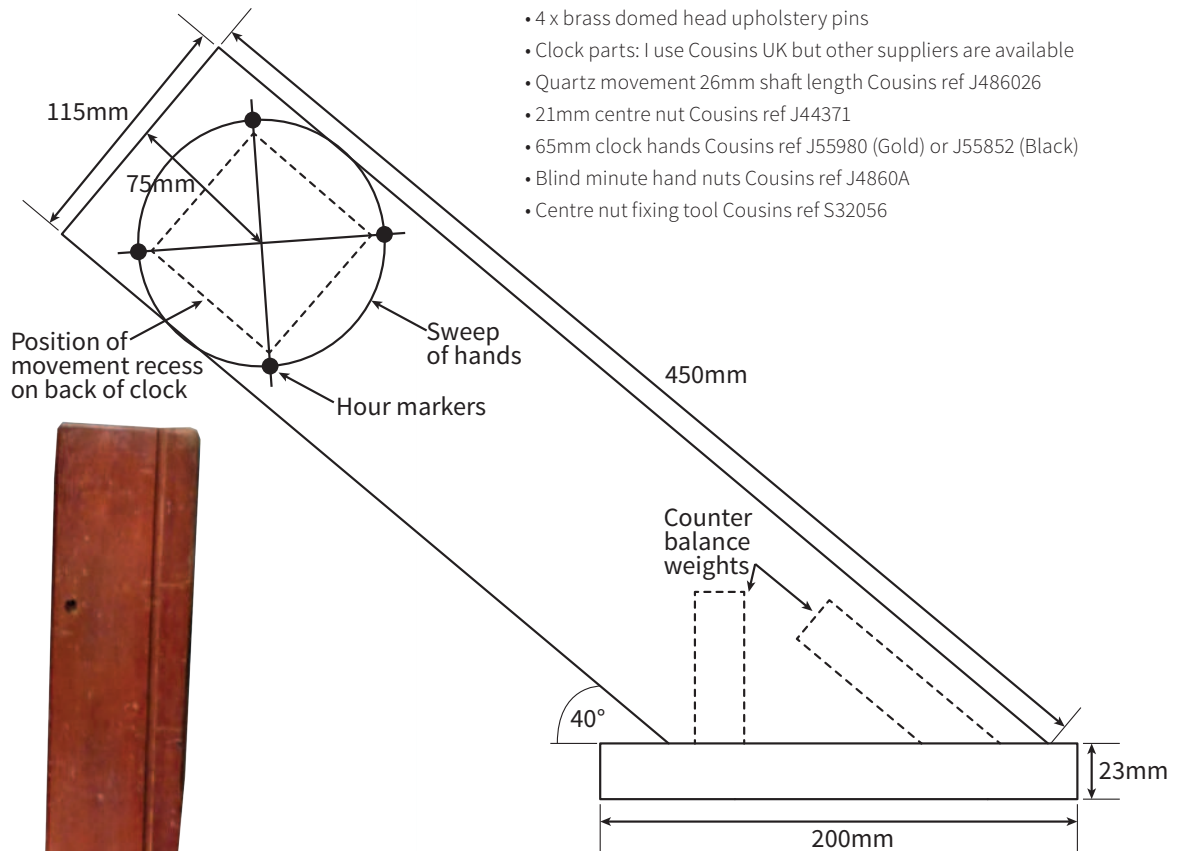
The clock consists of a section of oak with a lead counterbalance weight screwed to an oak base. A quartz movement will be mounted in a recess formed on the back of the clock with brass upholstery pins for hour markers, which can alternatively be made from Milliput two-part epoxy putty set into holes on the face.



## YOU WILL NEED

### MATERIALS:

- Piece of oak: 450 x 115 x 45mm
- Piece of oak: 200 x 90 x 23mm
- Lining paper
- Masking tape
- 2 x 1½in No. 10 brass countersunk screws
- Sanding sealer
- Chestnut Gloss Acrylic Lacquer aerosol
- 250mm piece of 22mm copper pipe
- Scrap lead for melting (around 1kg) or lead shot (around 450g)
- Milliput two-part epoxy putty – colour black
- 4 x brass domed head upholstery pins
- Clock parts: I use Cousins UK but other suppliers are available
- Quartz movement 26mm shaft length Cousins ref J486026
- 21mm centre nut Cousins ref J44371
- 65mm clock hands Cousins ref J55980 (Gold) or J55852 (Black)
- Blind minute hand nuts Cousins ref J4860A
- Centre nut fixing tool Cousins ref S32056



## Re-use of old timber

I like to re-use old timber whenever I can obtain it. It usually comes free or for 'the price of a drink', is often good quality, well seasoned, goes down well with potential buyers and gives you the satisfaction of helping save the environment. You will need to be vigilant when working with recycled timber and look out for nails, screws and sundry items of metalwork that may be attached to or embedded in the salvaged wood. Investment in a simple metal detector, such as contractors use to locate metal studs in walls, will be worthwhile if you intend to use any quantity of recycled timber.

There are many places to find old timber such as builder's skips (remember to ask before you help yourself), offcuts and waste from joinery works and surplus and waste from demolition and refurbishment contracts. Old furniture that is being discarded can be dismantled and re-used, if necessary laminating smaller sections together to make larger more useable pieces. There are also charitable

The oak fence post used for this clock and a salvaged mahogany corner protector



organisations that specialise in collecting old and surplus timber and selling it at below market prices with the proceeds going to good causes. An online search may also reveal some treasures.

Thinking back over the years, aside from the oak fence post that will be used for this project, some of the notable pieces of salvaged timber that I have acquired include some oak strip flooring dating back to the 1950s that was destined for the wood burner; pieces of teak from a public toilet that was demolished (teak had been used as the toilets were prone to flooding during periods of heavy rainfall and was able to cope with the wetting and drying cycle without deteriorating); and some more teak from old laboratory benches being stripped out of a school, the tops being 50mm-thick solid timber. During a healthcare renovation project which I was involved with, the 1960s wall corner protection consisted of pieces of mahogany 150mm wide by 30mm thick and 1,100mm long, which had to be replaced. There were about 20 pieces of timber in all! I have also been given large pieces of oak

from old beams and fireplace surrounds – the list goes on.

The point is that if you are prepared to look around and talk to people you could well save yourself some money and find some really nice timber for your projects.

## Design

Start by drawing a full-size plan of the clock on lining paper, which is available from DIY stores and decorators' merchants. Tape a suitably sized piece of paper to a piece of hardboard or similar which can be kept to one side and used for future projects. Dimensions are shown on the drawing on the opposite page but these can be adjusted to suit your ideas. The important point for a clock is the centre point for the dial so give this some thought as you develop your design. For this project you will need to consider the weight of the counterbalance, so if you decide to vary the dimensions or angle of the clock the weight may need to be adjusted by trial and error.



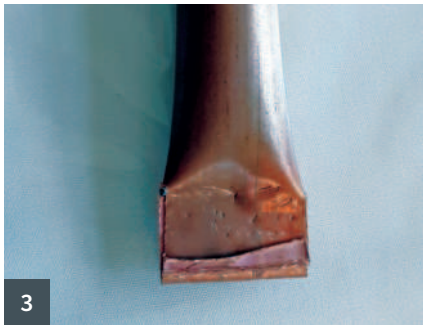
## Preparing the timber

- 1 Cut a 450mm length from your timber and form a 40° angle on one end. Select the front face for the clock which will be left



- in its natural state and then plane the other three sides square.
- 2 I cut the piece lengthwise on the bandsaw to form two sections each 45mm thick.

PHOTOGRAPHS BY PAUL MADDOCK



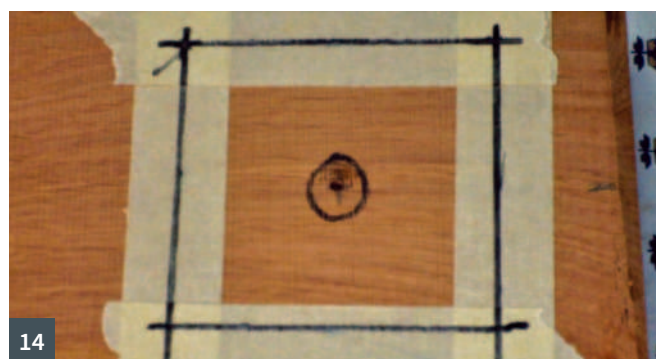
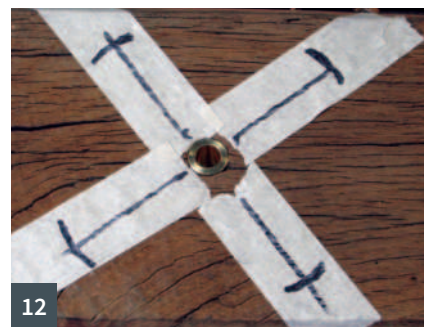
## Making the weight

- 3 You can either make a weight from a piece of copper pipe filled with molten lead as described below or alternatively you could use lead shot poured into the clock base without the copper pipe. Take the piece of 22mm copper pipe and make a saw cut with a hacksaw 30mm deep down one end of the pipe. Pinch the end of the pipe closed in a vice and fold it over to seal the end. Mount the pipe vertically in the vice.
- 4 It is essential to undertake a risk assessment before starting the next task. Carefully think through the task, work in a clear area and try a 'dry run' without heat before you fire up the camping stove. Take a suitable steel container, I use an old stainless steel teapot. Use tin snips to cut up some scrap lead into small pieces and place into the container. Before melting the lead decide how you are going to safely hold the container and pour the lead into the pipe. I used a large pair of pliers.
- 5 A camping stove will provide plenty of heat to melt the lead, which can be melted and poured in several goes without any problem. Make sure you have somewhere safe to place the hot container after pouring, a ceramic tile or similar on the bench will suffice.
- 6 Pour the lead into the tube. When you have finished pouring the lead, leave the pipe in the vice until it has cooled down. The pipe full of lead can then be cut to length using a hacksaw as required, there should be sufficient for two weights.

## Fitting the weight

- 7 The weight will be inserted in a 22mm hole running parallel to the long edge of the clock. Mount the timber in a vice and form a pocket with a 6mm mortise chisel in the angled base of the clock to allow the Forstner bit to start cutting square to the hole. Set the timber up in a drill press secured by a drill press vice bolted in position and check the timber is vertical. Drill the hole using a 22mm Forstner bit with a shank extension if necessary. If the oak is very hard, remove the Forstner bit after 20mm and exchange it for a 13mm twist bit to form an initial hole and then revert back to the Forstner bit to finish off.
- 8 Here you can see the completed hole, which needs to be 120mm deep.
- 9 You can now insert the weight into the hole and cut it off to match the angle on the timber. If you have opted to use lead shot you need to pour the shot into the hole and form a plug with some of the Milliput epoxy putty to seal the hole. For this project the weight required was 425g. The pack of Milliput contains two lengths of compound. Cut an equal length from each and knead them together as directed on the box, then press the putty into the hole on top of the shot. Once it has set it can be sawn, planed and sanded as necessary. The clock now needs to be mounted on the base to check it won't tip over, if it does a second weight will have to be inserted.





## Making the clock base

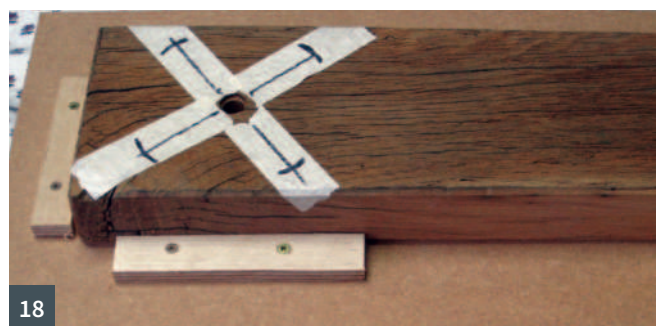
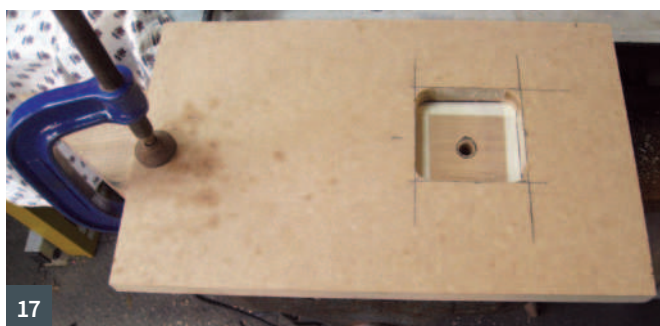
- 10** Cut and plane a piece of oak to 200 x 90 x 23mm. Using either a router with a 45° chamfer cutter or a hand plane, form a bevel around the top of the block. Place the clock centrally on the base and locate a position for a screw through the base that will avoid the weight. Drill a clearance hole and countersink it on the bottom of the base and form a pilot hole into the clock. With the weight in position, fix the base to the clock using a brass countersunk screw. If the clock tips over then you will have to repeat the process above and insert a second weight. Remove the clock from the base.

## Setting out the clock face

- 11** Working from the drawing, mark out the centre point of the clock face and then place four pieces of masking tape in the hour marker positions. Set a pair of compasses to 50mm and draw an arc on the masking tape to cover the positions of the hour markers. Set a sliding bevel to the angle of the base cut and aligning it with the centre of the clock face make two horizontal lines through the arcs on the masking tape.
- 12** Repeat this with another two lines set at 90° to the first pair which will give you the positions of the four hour markers. Offer the clock up to the base and ensure the hour markers appear horizontal and vertical.

## Forming the recess for the movement

- 13** The next task is to form a hole and a recess to accommodate the centre nut that holds the movement in place. Drill a 12mm diameter, 2mm-deep recess with a Forstner bit and then a 10mm hole through the clock. This will form the centre of the movement recess that will be formed on the back of the clock.
- 14** Using the hole as the centre point mark out the 70 x 70mm square for the movement recess on the back of the clock.
- 15** The recess will be cut out with a router. I used a Bosch router fitted with a 30mm template guide. The 30mm guide was selected to accommodate a cutter extension in order to obtain sufficient depth when cutting the recess.
- 16** I used a 10mm cutter so the template needed to be 10mm larger all round than the recess. This dimension is calculated by taking half the diameter of the guide (15mm), subtracting half the diameter of the cutter (5mm) and then adding the result ( $15 - 5 = 10$ mm) to the measurements of the recess. The template was made from a piece of 15mm MDF, the 90 x 90mm template hole was marked out, a 25mm diameter hole drilled in each corner and the waste removed with a jigsaw.



- 17** Position the template over the location for the recess and clamp.
- 18** Fix pieces of timber around the clock to prevent any movement when using the router.
- 19** Mount the clock in the vice, place the template over it and clamp it in place. Start the router with the cutter in the centre hole. Follow the template with the router guide and make sufficient passes to clear all the waste. Take several cuts to achieve the depth which will be correct when you insert the centre nut and all the threaded portion is visible.

## Fit the hour markers

The positions for the markers can be located with a compass point or bradawl pushed through the mark on the masking tape. For this project, I used brass domed head upholstery pins, which can be bought from upholstery suppliers, as a contrast against the dark oak background. I did not want to sand the natural weathered face of the clock. A 1.5mm pilot hole was drilled before fitting the pins. The alternative, if the face is being sanded, is to drill 9mm holes and fill them with Milliput epoxy putty which can be sanded and finished with the rest of the clock face.

## Finishing the clock

Using a router or a smoothing plane form a small bevel along the

corners of the edges and top but not the bottom. Gently clean the weathered face with a brass bristle brush and sand the other faces working through the grits down to a 400 grit finish. Apply a coat of sanding sealer, de-nib and then apply two coats of gloss acrylic lacquer. I decided that the base was too light compared to the clock so I toned it down with a coat of medium oak stain before applying the sanding sealer. Fix the clock to the base, a second screw may be required.

## Fit the movement and hands

- 20** These are the movement, hands and centre nut that I used.
- 21** The centre nut tool is supplied without the handle, which I fitted.
- 22** Place the soft washer over the shaft and insert it through the movement recess and secure it with the centre nut, pushed in from the clock face. Tighten it with the centre nut tool. I opted to use gold coloured hands which matched the hour markers while contrasting with the dark oak of the clock. Place the long hand on the shaft and using the adjustment knob on the movement align the hand with the number 12 position. Remove the long hand and fit the short hand aligned with number 12. Refit the long hand and secure it in place with the blind nut, holding the long hand to stop the shaft turning as the nut is tightened by hand. The movement should sit snugly in the back of the clock, as shown here.



# TOOL STORAGE CABINET

Andrea Zanini brings order out of chaos,  
with a useful workshop cabinet for storing tools and accessories

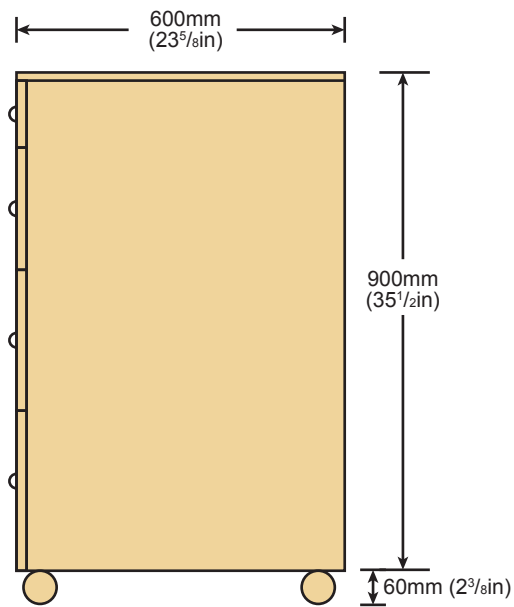
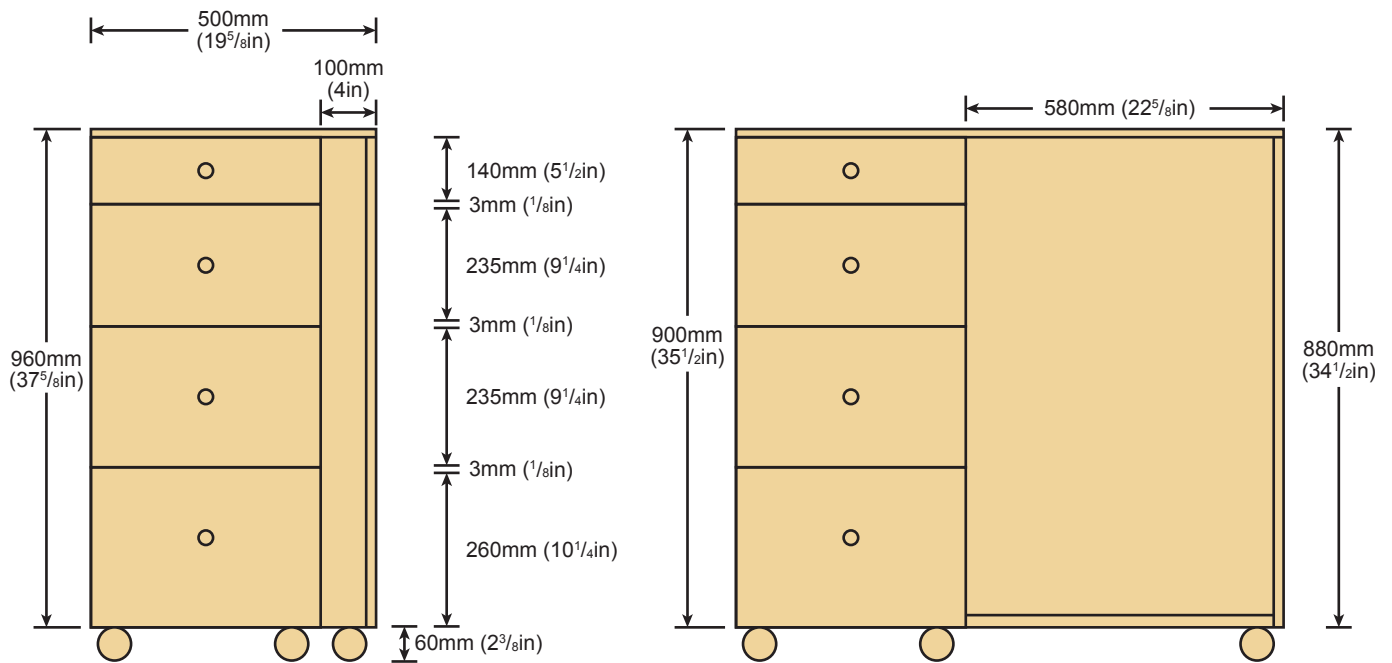
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When we start woodworking our first purchases are usually recommended by someone else, but soon enough we all find how satisfying buying new tools and accessories is. It soon becomes clear that everything needs a place, so we build a tool rack and struggle with the problem that all woodworkers face: everything gets covered in enormous quantities of sawdust and shavings. They seem to get everywhere and finding that chuck key, or the chuck itself, becomes a stressful rescue

mission. I've always liked to work in a clean and organised workshop.

A clean workshop is a safe workshop and finding what I need quickly means more time to work on a project. But which tool holder or cabinet is the most convenient? Here, I am going to describe the process and design of a cart, born after a long series of trial and error, that could fit in almost any shop, from the garage to the pro, and which will help you to save space and stay organised.





## YOU WILL NEED

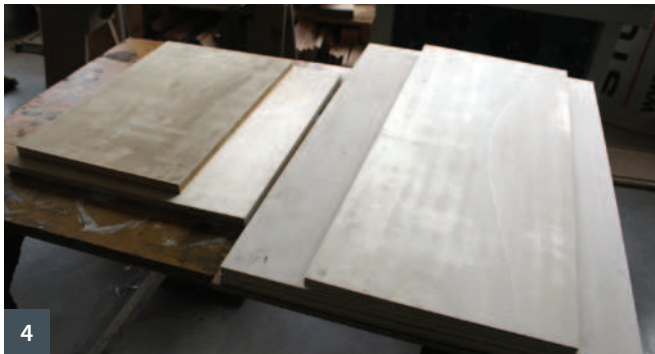
### TOOLS:

- Hand circular saw
- Hand saw
- Biscuit joiner
- Tape measure
- Straightedge
- Drill

### MATERIALS:

- 18mm plywood
- Brad nails
- Wood screws
- Wood glue
- Biscuits
- Hinges
- Castors
- Water-based finish





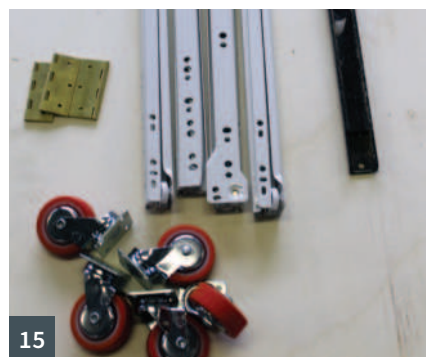
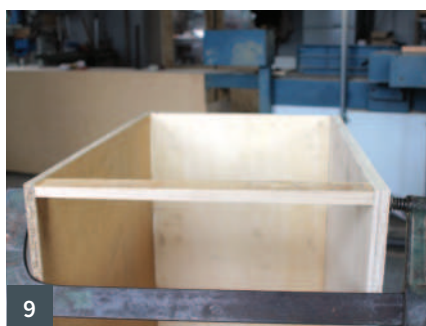
## Getting started

- 1 A project like this is perfect for using up scrap pieces of plywood. However, I didn't have enough suitable pieces and had to use a brand new piece of 18mm poplar plywood. Mark the main measurements in order to make the first cut to reduce the sheet to a manageable size. If you struggle with big plywood sheets, buy smaller pieces that fit the cart sizes or ask your local lumber supplier to cut it. It's a basic service and they will be happy to do it for you.
- 2 Now that the sheet is lighter, lay it down on a pair of sawhorses. When cutting wide panels it often happens that the sawhorses are too short to hold the piece in place once the cut is completed. A simple yet effective trick to solve this is to stop the hand-held saw once you're past the first sawhorse. Lift the panel and place a stick beneath it. This will support the timber once you've finished the cut. You can easily hold the other free end of the piece you're cutting with your hand but if don't want to take any risks, just add a stick on the other sawhorse before completing the cut.
- 3 With the sheet secure on the sawhorses, you can start making the cuts. You can use a panel saw or a tablesaw – but if you don't have one, a regular hand-held circular saw combined with a straight edge and a couple of clamps will do the trick. Even a jigsaw and a little bit of patience will work.

- 4 Once you've finished all the cuts you'll end up with two sides, a back and a top piece, a bottom piece and an extra side – plus some strips that will become the wings for storing turning gouges. Don't forget to cut the pieces for the drawers; just leave some extra material because the measurements might change a little to take account of different materials or hardware.

## Assembly

- 5 On a bench, table or the workshop floor, lay out the parts of the cabinet that will have to be jointed together. This step is very important because you must try a quick dry assembly to make sure that the measurements are correct. Then mark with a pencil the location of all the biscuit joints.
- 6 Hold the piece of ply on the bench tightly and let the biscuit joiner do its job. I used a biscuit joiner because I find it very quick and precise but if you don't like it or you don't have one, you can use any other method. Even screws will work, but in this case biscuits will guarantee a perfect alignment with no effort.
- 7 Spread an even amount of glue on the joints and inside the biscuit slots. Take your time and don't try to assemble all the sides in one go. The main body is the most important part of the cart and must be squared and well assembled to ensure stability once it's finished.



- 8** Create stability by adding some screws, just a couple per side is enough. If you care about aesthetics you could use dowels and glue or angle brackets screwed from the inside.
- 9** Before installing the top, cut a strip of wood as long as the width of the cart. This will keep the measures right and the cart's body squared. Keep it in place with a clamp and spread some glue on the top of the cart.
- 10** Once you have got the top in the right position, you need to fix it in place. Again you could use some other technique, dowels, biscuits or just screws. If you are going to use nails like I did, be sure to drive them not perpendicularly but at a slight angle, creating a sort of dovetail pattern.
- 11** With a third side and 12cm-wide strips of plywood assemble a sort of tray. This will be the 'wing' where you can store gouges. To assemble it use some glue and brad nails. It really doesn't need screws to add strength.
- 12** By now, the main body and the wing will be in place. As you can see, the top overlaps the wing in order to have a larger surface to put things on. Place the strip of wood that you cut earlier in the middle of the cabinet to add torsion resistance. When I took this picture the piece of wood wasn't in the final position.

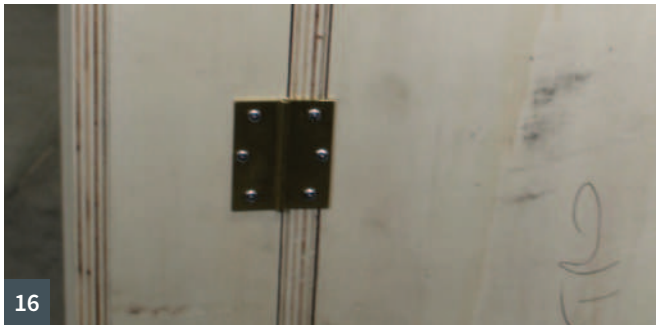
## Making the drawers

- 13** Take your time figuring out the quantities and dimensions for the drawers. Depending on the hardware you choose, the drawers' width might change, so when taking measurements have a drawer slide to hand and always add an extra millimetre to avoid an extra tight fit.
- 14** After a fair bit of work, glue and nails you will have four nice drawers. Scrap wood is fantastic for making drawers – have a look round your shop and you're bound to find some suitable pieces, just avoid super-thin bottoms. A 3mm-thick plywood might work, but only if you cut a groove along the sides where you will accommodate it and if you're not going to store your chucks there. I used some pieces of 5mm plywood cut to fit the inside of the drawer, glued and nailed in place.

## Installing the hardware and drawers

- 15** This is the basic hardware that you need: eight drawer slides, three hinges, a magnetic bar and five castors. The extra castor will be placed under the wing so the weight won't lie completely on the hinges. This means you won't need to buy expensive extra-strong hinges.





- 16** While the cabinet is sitting on the floor or the bench, install the hinges at the back. Space and align them accurately to ensure a fluid movement. If you are in the mood, and if the dimensions of the hinges fit, you can install them between the side of the cabinet and the wing. This is a good time to also attach the magnetic bar on the inside of the wing.
- 17** Lay the cabinet on its back, keeping the wing closed with a clamp and install the castors. The one that goes under the wing must be placed on the external corner opposite the hinges.
- 18** Installing the drawers is fairly easy. Cut a piece of scrap wood, in this case 140mm wide, 10mm-thick MDF (the length depends on the hardware you choose); this will be the interval between your drawers. Start from the bottom resting the scrap piece you just cut on the wide side, so that there is a 10mm gap between the first slide and the bottom of the cabinet. Then install the other parts of the slides on the bottom of the drawers and check the fit.
- 19** Once all the drawers are in place, it's time to cut the front. Use the front piece you cut earlier and always prepare the four pieces starting from the bottom. My advice is to prepare them in pairs instead of trying to do all four at once. Doing it this way lets you correct any small mistakes and achieve a nice, evenly spaced look.

Use a couple of shims as thick as the gap that you'd like to see in the finished front and use a couple of finishing nails to hold it in place. If you don't want to see those small holes, you can use double-sided tape or hot glue. Drive a couple of 30mm screws from the inside of the drawers to hold the front firmly in place.

## Finishing

- 20** It's now time to sand the cabinet. Start using a 150-grit abrasive and if you used a veneered plywood be careful not to sand through the veneer. For the fine sanding use a 240-grit abrasive and then you can apply a finish of your choice. You could also paint it if you want to personalise your cabinet even more.
- 21** This is the final result loaded with gouges, skew chisels, scrapers and all the bits and pieces we love so much. You could make some additions, like a magnet to keep the wing closed while you move the cart around or an extra knob to open it easily. If you wanted an external surface to store smaller stuff like screwdrivers or callipers, you could use the sides and attach more magnetic strips. Basically you can upgrade this cart over time to fit your own particular needs. It will become a trustworthy workshop companion that will save you a great deal of space and time.



# HALLOWEEN LANTERN

Fred and Julie Byrne light the way with this spooky scrollsaw project

It's nearly time for trick or treating, so why not join in the fun and make some Halloween lanterns to decorate the outside of your house. Stack cut the designs in any way you wish using 4mm and 6mm wood of your choice. Use either coloured acetate, 90 gram tracing paper or both to give an eerie glow. The bayonet unit at the bottom of the lantern makes it safe and easy to change the tealights.

These lanterns are designed to be used outside only, and where there is no risk of other flammable materials catching fire, so do not be tempted to light them indoors, or around any other flammable items, under any circumstances.

## YOU WILL NEED

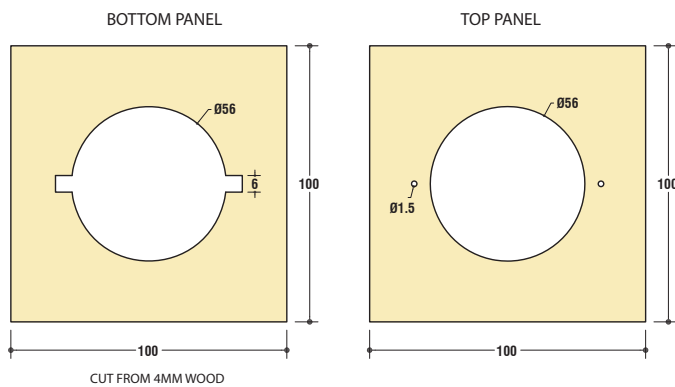
- Scrollsaw – No.3 blade
- Pillar drill – 1mm & 1.5mm drill bits
- A quantity of 6mm & 4mm hard wood or wood of choice
- Patterns
- Masking tape
- Glue stick/spray adhesive
- Wood glue
- Coloured acetate/90g tracing paper
- Double-sided tape
- Scissors
- 1.5mm x 300mm brass rod
- Finish of choice
- Tealight candles and holders



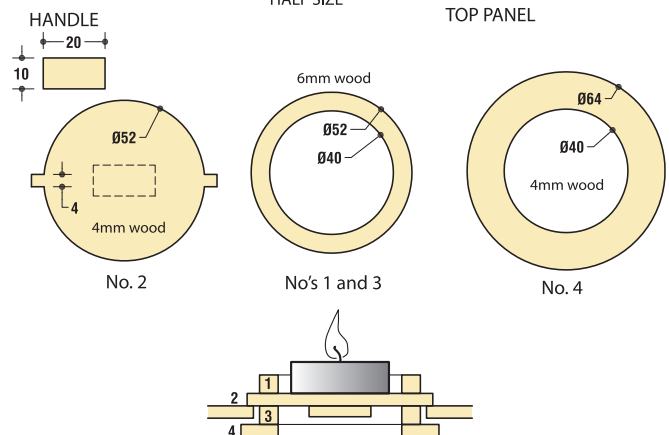


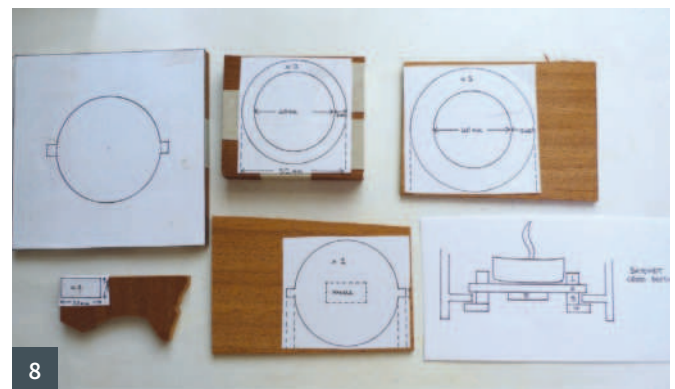
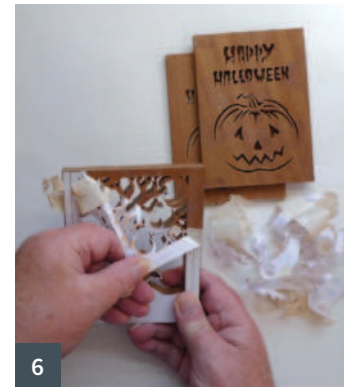
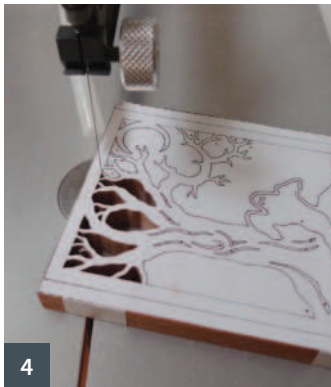
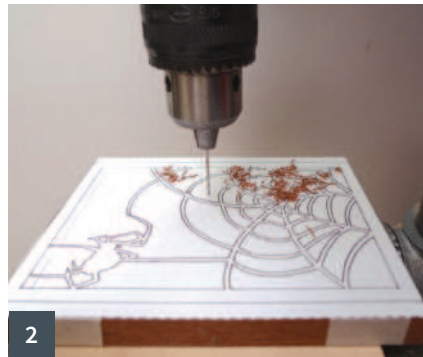
SIDE PANELS  
HALF SIZE

TOP AND BOTTOM PANELS  
HALF SIZE



BAYONET SECTION  
HALF SIZE





## Getting started

- 1 First, make a copy of the patterns and prepare your wood section by cutting out 4mm and 6mm side panel blanks, with the front and back panels overlapping the sides (two panels measuring 100 x 140mm, and two at 112 x 140mm) for each lantern. Stack together multiples of two or three, if you are making more than one lantern, and use masking tape to secure the stack.
- 2 Attach a pattern to each stack using either a glue stick or spray adhesive. Then, with the pillar drill fitted with a 1mm drill bit, drill all the blade entry holes.

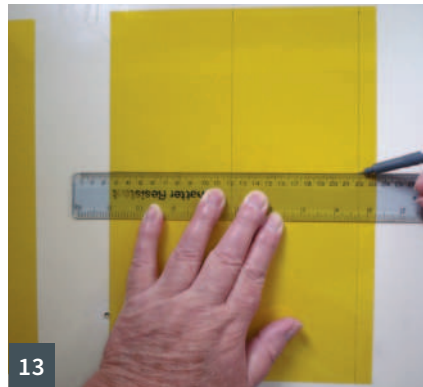
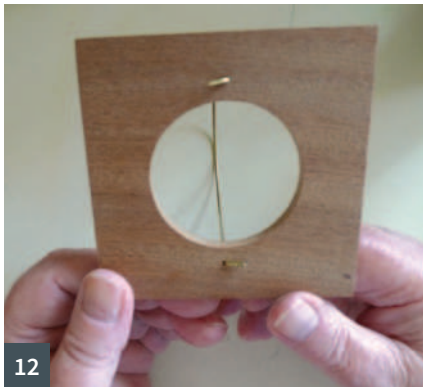
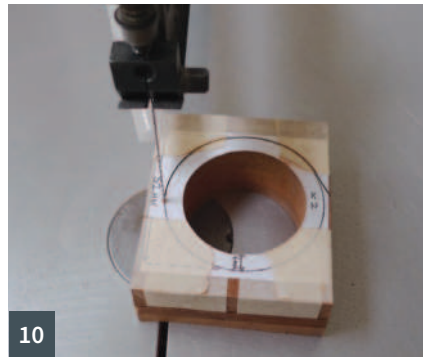
## Cutting out

- 3 With all the inner cuts to be made, a quick-release blade clamp is an essential piece of kit for the scrollsaw. Use a fine No.3 skip reverse tooth blade which will give a clean cut and help to minimise the burr on the underside. Place the blade through one of the pre-drilled holes to get started. When faced with a sharp inner corner, first cut into the corner and back the blade out just enough to turn and continue along the cutting line until you are back at the beginning,

then return to each corner to clean out the waste material.

- 4 Cut the smaller pieces out first, leaving the larger supporting pieces in place until the last. With the blade hole drilled into the widest of the parts to be cut, working from the hole, cut down into one of the points, then back the blade up to the hole and then cut towards the same point on the other side to remove the waste. Turn the whole panel around to complete the cut into the opposite point.
- 5 Continue in this way until all four panels are cut out.
- 6 Carefully remove the patterns and masking tape.
- 7 Next, sand each panel surface and de-burr the undersides using 220 grit sandpaper and a block, taking extra care of the delicate threads of the spider's web.
- 8 Next, stack together the blanks for the top and bottom panels – which sit inside the side panels – and the pieces that make up the tealight holder section, remembering to double up if making two lanterns, as we have.
- 9 Again, drill the blade entry holes and the two 1.5mm holes for the hanger in the top panel. Cut out the inner circles in both panels, and then the notches in the bottom panel.





- 10** Now once all the inner cuts have been made, continue to cut around the perimeters.
- 11** As before, sand and remove any burr from the newly cut pieces and then have a dry assembly of the lanterns to check the fit and make any adjustments if necessary. Mark reference points to assist when gluing.

## Finishing touches and gluing

- 12** To bend and attach the 1.5 x 300mm brass rod, first find the centre of the rod and then place it over an appropriate size glass jar, or something suitably rounded. Next, firmly holding the centre, bend both ends evenly around until each are pointing downwards. Then place the ends of the rod into the pre-drilled holes in the top panel, adjust to the required height, and then using a pair of pliers bend the ends over to secure.
- 13** Mark out and cut an A4 sheet of coloured acetate into four pieces (measuring 98 x 130mm) for each lantern. Alternatively, use 90 gram tracing paper, or both acetate and tracing paper together for a more opaque look.

- 14** With the side panels of the lantern laid out flat, as if dropped away from the bottom centre piece, position the acetate/tracing paper 6mm down from the top of each panel – this will allow for the positioning of the top panel – then attach using thin strips of double sided tape. Next, apply glue to all the adjoining surfaces, use a 6mm packing to the raised floor, and secure with masking tape or clamps until dry.
- 15** Glue the bayonet section in order, referring to the cross section pattern, and again allow to dry. To ensure the tealight doesn't burn through, purchase metal insert tealight holders, or alternatively, cut out a circular piece of aluminium to line the bottom of the lantern bayonet piece. Then apply a finish of your choice.
- 16** You can now hang the lantern outside in readiness for Halloweeeeen!

# JIGSAW MASTERCLASS

Anthony Bailey reveals how  
to get the best out of this  
workshop stalwart

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The jigsaw is one of those underrated but ubiquitous tools that lie on the shelf and get dragged out when nothing else will do the job. A sort of jack of all trades and master of none. However, there are ways to get the best out of it and benefit your work.

If you're serious about woodworking then there is no substitute for a decent, heavy-duty jigsaw. They cost quite a lot of money but the build quality is much superior than a cheapie. A bigger motor, hardened components and tighter tolerances all make for a more accurate and faster cut.





1



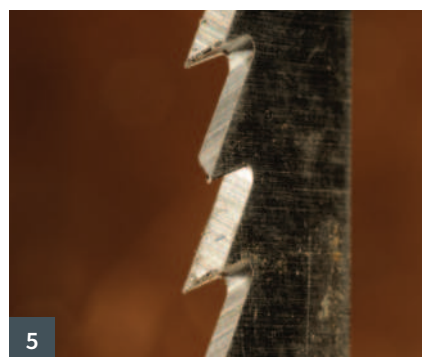
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7



8

PHOTOGRAPHS BY ANTHONY BAILEY/GMC PUBLICATIONS

## Getting the best from your jigsaw

- 1 Jigsaws depend on their blades. There are a wide variety on the market so choose with care – the Black & Decker type shank or the Bosch fitting, which are larger and come in more varieties, are good to work with. Select according to the job in hand: e.g. coarse wood cutting, fine wood cutting, scroll cutting, sheet material or metal, etc. There are extra long blades but don't expect them to hold an accurate course. Down-cutting blades are designed to avoid breakout but don't work with orbit on, so fit an anti-spelch plate instead, if your jigsaw takes them. Most blades have an up-cutting pattern.
- 2 Support the work properly on both sides of the cut – sheet material can bounce as it is tugged at by the blade.
- 3 A major reason why the cutter wanders is because the operator cannot see the cut line due to dust on the workpiece. A jigsaw with a blower can make a difference, or choose a jigsaw with built-in extraction.
- 4 The orbit lever is a valuable tool but use it wisely. It causes the blade to not only oscillate up and down, but also from back to front, so

that the teeth are pushed into the workpiece. Select orbit when you have thick material and want to speed up the cut rate, but leave it at zero when you want to cut thin material or prevent breakout on the surface. If you are cutting tight curves, the blade will wander and widen the cut with orbit in use.

- 5 Don't expect accurate cuts with blunt blades – it may feel sharp but if there is a slight shine showing on each tooth tip it means they have become rounded over with wear or damage, perhaps hitting nails or screws.
- 6 Jigsaws are great for roughing-out work prior to fine cutting such as before using a router and template. However, you need an accurate enough cut so you can work close to the cut line so that when you do trim with the router, the cutter won't be unduly strained.
- 7 Jigsaws often come with a straight fence or even a circle cutting trammel arm. They don't work that well – cut by eye because you can alter the angle of cut to reduce any cut wander.
- 8 When entering the centre of a workpiece either drill a start hole to drop the blade in, or lay the front of the jigsaw on the workpiece and do a face-sawn entry – but avoid straining the cutter in case it breaks.

# AN ARTISANAL HALL TABLE – PART 2

Keith Smith completes the work on his console table by adding flush-fit drawers

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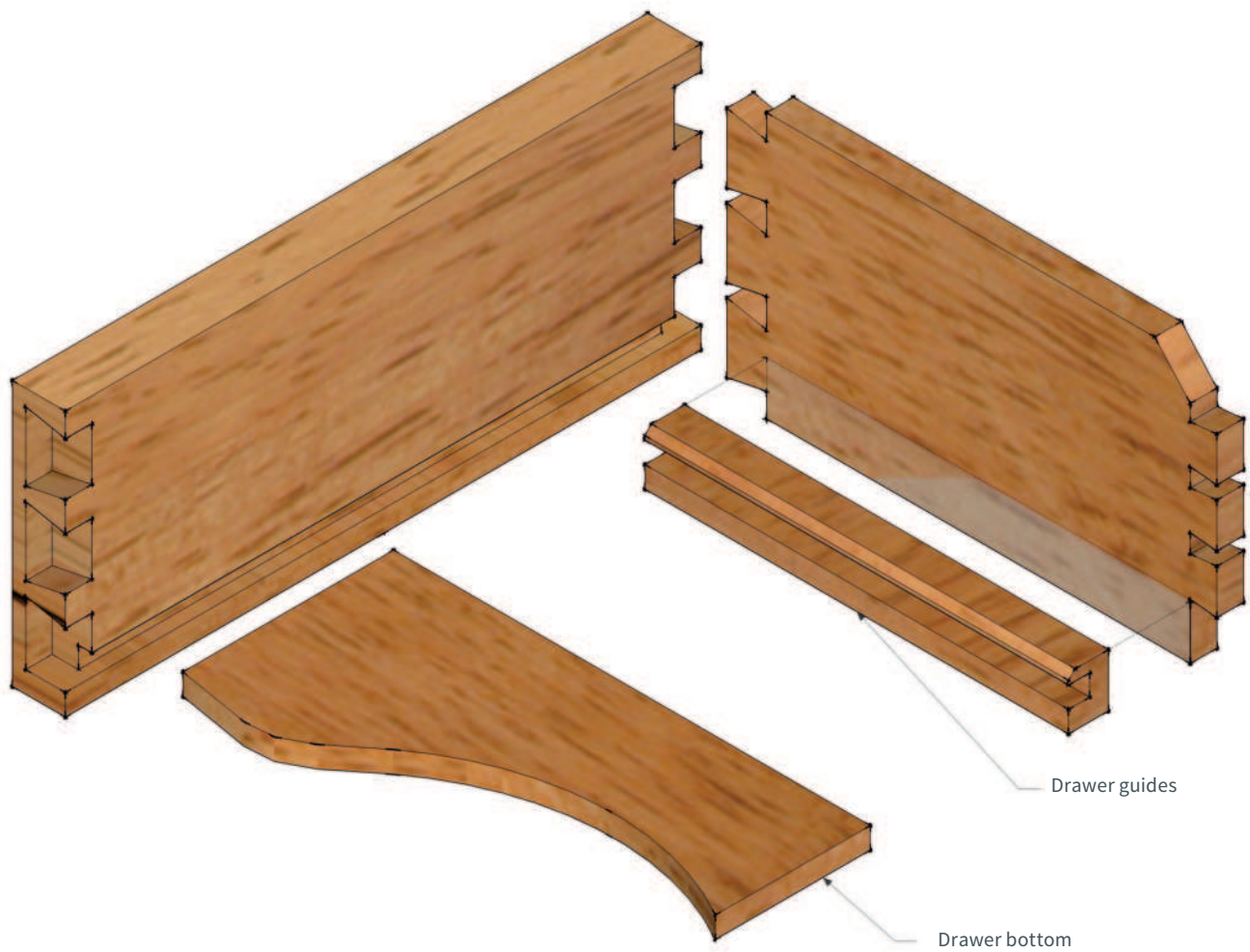
In the last issue (WWC 69) I began work on this small hall table by making and assembling the legs and table front. Now it's time to complete the project with the drawers and the final assembly.

## The drawer construction method

The construction I've used here is a traditional English technique that was widely used in the most refined furniture of the 1700s and 1800s; its main advantage is that it allows you to minimise the thickness of the side panels. Since the bottom of the drawer is supported by

the guides shown in the diagram above right, there is no need to groove the side panels, so they can be kept slimmer and more elegant. But there are other valid reasons for using this solution: the guides widen the sliding surfaces of the drawer, which in this way wear out less quickly (like the wooden frame on which they rest), they make it easier to take the objects that are put in the corners of the drawer and give greater freedom in the design of the dovetail joint, again due to the absence of the groove in the side rails.





**1** The joints of the drawers have three semi-hidden tails at the front and three through tails at the rear **2** Here you can see the reduced width of the rear wall **3** The groove in the drawer front where the bottom is housed falls just above the first pin of the joint. In this way it is possible to perform a through groove without showing the results on the outside. The strip with which the guides to be glued to the sides are obtained must be grooved with the same settings used for the front. The bevelled edge of the strip is the one that will remain visible inside the drawer



**4 & 5** To build a well-functioning flush drawer, the measurements must be accurate. When the drawer is glued, proceed to remove the little material that is enough to obtain a satisfactory sliding without play **6** When gluing the guides check the alignment of the grooves, waste from the bottom or material of similar thickness is used **7** Add support and guides where they are missing. Here you can see the guides inside the drawers

## Drawers

Flush-fit drawers are the most difficult to make as they have to fit perfectly within the frame and there should only be a small gap around the drawer, so the drawer itself needs to be perfectly square, or it will rack and jam as it is opened and closed. However, unlike the frame where most of the hand work is hidden, the drawers are always on show, and so it is worth spending that extra bit of effort on them. The drawers on my table have oak fronts and oak matchboard bottoms with beech sides and back.

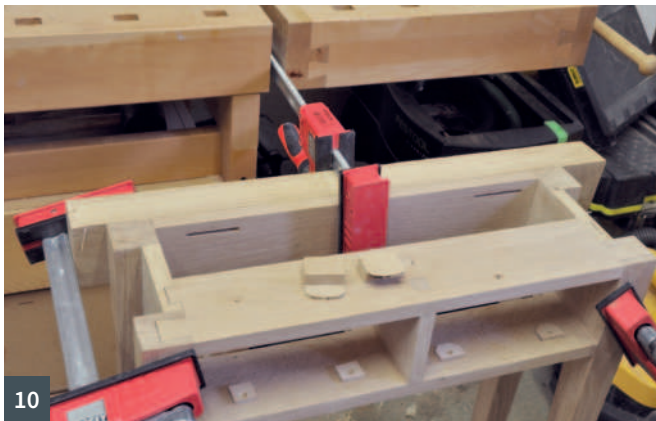
Bearing in mind that the drawer is made to exactly fit the opening and I expected to have to trim it to fit, I cut all the pieces to size and

then used a shooting board to make sure all the boards were perfectly square before marking out and cutting half-blind dovetails at the front and through dovetails at the back.

These drawers are fitted with slips; this is the traditional way to make drawers and allows slim drawer sides to be used. I cut the groove that will house the bottom in the drawer front and cut the groove in the slip at the same time. I then assembled and glued the basic drawer making sure it was both square and flat. I then tested this for fit and, as expected, it was too tight. I planed off small amounts from each side until it ran comfortably.

The slips could then be cut to length and glued to the sides, I used a





**8** One strip is screwed onto the central crosspiece and two more onto the sides of the table to allow the drawers to be supported and guided in the back of the console **9** The two stops that align the front with the front crosspieces of the piece of furniture. These are two plywood blocks screwed to the lower crosspiece **10** The top is screwed to the front crosspiece but it is free to expand and contract while being held to the structure. Two wooden brackets screwed to it fit into the rear crossbar via two grooves. To cut these housings, disc cutters are used, extending the support base on the rear crosspiece with a ruler clamped to the structure **11** The finished table

scrap piece of matchboard to make sure the grooves aligned. Once dry I fitted the bottom and screwed this to the back to allow for any movement in the wood. I then checked that the drawer was still a good fit.

I then had to fit the drawer runners as, even though the frame is small, the drawers will run better with runners fitted; there was no need to fit kickers. The runners are simply screwed in place, one between the drawers and one at each side. Finally, I screwed a pair of drawer stops, made from 6mm ply, for each drawer. To continue the handmade feel of the piece I turned a couple of small knobs on the lathe which were glued to the drawer fronts. It took me a full day to make and fit the two drawers.

## Finishing

The front is screwed down through the top rail but to allow for movement the back is fixed down with buttons. I cut two slots in the back rail and made two matching buttons.

I treated the top, frame and drawers separately with an abundant application of Liberon finishing oil using a cloth and brush, followed by, after about 15 minutes, the removal of the non-absorbed product with a cloth.

Two or three coats given every 12 hours guarantee a soft and natural finish to the frame and drawers; for the top, which is more subject to wear, it is better to give an extra pair of coats.



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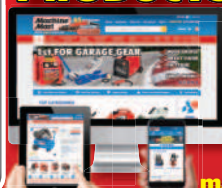
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# FABRICATING BEAUTIFUL OBJECTS

From staircases to pavilions, design and fabrication company **Cake Industries** works on a variety of fascinating projects; we [learn more about them here](#)

London-based Cake Industries is a design and fabrication company that produces a range of beautiful objects; their work can be anything from sculpture to staircases, and cabinetry to pavilions.

Directors Keefer Erickson and Andy Creed founded the company in 2009 – the firm's name is an anagram of their initials. The collaboration brought together their complementary backgrounds in industrial and architectural design, steelwork and cabinetmaking.

A third director, David Knight, later joined Keefer and Andy and together they developed a company with a strong design, structural engineering and fabrication capability.

Their projects range in scale from individual pieces of furniture to large structural steelwork, small bridges and buildings. They include art installations, staircases, bespoke kitchens, cabinetry, fitted furniture and other interior projects.

The Outdoor Living Room Pavilion is clad in glue-laminated larch timber with brightly coloured powder-coated aluminium shingles covering the exterior



## First major commission

The first major project for Cake Industries was a commission from Chris Wilkinson RA, who was asked to design and make the courtyard sculpture for the Royal Academy Courtyard for their Summer Exhibition in 2012.

Chris designed a powerful sculpture based on a series of 11 wooden artist's frames with a sequential 90° twist. It was supported on a timber structure and clad in polished stainless steel. The piece was entitled *From Landscape to Portrait*.

Cake Industries was commissioned to create the design for manufacture, construction and installation and also featured on the poster for the exhibition. When the exhibition ended, the installation was relocated to Canary Wharf.

This project was also where David met Keefer and Andy. David was the consulting structural engineer for the job and stayed in touch with Andy and Keefer after completion. David later joined the company as a director in 2017.

## The design and making process

Taking a design-focused approach to all their projects, Cake Industries is made up of a team of specialist craftspeople. They work with architects, designers, artists and contractors and on private commissions to bring ideas and concepts to life.

The company carry out a full design (including structural engineering) and assemble the elements in their south London workshop before installing them on site. At all stages they are committed to a collaborative approach with their clients to achieve the best outcome.

'We carry out all of our design in 3D packages. The majority of our work is developed in Solidworks, and we use Rhino 3D with the parametric plug-in Grasshopper for geometrically complex work and for structural engineering design,' explains David Knight.

## Materials and sustainability

Cake Industries have fully equipped steel and timber workshops and are experienced at working in aluminium, brass, plastic, concrete, and hardwood, panel and engineered timber products.

The choice of timber varies according to the demands of each project. 'The majority of our work is coordinated closely with an architect or designer's requirements for finishes. For staircases we often use English or European oak, which is hardwearing and can be stained or finished to suit. We have used a range of timbers for handrails and staircases (e.g. cherry and walnut). We have carried out a number of recent projects which use plywood structurally (as arches and beams), as well as glue-laminated larch. Our outdoor projects use naturally durable hardwoods such as iroko,' says David.

Sustainability is an important factor when choosing materials. David explains: 'As signatories to the "Construction Industry declares a climate emergency" manifesto we have an obligation to our clients to suggest sustainable solutions for their projects. This includes providing embodied carbon dioxide calculations as standard on all projects, which is often used as a design tool to promote a switch from steel to timber solutions. We obviously try to ensure all our timber is sourced from FSC or PEFC suppliers; more importantly, our integrated design process allows us to reduce wastage by ensuring pieces can be cut efficiently from sheets or billets.'



The Cake Industries south London workshop is equipped to work with metal, timber and a variety of other materials

## The Hothouse

In summer 2019 Cake Industries was approached by the London Design Festival (LDF) and became part of the team that created the arched greenhouse named the Hothouse. The finished greenhouse stands near the Olympic Park in Stratford. It is filled with plants, highlighting the many exotic varieties that may grow outdoors by 2050 if climate change continues.

Cake Industries worked closely with LDF, the architect Studio Weave and structural engineers Arup. They helped develop a design that fitted into the required time frame and budget for the project. The design also needed to satisfy aesthetic and practical requirements as well as be reusable and therefore more sustainable.

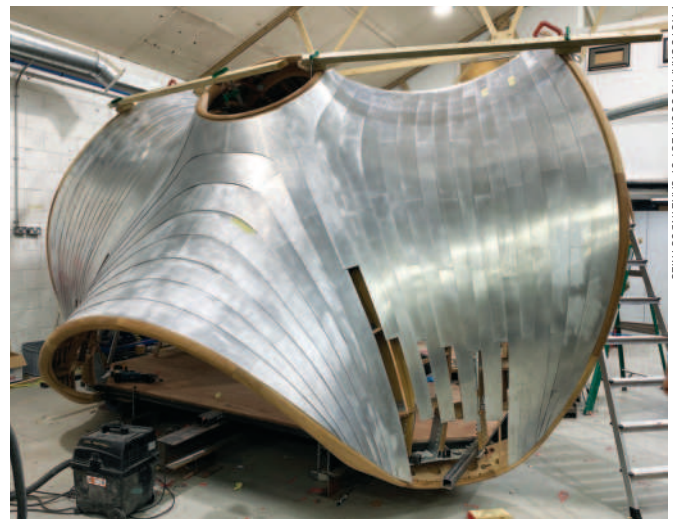
Fabrication started in the middle of July 2020 and the team worked long hours to weld the bespoke steelwork together while ensuring that all the interior elements were built on time. The steelwork was galvanised and then sent to site where they had three weeks to install the pavilion and plants.

Cake Industries also had to design the electrical items and ventilation to make sure that it didn't overheat in the summer. Despite some late summer





The Blue Stair features a delicate steel framework set off from the out of square walls of this renovated house supports solid oak treads and a brass handrail



PHOTOGRAPHS COURTESY OF CAKE INDUSTRIES

Bicupola is a recently completed pavilion for a central London location. Clad in aluminium, its plywood grid forms a doubly curved minimal surface, edged with a bespoke, robot-carved edge beam



Made for a private home in Wimbledon, this innovative staircase used CNC-cut birch plywood pieces bolted together to form a strong aesthetic statement



storms the project was completed a couple of days early in time for the launch of LDF in September 2020 where it was the landmark exhibit.

It was exciting work for the company to create a structure that is visible to so many people each day. It will remain part of London's horizon for some time to come.

## The Outdoor Living Room Pavilion

Cake Industries were approached by Lendlease to realise a competition winning scheme for a feature pavilion in the busy new commercial office district of Stratford's International Quarter, London.

The galvanised steel cantilever structure, clad in glue-laminated larch timber, is repeated through nine bays, supporting a canopy roof which wraps around one side of the structure.

Powder-coated aluminium shingles cover the exterior in a bright and colourful pattern blending from vivid pink to pastel green, creating a sculptural shelter from every view point. The vibrant colour scheme is continued in the bespoke, galvanised and powder-coated steel work of the fixed furniture inside, with durable hardwood seating and a long communal table.

## Current and future projects

Recently completed projects include a curved timber outdoor meeting room, approximately 5m<sup>2</sup>, fabricated from a complex plywood grid with a CNC-carved iroko edgebeam and clad in raw aluminium strips. They are also currently building a 10m-long arched music studio for a private music industry client out of birch plywood, clad in Douglas fir, and are in the last stages of a finishing a complex timber staircase with a central spine beam, with all structural elements from cherry including solid timber treads topped with cork.

Cake Industries is looking to expand in the future. They would love to be able to combine their structural engineering capability with the design and fabrication of beautiful objects on a larger scale. Their 'ideal project' is an architectural footbridge to provide connectivity and be a delight for users.

There is no doubt this innovative, forward-looking company will go from strength to strength and achieve their ambitions and much more.

[cakeindustries.co.uk](https://cakeindustries.co.uk)

Instagram: @cakeindustries

# RESTORING A GEORGIAN DESK

Chris Tribe makes some essential repairs to an antique mahogany bureau

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This bureau belongs to a 94-year-old lady who unfortunately fell on the lowered flap, breaking it at the hinges. I was asked to repair the flap and replace some of the cockbeading. Once I had the piece in the workshop I found that the drawers were in a fairly bad state and the bottoms of the sides were badly worn.

Some remedial work had been undertaken previously, but this had made things worse. There were also some problems with the jointing of the rails to the sides and a vertical split in one of the sides, plus some other odds and ends.

## Construction

I would estimate that the bureau is George III period. The carcass sides appear to be solid if bland mahogany – it was common for

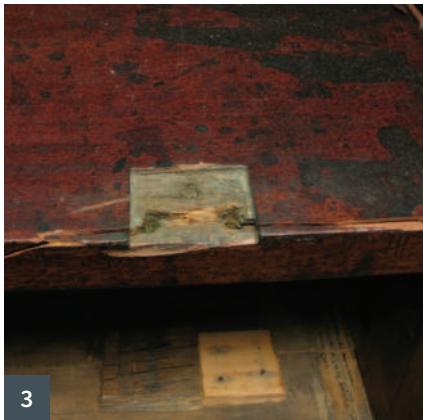
the sides of pieces to be of lesser quality as they were less likely to be on show.

The top and the interior document surface are mahogany veneer on an oak substrate. The veneer was of a good thickness, varying from around 1.5mm to 2mm, indicating age. The interior is well fitted with drawers and pigeonholes. The flap hinges down to rest on lopers that slide out from recesses at either end of the top drawers.

The main drawers run on pine dust boards along the width of the carcass and are housed into the sides. The boards are secured by kickers tapped into the housings on the underside of the boards.

The back consists of vertical deal boards nailed on. The drawer sides and bottoms are not of oak or pine, as one would expect, but a wood I had difficulty identifying – it may have been elm.





**1** Damage to the left hand of the flap; note the worn screw holes **2** Trimming off the dowels inserted to strengthen the repair to the left of the flap  
**3** Damage to the hinge point at the right side **4** Preparation for cutting the recess to repair the broken hinge area **5** Clamping on the replacement in the recess **6** Clamping an additional piece around the screw area **7** The improvised edge clamp

## Repairing the flap

The flap had broken at the hinge on the left and the hinge had broken from the interior on the right. There had been a previous breakage at this point, which had been repaired with a nail. This meant that the break was not clean so the repaired fit would not be perfect. After removing the nail the broken piece was carefully cleaned of old glue using meths and warm water, then glued and clamped into place. Animal (hide) glue should be used when re-gluing old woodwork or as a result of removing new repairs and reworking them. Modern PVA can be used on new replacement wood which is part of the fabric of the piece, but it is better to use animal glue throughout.

One of the hinge screw holes was on the line of the break so there was a danger of the repair being weakened when the screw was

replaced. All the screw holes were badly worn and had been plugged, so 6mm dowels were inserted from the edge of the flap to coincide with the position of the screws and then trimmed off with a chisel.

This helped to stabilise the repair and gave more for the screws to bite into than inserting a dowel into the screw hole. When in position the edge of the flap is angled downwards, so the dowels are not evident.

## Interior damage

At the other hinge point the damage was to the interior. The break had occurred at the line of the two front screws of the hinge, breaking away the 4mm-thick mahogany lipping and some of the oak substrate.

I decided to recess a new piece of oak underneath the veneered surface. This meant using the router running on the edge of the board,



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**8** Clamping the glue-injected rail joints **9** The kicker being glued in place; sprung lathes hold it in place **10** The vertical fillet fitted to the left-hand side **11** The worn and damaged drawer sides and nailed runner

a tricky operation requiring packing and jiggling.

I started by turning the bureau onto its back. Clearance for the router fence was created by clamping a wide board to the interior surface of the bureau.

To provide a stable surface for the router to run on, a piece of 9mm MDF with a hole in it to provide access to the area to be cut was clamped to the front of the bureau. A replacement piece was cut with angled ends and fitted by trial and error to the cleaned-up recess. Because of damage round the screw holes the area around them was replaced.

## Substrate

Some of the substrate behind the 4mm lipping had broken away so I ensured that the piece fitted snugly around the previously fitted oak piece, clamping with a small G-clamp and an oak wedge, then replaced a small strip of veneer adjacent to the hinge.

## Carcass repairs

The fit of the drawers was slack, vertically due to wear in the drawer bottoms and running surfaces and horizontally due to the sides detaching from the front rails. The rails are only retained by quite

short housings into the side pieces. I decided to inject animal glue into the joints and clamp them. Using a 1.5mm drill bit and choosing an unobtrusive location I drilled into the joint until I felt the drill hit a void. Animal glue was injected via syringe and needle into the joint and the sides were clamped. I used a needle from the local vet to inject the glue, the sort he uses on horses. For more delicate jobs, like re-laying veneer, a hamster needle may be more appropriate.

## Missing kicker

An issue probably related to the loose side joints was a missing kicker on one of the housings between the dust boards and the side. This was shown by the dust board dropping in its housing, thus increasing the slackness of the drawer, and was corrected by fitting a 25mm-wide piece of oak into the housing below the dust board. The piece was glued and held using sprung lathes.

## Vertical split

The left side had a vertical, fairly straight split from top to bottom where the boards had parted. After cleaning any debris and wax from the opening a fillet of mahogany was planed up to fit, catering for the slight taper from top to bottom. The fillet was also tapered slightly in





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**12** Grooves worn in the dust boards by drawer runners **13** Damage to the drawer bottoms from rubbing on stops **14** Fillet glued in place on the dust boards using sprung lathes **15** Cutting the bottom of the drawer sides with router collar bearing against MDF straightedge **16** L-shaped area removed from the bottom of the badly damaged drawer side

width to gently wedge into the split. The fillet was glued and tapped home, leaving a small amount standing proud to be removed with a block plane and scraper after the glue had set.

## Drawer repairs

Because the drawer sides were only 7–8mm thick and the bottoms were much thicker than that, there was considerable wear and break up at the bottom of the sides. To remedy this, a previous restorer had nailed some pine runners to the bottom. The pine had worn to allow the nails to excavate grooves in the runner boards, causing the drawer stops to wear wide grooves in the bottoms.

To remedy these problems I decided to fit oak fillets on the dust boards and to replace the bottoms of the drawer sides in order to provide good running surfaces for the drawers and lift them up to prevent wear to the bottoms.

Using a shoulder plane a groove was excavated next to the carcass side. To ensure a clean edge to the groove, a marking knife was used to cut the fibres at the edge, using the plane edge as a guide for the knife.

The groove was deepened until a flat bottom was achieved, about 3mm, and a 3mm fillet was glued into the groove and held using sprung lathes.

## Drawer sides

The repair to the drawer sides required the removal of the worn or broken bottom parts, leaving a clean line for fitting a new piece, achieved by using a router with guide collar running against a straightedge of 9mm MDF clamped to the drawer side so that the edge was parallel with the top edge.

The cut was made with the collar bearing against the MDF. The depth of cut depended on the amount of damage to the side, in effect cutting the side in line with the underside of the drawer bottom.

A couple of the sides had damage higher up which required a shallower cut to remove an L-shaped area.

Oak pieces were used to replace the cutaway sections and rebated pieces were machined, marginally oversize to allow for trimming to fit, to fit the cutaways. After gluing up the drawers were fitted.

## Cockbeading

The 3mm thinness of the cockbead on this piece made it more prone to damage and the looper ends had almost no bead left. The rounding was formed using a block plane and abrasive paper. Damaged areas were removed and the new bead spliced in. I mitred the corners by making a jig from stock cut at 45° and clamped to a saw hook.



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**17** The replacement cockbead **18** Cockbead repair around the lock after refinishing **19** My makeshift mitre jig for working on the corners **20** Colour matching with a quill **21** Careful finishing meant the original patina was retained

## Touch up and colour out

The whole piece was carefully cleaned to remove grime and wax from around the repaired areas, using white spirit.

For the mahogany a dilute light-fast mahogany spirit stain was applied to achieve an initial colour then a light coat of button polish applied with a rubber (a water stain would be more reversible than a spirit stain).

Final colour matching was now possible using spirit stains and earth pigments mixed in a thin dilution of button polish and meths applied with a quill.

A coat of thin button polish was applied with the quill followed by more applications with a rubber to blend with the background,

and an application of mahogany antique wax was followed by buffing with a duster to bring up a nice glow.

## Conclusion

Restoration requires reconciliation of conflicting concerns. How radical should you be in repairing, possibly correcting, bad original design, against retaining the integrity of the original maker?

How far do you go to repair every single defect, against the time and profit considerations of the business and the need to allow the wear of centuries to be evident? I hope that balance has been maintained in the work undertaken on this piece.





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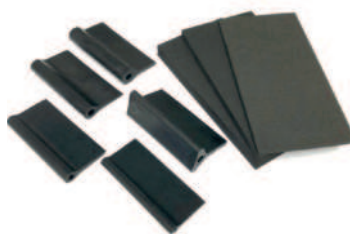
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# GILDING

Follow Steve Bisco's  
advice to enrich your  
woodwork with gold leaf

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Carvers, furniture makers and woodworkers have been decorating their work with gold since ancient times. By applying a thin 'leaf' of metal to a carved surface, the reflected light focuses attention on the curves, swirls and angles of the pattern, where otherwise, the grain and figure of the wood may distract the eye. Nothing breathes life into a carving quite like the flash and glow of gold.

If you think gilding is too difficult and too expensive, think again. It may be difficult to gild a grand palace to heritage standards, but it is well within the capabilities of the average woodworker to

decorate their own carvings and other projects to an acceptable domestic standard. It is expensive to use pure gold in large quantities, but it is almost ridiculously cheap to cover a carving in imitation gold leaf, and well within the limits of a woodworker's pocket money to decorate parts of a piece in real gold by the process of 'parcel gilding'.

For a rich 'antique gold' finish, you don't need to be rich yourself or have any experience as a gilder. Just follow these cheap and simple amateur methods and with a little practice, you will have lovely, rich-looking pieces.



## Gilding with imitation gold leaf

The cheapest and easiest way to gild a whole piece is by using imitation gold leaf – basically brass. It is sold at most art supply shops in books of 25 sheets. Each sheet measures 140mm square, so a book can cover a lot of wood, even allowing for wastage. You will also need a good quality gold lacquer for use as an undercoat, some gilding size and some French polish, which we will use as a sealer (**photo 1**).

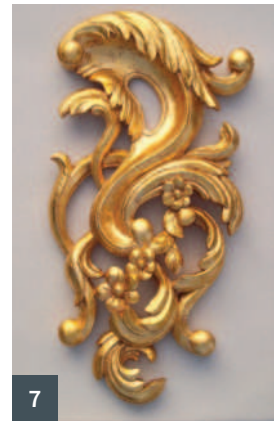
### SEALING AND SIZE

This limewood Rococo swirl is a nice carving, but the dull matt colour of the wood doesn't really give us the true period feel (**photo 2**).

Through gilding, the reflected light from the golden metal will make it sparkle like a diamond!

Start by sealing the wood with a suitable sealer (such as Danish oil) then coat the whole carving, front and back, with a good gold lacquer (**photo 3**). Put it on thinly so you don't clog the detail, and leave it to dry thoroughly.

Apply some gilding size thinly to a section of the carving (**photo 4**). Leave it for about 10 minutes until it is dry but slightly tacky to the touch. Only size an area you can comfortably gild in about 30 minutes, then progress over the carving, one section at a time.



## APPLYING IMITATION GOLD LEAF

Take a sheet of gold leaf, still in its cover papers, and cut it into pieces about 50 x 25mm with scissors. The ideal size varies according to the features on your carving – it should fit over an individual feature like a leaf or flower – if it is too big, you will waste a lot.

Fold a small piece of paper and use it to pick up a piece of leaf, then slowly and carefully – it is very thin and delicate – place it on the sized area. Press it down gently with a soft brush, and brush away any loose pieces of leaf (**photo 5**). Don't worry about small gaps – the undercoat will disguise them – but go over larger gaps with more leaf. This is a bit tricky at first, but you will soon get the hang of it.

Where the surface is concave, place the edge of the leaf in the hollow, and lay it up and over the adjoining ridge. If the leaf spans the hollow, it will just tear in the middle.

## ANTIQUING

Imitation gold leaf needs a sealer to stop it tarnishing. It also looks a bit 'brassy' so to 'antique' it and seal it at the same time, you can use French polish (a form of shellac).

Apply the French polish thinly by brush, letting it settle a little in the crevices (**photo 6**). Work quickly as it dries fast, and avoid going over the same bit twice, or you will build up a muddy looking patch. If it all goes horribly wrong, wipe it off with methylated spirit and start again.

Now see the difference (**photo 7**). The combination of imitation gold

leaf and French polish gives a rich antique gold finish that will sparkle off the curls and swirls. Compare it with photo 2 to see how much glamour we have brought into its life, and at such a modest cost.

## Parcel gilding with pure gold

Some jobs are worth going the extra mile, and there is nothing quite like real gold for giving your project an authentic period look. Pure gold leaf of 22 to 24 carats (I use 23½ carat) is more expensive and a bit harder to handle than imitation gold leaf, but it gives a true gold finish that needs no sealer and will never tarnish.

Although more expensive, it is not prohibitively so, especially when used as 'parcel gilding'. 'Parcel', in this context, is a corruption of 'partial' and refers to the practice of gilding parts of a carving as highlights, leaving the rest painted or French polished.

Real gold leaf is much thinner than imitation gold, and the first time you try gilding with it, you will find it frustrating, but you will soon get the hang of it. Like imitation leaf, it comes in books of 25 sheets, but each sheet measures only 80mm square – a third of the area of an imitation leaf. You will need to source it from a specialist supplier.

Real gold is best applied over several coats of gesso, which gives a smooth surface to the wood. Traditional 'rabbit skin glue and chalk' gesso is fiddly to use, so buy a tub of ready-mixed acrylic gesso from any art store.

You will also need some gilding size, some red and yellow food colouring, a soft brush for pressing down the leaf, and a special 'gilder's tip' (**photo 8**).





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PHOTOGRAPH BY SHUTTERSTOCK

## SEALING AND GESSO

I'll demonstrate this technique with a Georgian-style corbel that I carved (**photo 9**).

Seal the wood with Danish oil or sanding-sealer and give it two coats of a suitable heritage paint. Apply very thinly over the detail so you don't clog it with paint.

Apply 6–9 coats of acrylic gesso over the areas to be gilded to build up a smooth surface for the gold leaf – take great care with accuracy. To make it easier to see where each coat is going, and to give a background colour to the gold leaf, add a little red food dye to the first coat of gesso, then yellow to subsequent coats (**photo 10**).

## APPLYING THE GOLD LEAF

Apply a thin coat of size to the areas to be gilded, one section at a time. The gold will stick exactly where you put the size, so accuracy is important. The size takes about 10 minutes to become touch-dry.

Carefully fold back the cover paper on a sheet of gold leaf (it is very delicate) and gently score across the leaf with a knife at the edge of your fold. Cut it into sections slightly larger than the patch you are going to gild. Pick it up slowly and carefully with a 'gilder's tip' – rub it in your hair first to build up static – lower it carefully into position, and press it down gently with a soft brush (**photo 11**). Brush away loose leaf from the edges and go over bare patches again with small pieces of leaf.

This carving (**photo 12**) took about 40 leaves of 23 $\frac{3}{4}$  carat gold at a total cost of about £30. It is much more expensive than imitation gold but as it will never tarnish, it will not need sealing and will retain its brightness for very many years.

## Try it for yourself

I hope this article has given you the inspiration to experiment with gold leaf for yourself. You'll be surprised by how easy it is and the range of things it can be applied to. Why not try adding gold to a picture or mirror frame (**photos 13 and 14**) for a rich finish?

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# SLAB TABLE

Mark Ripley builds a heavyweight table that can be taken apart for easy transport

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One of my clients saw a laminated-back chair and a slab-end-style coffee table that I had exhibited in a show, and commissioned eight chairs and a refectory table, based on those designs.

In order to make the design work ergonomically, the table needed to be at least 2,400mm long but the client thought 2,200mm was the maximum the room could take. I was pleased that they wanted a static table, as opposed to an extending one. An extending table is a different challenge, but a static table has a directness and simplicity that I find appealing as a design opportunity.

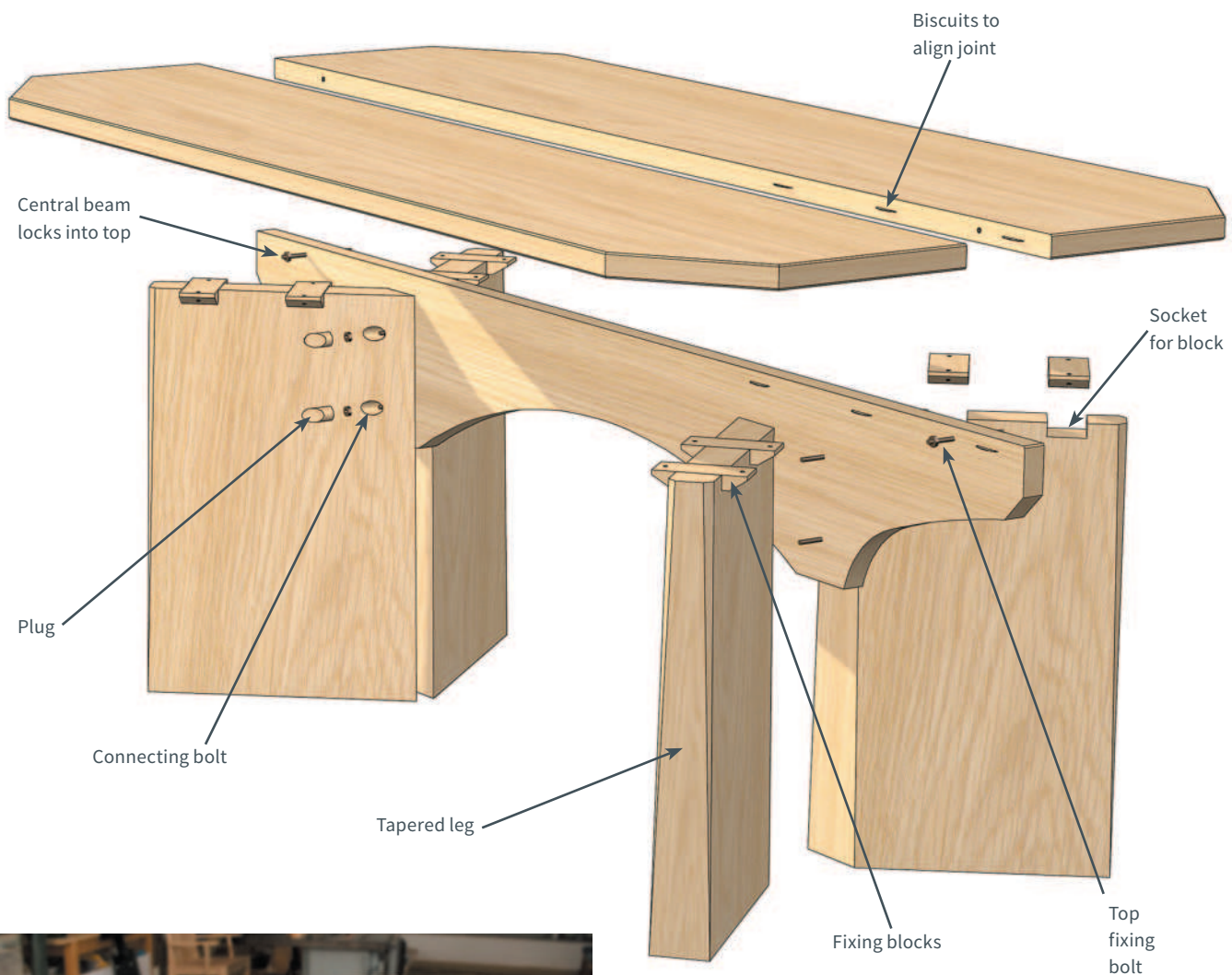
However, we were left with the problem of accommodating the legs

of the sitters, especially at the ends. It was the client's idea to turn the slab legs inwards, and the design was developed through scale models, as it was difficult to visualise two-dimensionally.

The first realisation was that inclining the legs and deepening the top rail created a very strong and simple structure, which obviated the need for a lower stretcher rail and left foot room unrestricted.

In practice, the table accommodates eight comfortably, as the chair was conceived as a more compact design than its predecessor, and had a smaller footprint, while maintaining the seat size and comfort of the back.





PHOTOGRAPHS BY GMC PUBLICATIONS



**1** The central stretcher beam is an integral part of the top **2** Only seven components make up the very direct, simple concept

## Construction

The construction of the table is unconventional. It comprises seven components: two tops, a top rail and four slab legs. These are all joined together with threaded stainless-steel rods set into counterbored and plugged holes. The elliptical end profile created by setting a round plug into an angled surface echoes the elliptical handles used in furniture I designed and made for the same room a year previously.

## Timber

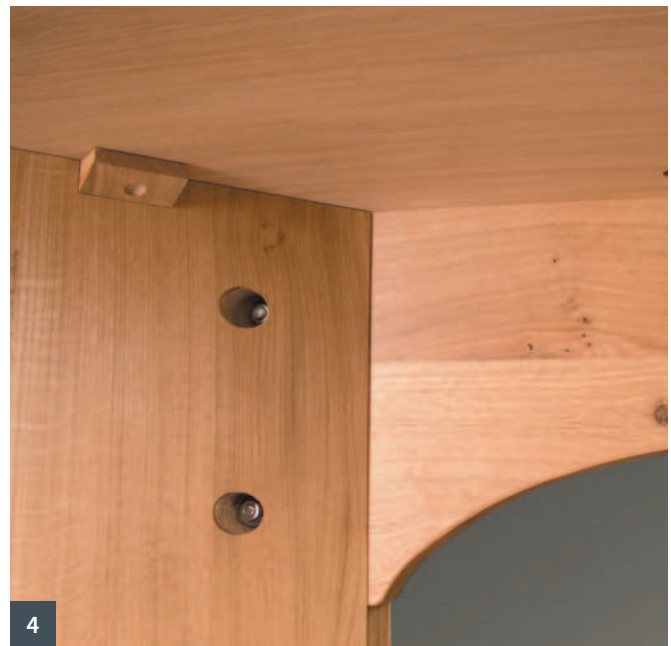
The thick sections of the components, especially the legs, require careful selection at the buying stage if expensive waste is to be avoided. I was fortunate in finding well-dried 100mm-thick boards with one square edge and about 305mm clean timber before the sap; 3,000mm lengths of this allowed the legs to be prepared with little waste – given the cost of prime 100mm oak, this was just as well. I also knew that there was plenty more in case of mishaps.

The 50mm for the tops and frame was also carefully selected, but with more allowance for selecting planed stock for the table top, I would like to have made the top from two 510mm widths; that, however, proved unrealistic. There is a single joint in each leg and in each half of the table top.



**3** Biscuits help align the top while bolts hold it all together

**4** Underneath, note the slot which takes the top fixing bolt and is covered by a capping piece **5** The leg bolts are covered with plugs



**4**



**5**

## Preparation

The first stage in making is the hard graft of machining the raw material into components. While ripping the 100mm board to sizes that I could handle, I burned out my portable circular saw!

The tops and rail were prepared into six planed boards, thickened to 48mm allowing for final selection and planing of the four table-top members when they settled, one for the rail and one spare. I had someone with me on work experience for one day, and made use of the extra set of muscles to further plane and thickness the components.

## Making the tops

The tops are fine-thicknessed and made with biscuited butt joints, faced off and sanded. The edges are dimensioned and sanded all round.

## Leg taper and construction

The leg stock was quartersawn and of even colour, making the setting out for gluing easy. By making stopped cuts two-thirds and one-third along the board and then turning the piece around and planing in the opposite direction, a clean result can be produced safely. This process has to be carried out twice on each face to achieve the required taper.

Once the butt joints have been prepared, biscuit joints are cut off each face to produce a double row of biscuits in each joint.

After gluing, the faces were sanded. I used a pad sander with a batten supporting the narrow end to make the surface parallel with the sanding belt. The bevels were sawn on the bandsaw and planed true by hand.

Tapered chamfers on the outer edges are again cut on the surface planer. These components are heavy and, like any heavy woodwork components, are easily damaged yet need to be made to accurate dimensions. Obviously care needs to be taken in machining and lifting during such jobs.

## Stretcher rail

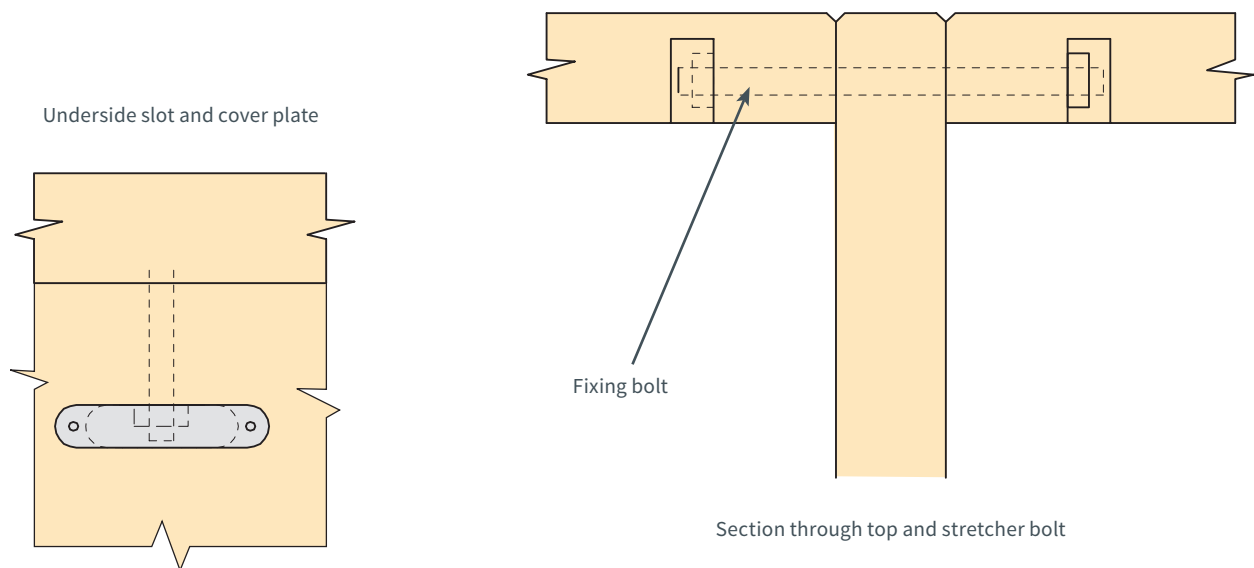
The legs and tops were set up on the workshop floor, and the stretcher

rail positioned and supported between them. Fine-tuning of the positions of the legs and the cutaway corners on the tops can then be tried and tested. I tried out all seating positions on the prototype chair, in order to establish the optimum distance between legs, then the inside bevels were re-checked for alignment, and fine planed. The positions of the legs on the rail, then the curves, were marked, sawn to shape on the bandsaw and finished with a spokeshave. The corner reliefs are then sawn with a portable circular saw and hand planed to finish.

## Boring set-up

The positions for the top/rail bolts are marked on the table edges and rail. Routed slots cut on the underside of the tops give access for fitting the washers and nuts, and tightening them with spanners. These slots are 30mm deep by 40mm long with a further 12mm each end at 4mm deep.





6

6 The fixing blocks are screwed into sockets

Biscuit slots are cut in the table edges and rails to aid alignment. I used an 8mm threaded stainless steel rod throughout and drilled 10mm holes with the hole slightly reamed with a countersink to make rod fitting easier.

Setting up for the legs/rail uses a similar technique to the top/rail joints with the complication that the leg joints are drilled at an angle. These were drilled freehand after careful marking. The holes in the rail are 112mm diameter to allow for rail movement. The nuts are fitted with socket wrenches.

## Legs/top blocks

Fixing blocks are let into the tops of the legs to which the tops are screwed. I made a simple jig to rout a recess in the legs.

The eight blocks begin as a strip which is fitted to the recess. The central holes are marked and drilled before the individual blocks are cut off and tapered. Holes are drilled into the angled faces and countersunk before the blocks are sanded.

## Plugs

The plugs for the legs are individually turned on the lathe, beginning with a 125 x 25mm square blank, to allow enough length for easy handling. Initially the blanks are turned to cylinders and then to a taper and checked for fit. The bevel is marked from the table legs, and each one is individually fitted and numbered. The plugs project by 2mm with a chamfer filed onto the outside edge.

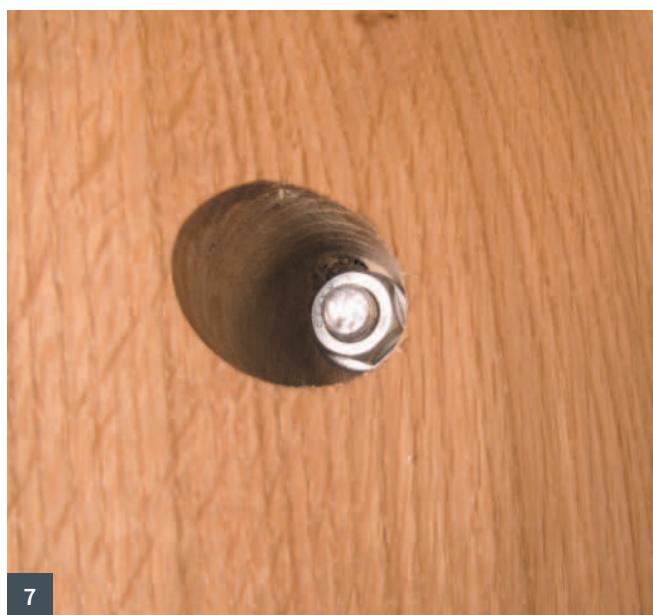
Covers for the table-top slots are again made in a single strip before cutting off and fitting. They are drilled and countersunk to take No. 4 screws.

## Assembly

At this stage a full assembly is set up. Cutting the threaded rod to length is done with a hacksaw and the ends are chamfered on a linisher, using an old belt to remove sharp edges and burrs and ease the fitting of the nuts.

- ♦ First the blocks are screwed to the tops of the legs. The assembly sequence is to set up the legs of one side, and place them in position on the floor.
- ♦ Push threaded rods with nuts and washers fitted to one end. The rail slides onto these and the opposing legs are fitted and bolted in place. The bolts are tightened with two inexpensive socket spanners.
- ♦ Next, the biscuits are fitted to the divider together with the threaded rods. Both tops are placed in position, and the washers and nuts fitted. When the alignments are correct, the nuts can be tightened.
- ♦ The ends of the table top and rail can be finely trued. The assembly will not be glued. The table is very heavy and yet in its knock-down form, I had no trouble delivering and setting it up single-handed.

Once the assembly has been successfully set up and numbered, it is taken apart for chamfering of the top edges, rail and feet.



7 One of the bolts that locks the legs in place

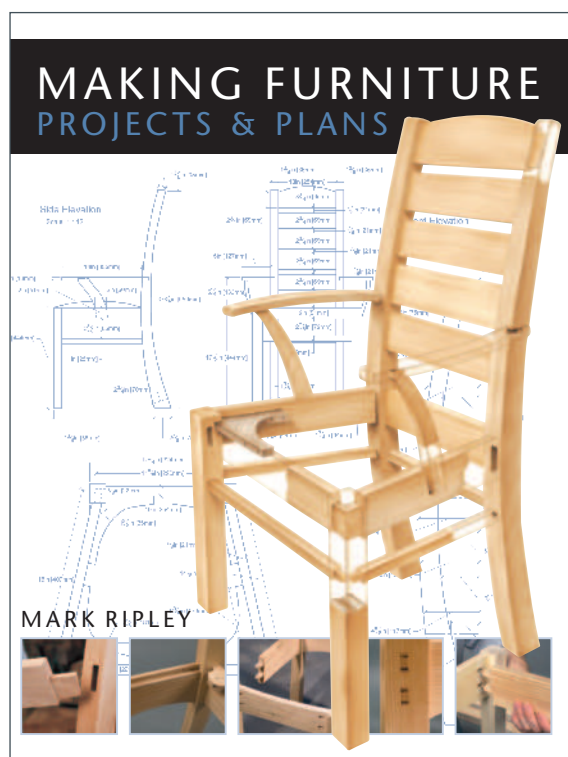
## Finishing

The whole job is fine sanded and sealed with thinned polyurethane, three coats on the top cut back between coats, and one elsewhere.

A palm sander with 240-grit silicon carbide paper prepares the sealed surfaces for three coats of Danish oil, then all that's left to do is a final assembly.

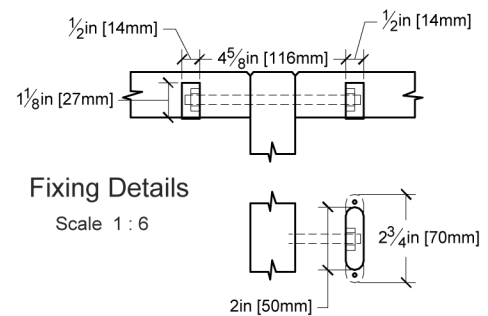
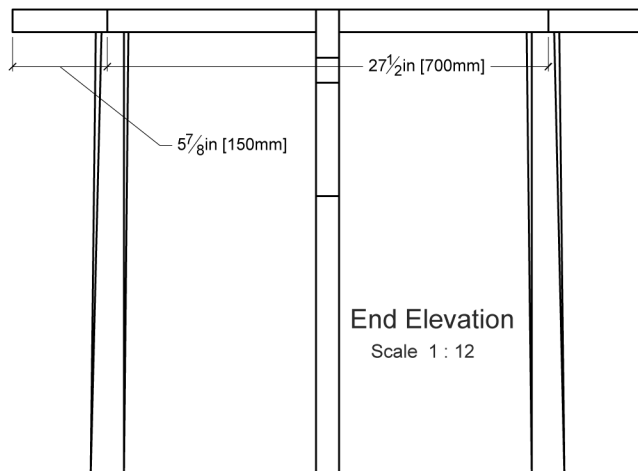
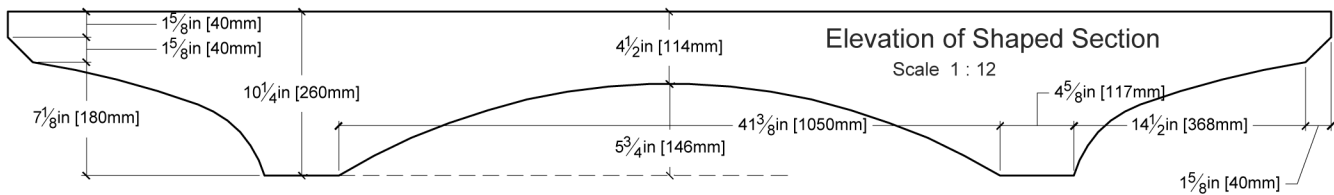
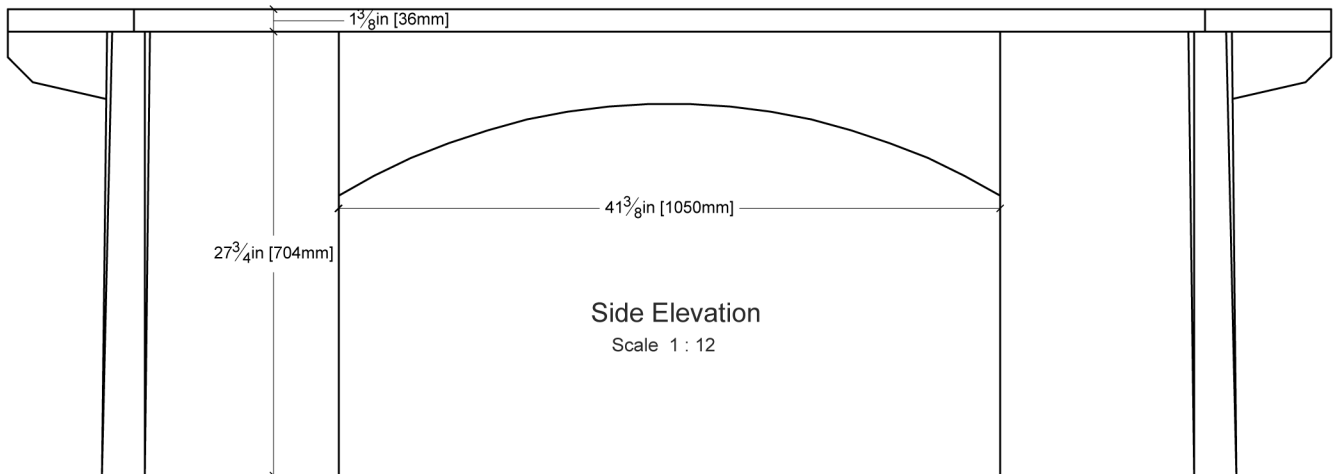
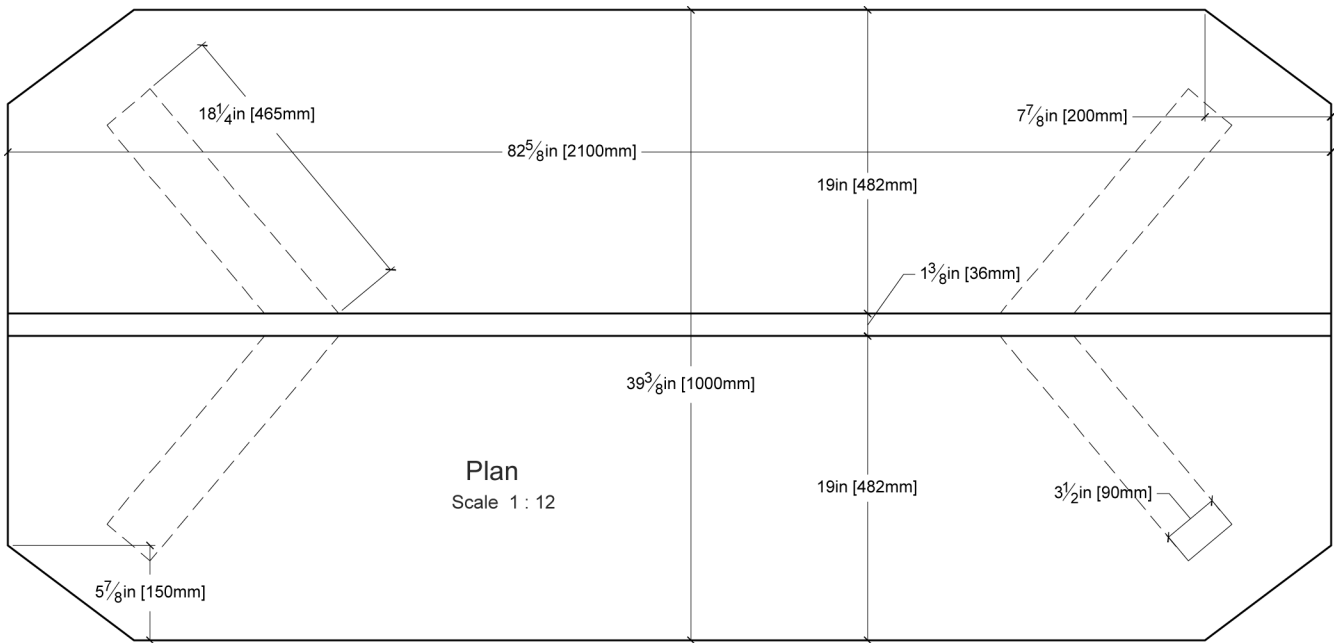
I recommend a bi-monthly dressing of teak oil on table tops. I've found that polyurethane is flexible, so it does not chip or craze and has excellent heat and moisture resistance. It also has UV protection and wood does not darken as much as it does under a pure Danish oil finish.

The legs and frames do not need quite so much work – a sealing coat of polyurethane and two to three coats of Danish oil will suffice.



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A collection of various woodworking tools is scattered across a rustic wooden surface. In the top left, there's a wooden handle and a red-handled tool. To the right, a red square tool with a hole is visible. Below it, a black and red tool with a serrated edge lies horizontally. On the left side, a hammer with a black head and a wooden handle is positioned vertically. In the bottom left corner, a black tool is partially visible. On the right side, a large circular saw blade with a serrated edge is partially shown, along with a long, thin metal rod. The background is a rich, textured wood grain.

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# UNDERSTANDING ABRASIVES

Steve Russell sorts out the best smoothers and shapers for woodworkers and unravels the technical jargon of abrasives

---

Woodworkers divide into three groups: those who love everything about the finishing process; those who regard it as a necessary evil; and those who absolutely loathe it. Whichever group you fall into, the fact remains that the job has to be done, and it is

a task that can be rendered more satisfactory if the most suitable abrasive is used.

In this article I'll look at popular abrasive types and list the pros and cons of their different grains, backings and coatings. I'll also explain gradings

and talk about the 11 most useful types of abrasive.

## Abrasive terminology

Before we discuss specific abrasives, it's helpful to know some of the terms used to describe them.

**Abrasive grade:** Specifies the grit size of an abrasive product. There is an inverse relationship to the size of the abrasive grains and the grade number, thus the higher the grade number, the smaller the grain size.

**Friability:** The ability of an abrasive grain to cleave easily along weak crystallographic planes, producing new sharp fracture facets.

**Loading:** Term used to describe the accumulation of resins, sawdust or finish on the surface of an abrasive.

**Micron:** One millionth of a metre, or one twenty-fifth of a thousandth of an inch. This term is used to describe the average abrasive particle size of very fine microgrits and abrasive powders.

**Micron-graded abrasives:** A more precise grading system than the traditional grit grading process that utilises stringent controls for producing abrasives with a more consistent and superior scratch pattern. Typically used with diamond and micro-finishing abrasives.

**Mohs:** Mineral hardness scale introduced by Friedrich Mohs in the early 1800s, going from talc with a value of one to diamond with a value of 10.

**Zinc stearate:** A dry white-grey non-abrasive lubricant added to some coated abrasives that reduces loading on the surface of the abrasive

## Abrasive grading comparisons

Two primary standards exist for classifying



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the grit size of abrasives. In the US the CAMI (Coated Abrasives Manufacturing Institute) standard is used. Europe uses the FEPA (Federation of European Producers of Abrasives) standard. Japan uses the JIS (Japanese Industrial Standard), which is equivalent to the FEPA standard. FEPA-graded abrasives can be easily distinguished by the letter P in front of the grit number, such as, for instance, P240. There are sizing differences between the CAMI and FEPA standards, so the two are not universal.

|                                                    | FEPA grit designation for coated abrasives | CAMI grit designation | Average grain diameter in microns |
|----------------------------------------------------|--------------------------------------------|-----------------------|-----------------------------------|
| Macrogrits – abrasive grains coarser than 240 grit |                                            |                       |                                   |
| Extra coarse                                       | P12                                        |                       | 1,815                             |
|                                                    | P16                                        |                       | 1,324                             |
|                                                    | P20                                        |                       | 1,000                             |
|                                                    | P24                                        |                       | 764                               |
|                                                    |                                            | 24                    | 708                               |
|                                                    | P30                                        |                       | 642                               |
|                                                    |                                            | 30                    | 632                               |
|                                                    |                                            | 36                    | 530                               |
| Coarse                                             | P36                                        |                       | 538                               |
|                                                    | P40                                        | 40                    | 425                               |
|                                                    |                                            | 50                    | 348                               |
| Medium                                             | P50                                        |                       | 336                               |
|                                                    |                                            | 60                    | 265                               |
|                                                    | P60                                        |                       | 269                               |
|                                                    | P80                                        |                       | 201                               |
| Fine                                               |                                            | 80                    | 190                               |
|                                                    | P100                                       |                       | 162                               |
|                                                    |                                            | 100                   | 140                               |
|                                                    | P120                                       |                       | 125                               |
| Very fine                                          |                                            | 120                   | 115                               |
|                                                    | P150                                       |                       | 100                               |
|                                                    |                                            | 150                   | 92                                |
|                                                    | P180                                       | 180                   | 82                                |
|                                                    | P220                                       | 220                   | 68                                |
| Microgrits – abrasive grains 240 grit and finer    |                                            |                       |                                   |
| Very fine                                          | P240                                       |                       | 58.5 +2                           |
|                                                    |                                            | 240                   | 53.0                              |
|                                                    | P280                                       |                       | 52.2 +2                           |
|                                                    | P320                                       |                       | 46.2 +1.5                         |
|                                                    | P360                                       |                       | 40.5 +1.5                         |
| Extra fine                                         |                                            | 320                   | 36.0                              |
|                                                    | P400                                       |                       | 35.0 +1.5                         |
|                                                    | P500                                       |                       | 30.2 +1.5                         |
|                                                    |                                            | 360                   | 28.0                              |
| Super fine                                         | P600                                       |                       | 25.8 +1                           |
|                                                    |                                            | 400                   | 23.0                              |
|                                                    | P800                                       |                       | 21.8 +1                           |
|                                                    |                                            | 500                   | 20.0                              |
|                                                    | P1000                                      |                       | 18.3 +1                           |
| Ultra fine                                         |                                            | 600                   | 16.0                              |
|                                                    | P1200                                      |                       | 15.3 +1                           |
|                                                    | P1500                                      | 800                   | 12.6 +1                           |
|                                                    | P2000                                      | 1000                  | 10.3 +0.8                         |
|                                                    | P2500                                      |                       | 8.4 +0.5                          |

## Abrasive types



### POWDERED GLASS (5 MOHS SCALE)

Although still available, this is rarely used today except for hand finishing. Glass papers are usually pale yellow. This type of abrasive has been superseded by those which can be used dry or wet and which cut quicker and leach colour. It is available in sheets.

#### Pros:

- Inexpensive
- Still popular with French polishers for cutting back cured finish surfaces
- Can be used for abrading leather, plaster of Paris, polyester and epoxy fills and glazed ceramics.

#### Cons:

- Very slow cutting
- Wears and loads easily
- Useful for hand sanding only.



### EMERY (7.5–8.5 MOHS SCALE)

A dark grey, blocky-shaped impure form of corundum, a natural aluminium oxide. The use of emery abrasives has been largely replaced with newer high-

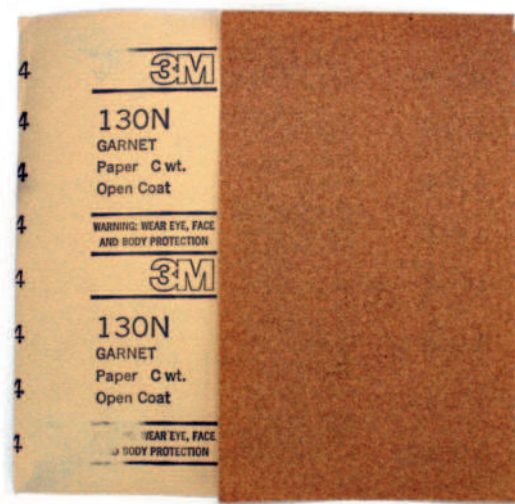
performance synthetics. Available in sheets, strips and rolls.

#### Pros:

- Useful for some metal finishing and glass grinding operations
- Available in sheets, strips and rolls.

#### Cons:

- Slow cutting
- The shape of the grains can create deep scratches in wood and its grains can cause tannin-rich woods to discolour.



### GARNET (7.5–8.5 MOHS SCALE)

A naturally occurring, very sharp dark reddish-brown abrasive grain made from semi-precious garnets. Of the seven species, pyrope – a magnesium aluminium silicate – and almandine – an iron aluminium silicate – dominate. Available in sheets, belts and discs.

#### Pros:

- Inexpensive
- When used by hand, garnet abrasives can leave a smoother finish, grit for grit, than aluminium oxide-based abrasives
- Works well on softer woods.

#### Cons:

- Abrasive grains wear out quickly when used in power-sanding operations
- Limited availability.



## ALUMINIUM OXIDE (9.0 MOHS SCALE)

One of the most popular man-made abrasives featuring very tough wedge-shaped grains that lack a clearly defined crystal structure. Aluminium oxide is manufactured using a fusing process from bauxite in a Higgins furnace at very high temperatures. Aluminium oxide abrasives include those made from brown – the most common type – white and pink aluminium oxide grains. Available in and for sheets, rolls, belts, H&L discs, flap wheels, fibre discs and others.

### Pros:

- Very tough and durable
- Recommended for use on hard woods and for grinding some types of metal including carbon steel, alloy steels and bronze. Heat-treated products offer extended life.

### Cons:

- Lack of a clearly defined crystal structure in lower grades causes the grains to round over when worn instead of fracturing
- Higher grades feature friable grains and have a significantly longer life.



## SILICON CARBIDE (9.25 MOHS SCALE)

A black synthetic material with a hexagonal crystal structure and blocky, sharp-edged grains, manufactured by the reaction of silica sand and coke in an Acheson furnace at very high temperatures. It has very good friable grain structure that breaks along crystal cleavages to expose new sharp-cutting

surfaces. Available in and for sheets, H&L discs, strips and belts.



### Pros:

- Can be used wet or dry
- Grains are among the hardest synthetic abrasives, being surpassed only by diamonds, cubic boron nitride and boron carbide
- Excellent for cutting back hard lacquer, epoxy and urethane finishes
- Can be used on some metals and plastics.

### Cons:

- Dark, brittle grains can release during sanding and discolour light-coloured timbers.



## ALUMINA ZIRCONIA (9.2–9.5 MOHS SCALE)

A synthetic abrasive with self-sharpening crystalline structure with blocky grains, manufactured from aluminium oxide and zirconium oxide and quenched when molten, producing a crystalline structure that fractures well in use, revealing new cutting edges. Available in and for sheet, disc, belts, fibre discs and flap wheels.

### Pros:

- Extremely sharp and durable self-sharpening grains with excellent friability
- Excellent for use in heavy-duty stock removal or production sanding operations.

### Cons:

- Expensive
- Extreme hardness of grains makes it difficult to crush into fine grit sizes, generally limiting availability to 150 grit or larger.



## CERAMIC ALUMINIUM OXIDE (9.5 MOHS SCALE)

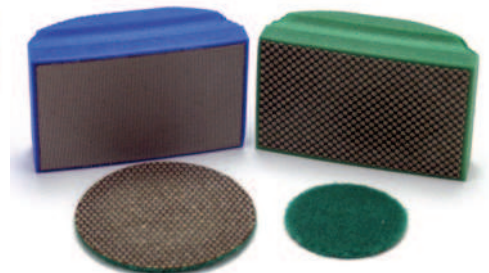
An exceptionally hard and sharp synthetic abrasive with a very uniform crystalline structure that is formed when alumina gel is dried and crushed. The name is derived from a manufacturing process that is similar to manufacturing industrial ceramics. Available in and for sheet, PSA discs, flap wheels and belts.

### Pros:

- Exceptionally hard-wearing. Lasts 5–7 times as long as standard abrasives on wood
- Grains fracture on a sub-micron level
- Overall, the best abrasive for heavy shaping and the production sanding of wood.

### Cons:

- Expensive
- Grit sizes are limited to 80–220.



## DIAMOND (10 MOHS SCALE)

The hardest-known substance, diamond abrasives are made from carbon and are manufactured using natural diamonds and man-made diamonds. Industrial diamonds occur as three main types: bort (single crystal non-gem-quality fragments), ballas (spherical masses of crystals) and carbonado (impure diamonds). Available in and for H&L discs, flexible foam hand pads, PSA discs.

### Pros:

- Extremely durable abrasives offering exceptionally long service life when used on a variety of hard and tough materials
- Excellent grading and uniformity of particle sizes ensures a superior finish
- Best abrasive for sanding stone and glass inlays.

### Cons:

- Expensive.





## OPEN COAT

Open-coat abrasives have grains covering about 50–60% of the backing surface. This system offers a faster cut and increased flexibility when compared to closed-coat abrasive systems. In addition, the open coating offers more resistance to loading on the surface on the abrasive.

## CLOSED COAT

Closed-coat abrasives have abrasive grains covering 100% of the backing surface. The increased density of abrasives on the surface makes these abrasives less flexible than open-coated abrasives. Closed-coat abrasives offer increased stock removal rates when compared with open-coat abrasives.



## NON-WOVEN SYSTEMS

Non-woven-based abrasives offer significant advantages over traditional products like steel and bronze which tend to load easily and wear out quickly. Non-woven abrasive pads are constructed from flexible non-metallic materials and do not compromise the surface with metallic fragments that may eventually rust or discolour pale timbers.

The primary abrasives used in non-woven abrasive pads, from most aggressive to least abrasive, are: aluminium oxide (brown, tan, maroon and blue pads), aluminosilicate (green pads) and talc (white pads).

These are available in and for sheets,

H&L discs and belts. Non-woven surface-conditioning pads offer consistent performance with an easily controlled cutting action that resists loading. Non-woven abrasives are also available as polishing papers in roll, sheet and disc form, in sizes ranging from 1–30 microns.





# TOOLS OF THE LUMBERJACK'S TRADE

Discover the hardware used by 19th-century loggers



A logger uses a crosscut saw in Malheur National Forest, Oregon, 1942



*Lumberjack* by Lauren Jarvis, Ammonite Press, RRP £9.99, available online & from all good bookshops

Today's high-tech harvesters can cut and clear trees with ease, but in the 1800s, logging with hand tools was back-breaking work. Here's a guide to the essential old-school lumberjack hardware.





Two lumberjacks pose with the tools of their trade in Wisconsin, ca. 1900

## Axe

The essential and most iconic of all lumberjack accessories, the axe was the primary tool used for felling trees until saws became the preference in the 1880s. Loggers had the choice of two heads: single- or double-bitted, with many different head shapes and weights to choose from. Wider blades are better for chopping softwoods, and narrow blades are better for hardwoods. Axes were also used for cutting the branches off trees, known as 'limbing'.

## Crosscut saw

Still widely used around the world, one- or two-person crosscut saws – measuring from 1.2 to 4.9m – are designed to cut across the wood grain. Felling saws for cutting down trees have a concave back, and are lighter and more flexible with a narrower blade; while bucking saws for cutting trees into logs have a straight back and are heavier and stiffer, with a broader blade. Loggers call the two-person saw the 'miserable whip', reflecting the hardship of a day felling trees by hand in the forest.

## Bow saw

First developed in Sweden, the smaller, one-person bow saw – also known as a buck- or Swede saw – cuts smaller logs, less than 25cm) in diameter. It was the tool of choice for cutting pulpwood – used for making paper products – in Canada and the US.

## Wedge

Essential for felling, bucking and splitting wood, wedges lift the tree, preventing it from sitting back when it's being felled. They also reduce binds on the saw during bucking, allowing the tool to continue to move freely. In the early 1800s, lumberjacks used old axe handles or wooden wedges to help fell a tree, with steel and iron varieties coming into play towards the end of the century. They usually measure up to 30cm and are 2cm thick at the head (splitting wedges are usually thicker and longer).

## Peavey

This long pole (also called a stock or handle) has a metal spike or pick

## TWICE AS TOUGH

On a double-bitted axe, one edge is usually sharp for chopping, and the other is 'stunt' or thicker for work where it may hit metal, stone or tree knots.

at the end and a lever to help grab and turn logs. Named after Joseph Peavey, the blacksmith who invented the tool that revolutionised the logging industry in 1857, the Peavey Manufacturing Company still makes them today.

## Cant hook

Similar to a peavey but, instead of a point at the end, fitted with a metal thimble with a bill and a lever. Used more frequently at the landing in the forest or the mill – rather than on the river – its primary use is for rolling logs.

## Pike pole

This wooden tool, with a straight metal spike and hook at the end, was used to transport logs along the river and construct timber rafts.

## Pulp hook

A short, one-handed device, used for moving small logs of pulpwood. The hook is made of steel with an oval handle and is useful for handling frozen wood.

## Calk or xaulk boots

This tough, spike-soled footwear gave better traction when logging in damp forests, and riding the logs on rumbling rivers during the spring drive. The boots are still worn by forestry workers today.



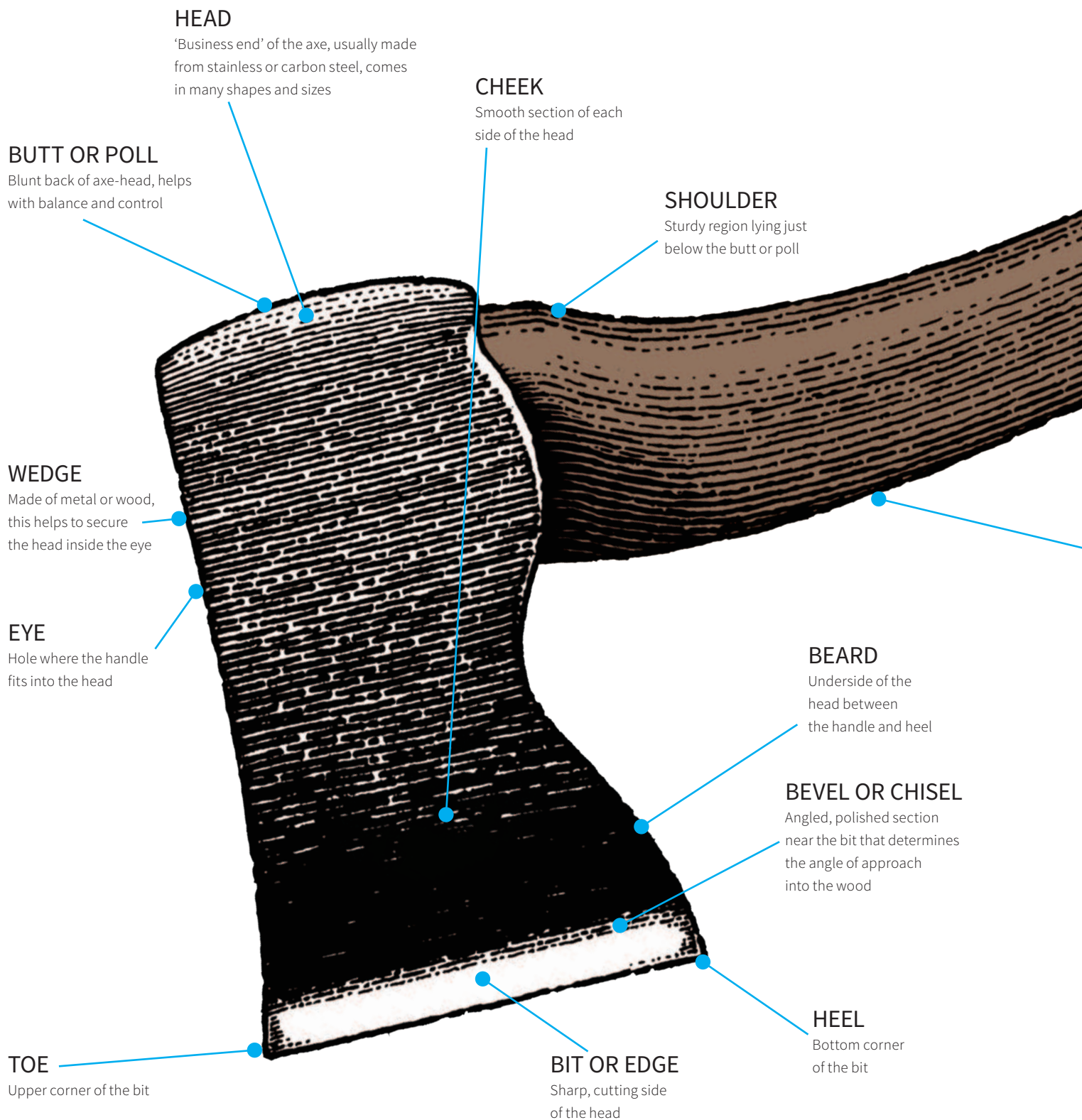
Two men use cant hooks to move a fallen tree at camp near Effie, Minnesota, 1937

## HOOKED ON THE RIVER

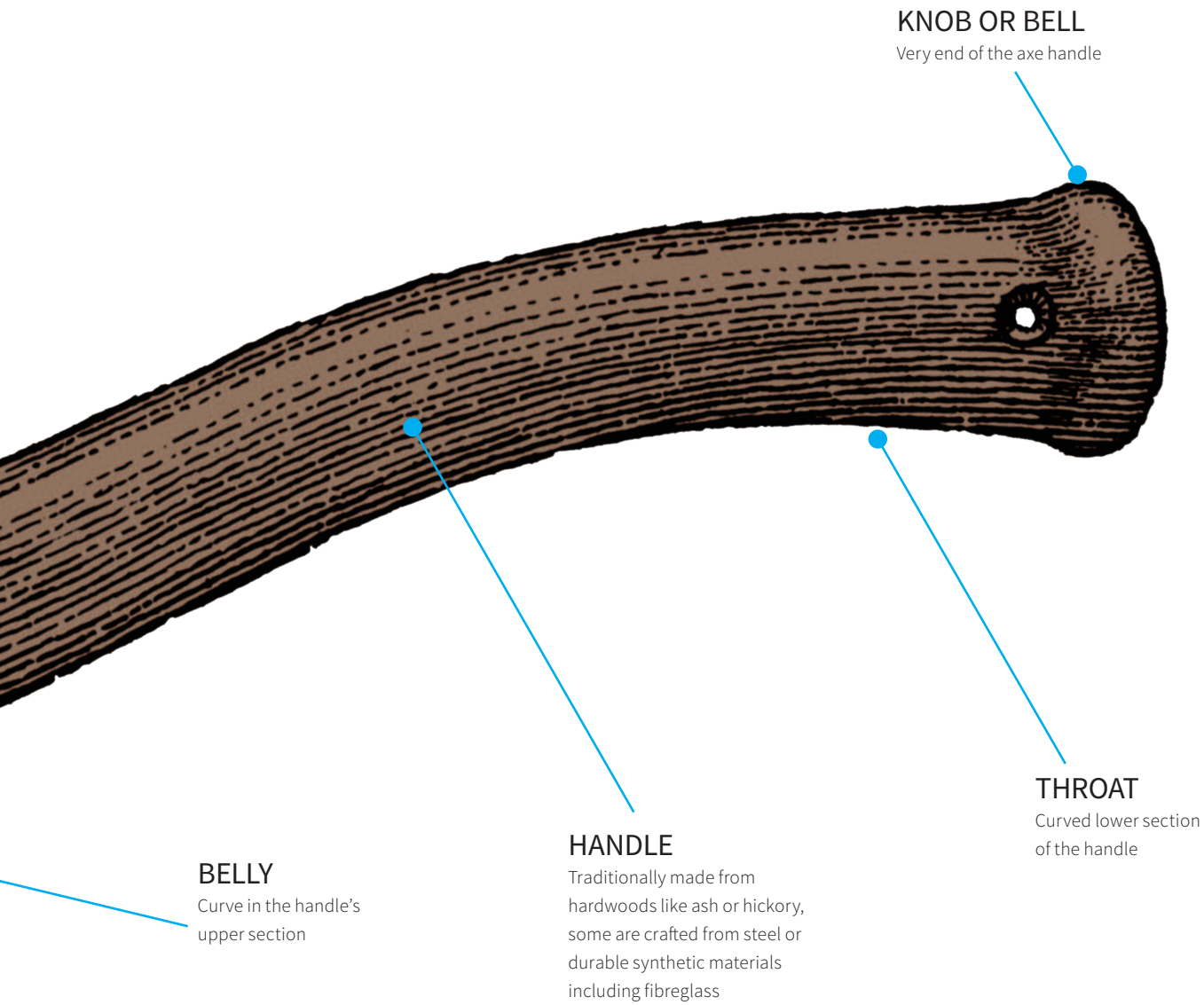
In the heyday of the river drives, Maine's Peavey Manufacturing Company made 12 different styles of hooks. The last Maine river drive was in 1976, when trains and trucks took over transporting logs to the mill.

## Anatomy of an axe

There's more to this tool than just a head and a handle – many elements are named after body parts. Here's an in-depth dissection of the lumberjack's trusty chopper.







### WEDGE ALERT

The phrase 'to fly off the handle' – meaning to lose emotional control – came from the uncontrolled way an axe head can fly from its handle if it isn't properly wedged.

# KEY CABINET

Anthony Bailey uses his router to make this handy little storage unit

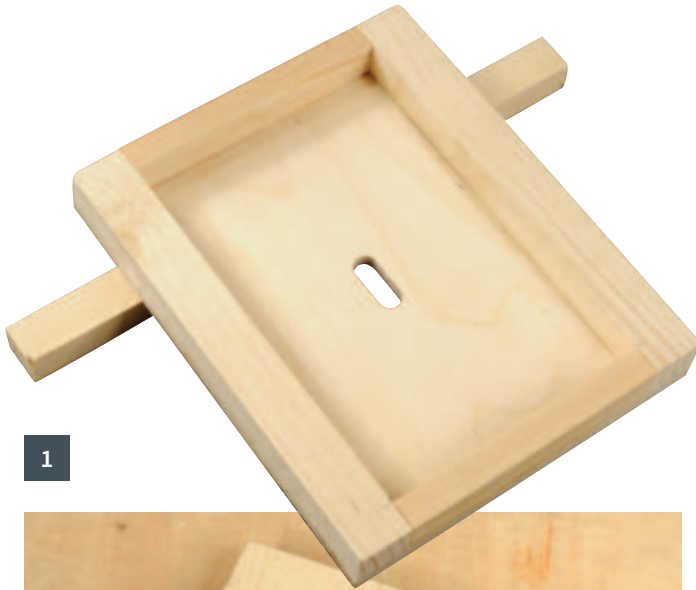
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This is a simple, but very useful, small-scale project for keeping all your keys organised and easy to find. There are a number of router-based operations that are used to create this key cabinet. It can be made from solid wood or multi-laminate birch ply, and at a size to suit how many keys you have – you'll have no excuses for losing them ever again!

The router is the most versatile power tool there is. Along with a vast range of cutters, jigs and gadgets – many of which you can also make for yourself – it can help produce high quality woodwork. This article is intended to show you how the router can expand your woodworking skills.







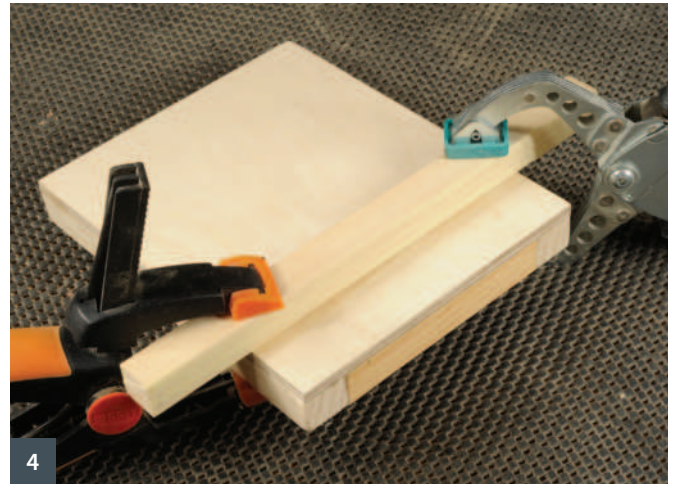
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2



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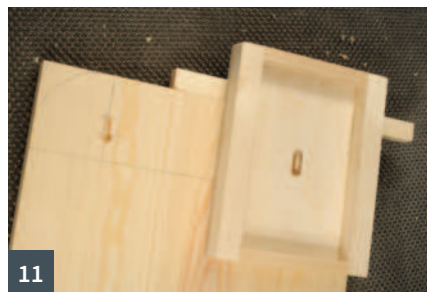
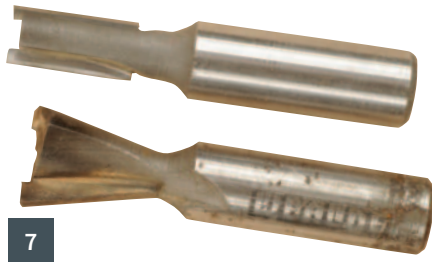


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## The jig

- 1 The keyhole cutter is a useful little tool for making a hidden slot for a screwhead to sit in so we can hang this cabinet on the wall. However, the catch is that the head is obviously larger than the slot cutting section above it. To avoid mistakes, we need what you might call a 'tray jig' in which the router will sit to restrict movement.
- 2 Glue and fix battens in place onto your plywood base so they allow the router to move in one direction only.
- 3 Work out the desired limit of travel for the router and then glue and fix battens between the battens in step 2, to allow the router to travel that distance in the jig.

- 4 Place the tray jig on the back panel to ascertain the correct position and then fit a crosswise batten underneath the tray jig at the chosen position.
- 5 With the jig resting on battens lifting it clear off the bench, place the router at the top end of the tray jig. Switch on and plunge the cutter so the widest part that will create the keyhole entry point goes into the jig base, and slide the router along to create the full length slot – you may need a deeper second pass to machine right through. You now have visual access of the slotting area and the jig is ready for use on the back panel of the cabinet.
- 6 The resulting keyhole slot is neat and very functional.



## Using necked cutters

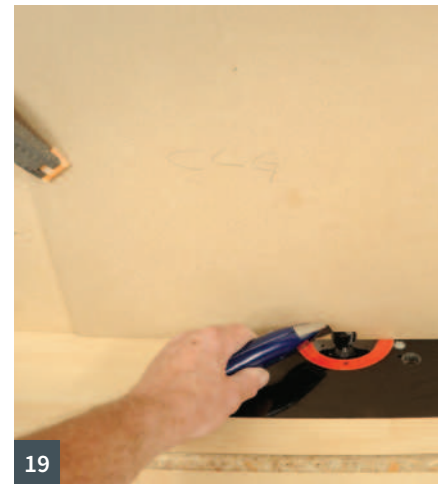
- 7 Home woodworkers, unlike specialist trades, seldom use narrow necked cutters like the keyhole cutter, but there are times when such cutters are very handy. They are great for making dovetail housings, which are often used for casework and bookshelves.
- 8 The downside of necked cutters of any kind is that they have to cut at full depth in one pass. You simply cannot plunge in several depth passes like a straight cutter can. To remove the bulk of the waste, first use a straight cutter that is narrower than the width of the opening into the joint, and do repeated passes to near final depth. Fit the desired necked cutter and make the cut from the end, thus creating the final profile while taking out a minimal amount of wood. It avoids burning, chip clogging, and cutter breakage, plus it improves the blade life and your working experience.
- 9 I have used no less than seven cutters on this project, several of which are non-standard, but fun to use:
  - ♦ The basic joint work is rebating, done with the small but excellent Wealden tenon cutter, which gives a very good result.
  - ♦ Next is the smallest size Wealden keyhole cutter.
  - ♦ The projecting top section of the back has a small Trend stopped ogee profile on a bearing-guided cutter.
  - ♦ A Trend 3mm spiral cutter was used to drill the holes for the piano hooks.
  - ♦ The hinge cutter gives a good clean finish and minimal edge tearout.

- ♦ The door has a pattern made with a face mould cutter – this has a bearing mounted on the shaft for template following. This must be used with a thick template so you can take shallow passes while the bearing can still contact the template edge.
- ♦ The door edge has a small ovolo moulding created by setting the cutter down enough to make slight step shapes.

## Making the cabinet

- 10 Cut and plane all the components to width and length, except for the top and bottom pieces and the door, which is trimmed to size later. If you're using solid wood for this you may need to carefully edge joint pieces together for the door and back panel – which should be thick enough to accommodate the piano hooks.
- 11 Mark out the cabinet top position on the backboard and the shape for the projecting top, also the keyhole positions on the reverse side. Use the keyhole jig to machine the keyhole slots while the top is still square.
- 12 Jigsaw or bandsaw the top curves and sand to a smooth, even, finished shape. Use a small bearing-guided ovolo cutter to run around the top edge, making sure you start and finish before the marked line of the cabinet top.
- 13 To make accurate holes for the piano hooks that hold the keys, a 3mm spiral cutter is ideal for drilling with the router. Use some abrasive taped to the baseplate if necessary, to stop the router from wandering.





- 14** Use a tenoning cutter, or a 19mm straight cutter with a through fence in place to machine a rebate on the ends of the cabinet side pieces. Use a square cut push block behind for accurate support and to avoid breakout.
- 15** The cabinet sides are also rebated so they sit along the sides of the back panel without projecting too far, for aesthetic purposes. Do this at the same cutter and fence settings.
- 16** Now cut the top and bottom to fit when the side pieces are in place. All components can be sanded and glued and pinned in place. For simplicity, the hinge recesses can be machined to the full depth of the folded hinge into the cabinet carcass, and simply surface fixed to the door. You don't need a jig for just two recesses, but you do need to clamp a batten along the cabinet side to give more support for the router and fence.
- 17** The door is cut to size and a template made for the bearing-guided face moulding cutter. Make sure you use an offcut in the middle for support and keep the router tight to the edge of the template and machine at an even pace. The template is pinned to the door blank and the blank sits on a rubber router mat. The edge has an ovolo shape routed on it. Finally, sand, apply a finish and fit the hooks, hinges, knob and a catch.

## Router tech: the through fence

- 18** There are a number of reasons why a through fence, as used in step 14, is the best way to work. My own experience with routers and spindle moulders shows that you get better work support, and you can work more safely as only part of the cutter is exposed. Also, when you do scribing (end) cuts, there is no danger of the workpiece slipping into the fence opening, or getting dragged on to the cutter as seen in this photo.
- 19** Even with the best aligned fences, a workpiece can catch on the outfeed fence, causing a slight 'dink' in the surface and marring the finish. Where a cutter will be partly behind the fence line, fit a sub-fence and start with the cutter well behind it. Switch on and push the fence back carefully until the cutter breaks through and is exposed enough for the cut you need. Keep hold of the fence and press the NVR switch to cut the power. It is best to keep hold of the fence for this, so have a friend switch it off for you. This is because snatches and kickback occur at slower speeds, and you need the fence to stay put. If there is a bearing or shaft on top of the cutter you need to cut this area out with a bandsaw first. Your subfence is now ready and you can wind the cutter up or down while running. Trim away any fluffing at the outfeed side of the cutter with the router off as in this photo.



# CABINETMAKER'S BUTTONS

Charles Mak shows how to make these fasteners using both power and hand tools

Wooden buttons are the traditional and reliable way to attach table tops to aprons or case tops to top rails, while allowing for the tops to expand and contract. Those buttons in essence are rebated blocks that are screwed to the top with their tongues seated in a shallow mortise or slot on the inside face of the aprons or rails (**photo 1**).

Normally, cabinetmakers use a router table and a saw, or a tablesaw with a dado cutter to make their buttons. However, dado blades are not allowed in some countries for safety reasons. In this article, I will show three other ways of making wooden buttons without using a router or dado cutter.





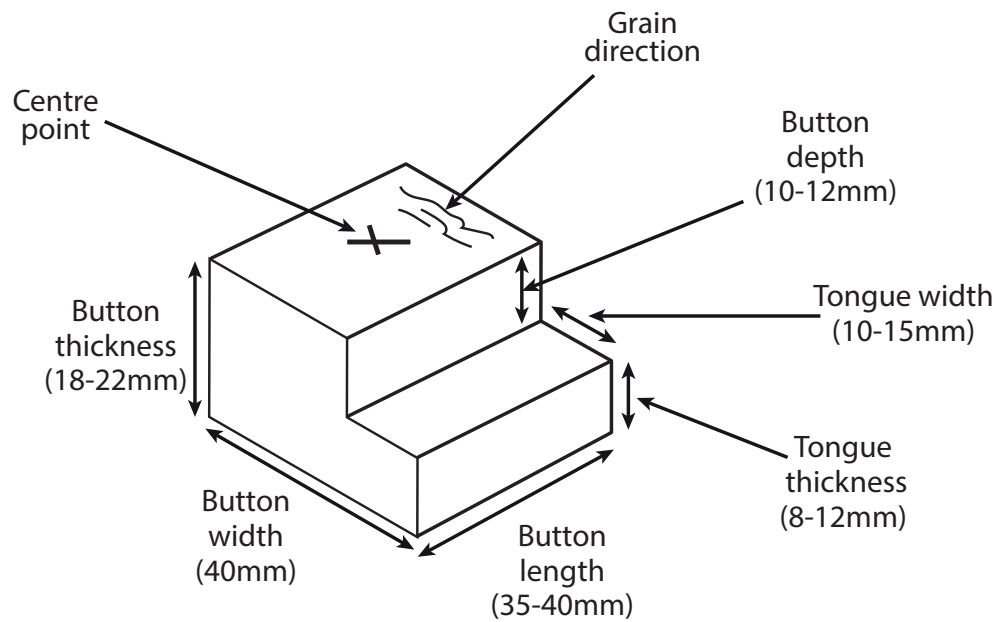
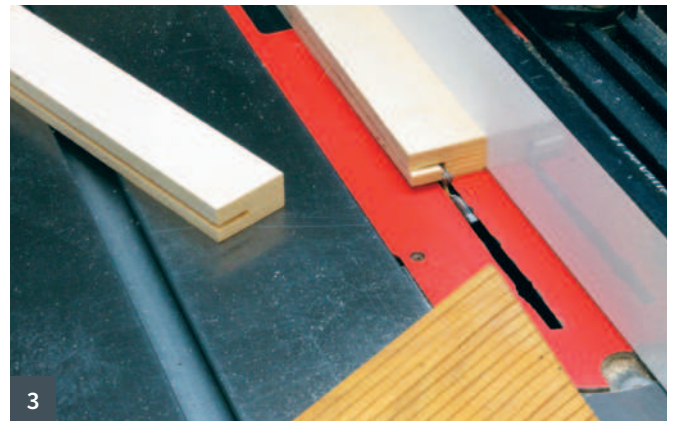
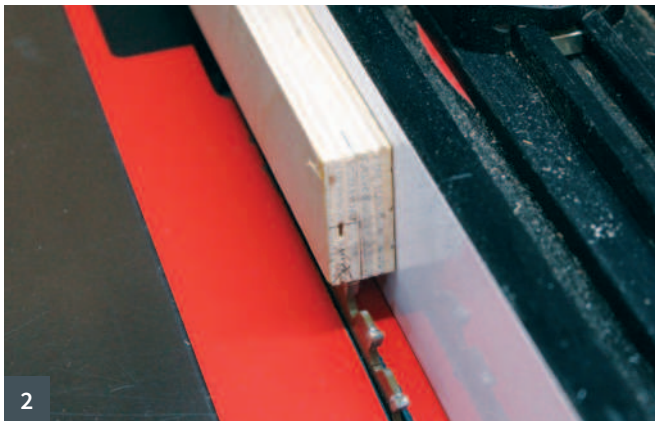


Diagram not to scale

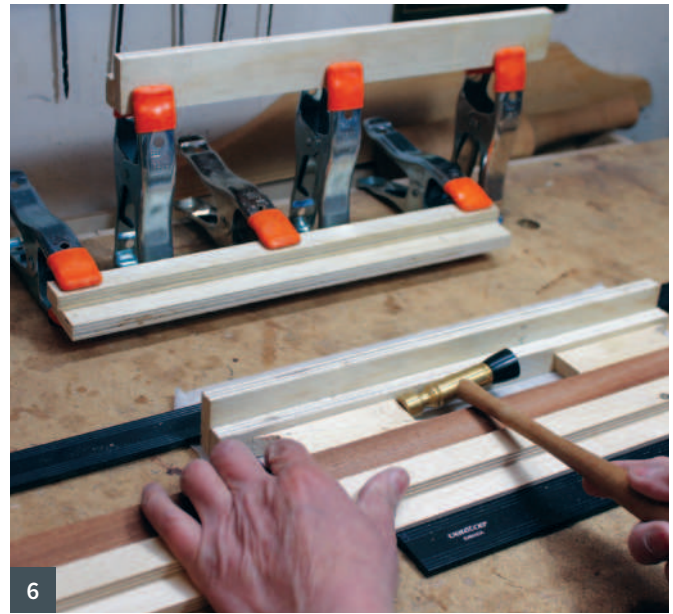
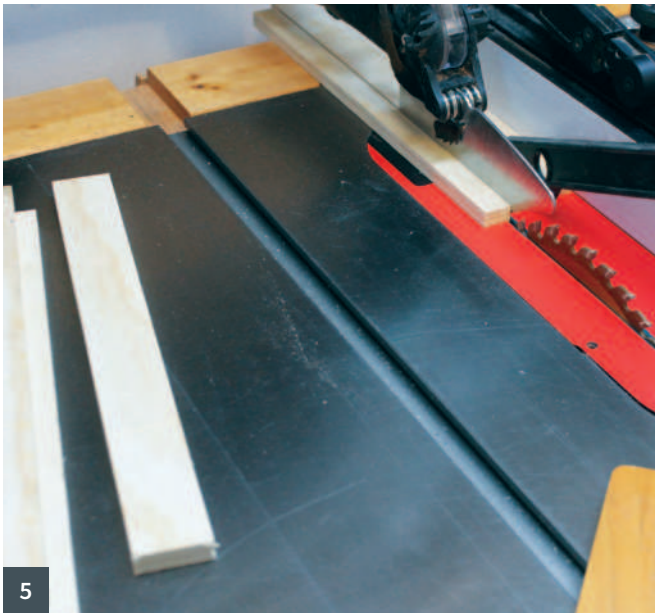


## Make buttons by rebating

We can use a regular tablesaw blade to cut rebates. Here's how:

- Set the blade height and the fence in position (**photo 2**).
- Make the first rip cut with the strip's narrow edge on the table.
- Reset the blade height and fence, and cut the strip in the horizontal position to complete the rebate, with the offcut falling away from the blade (**photo 3**).
- Drill clearance holes, countersink and crosscut the strip into individual buttons (**photo 4**).





## Make buttons by lamination

A quick way to mill rebated strips is to glue one narrow strip on top of a wider strip as follows:

- Start with stock that is about half the desired thickness of the buttons.
- Cut two strips to length for the required number of buttons, one strip as wide as the button is, and the other strip about half to two-thirds as wide (**photo 5**).
- Glue and clamp the two strips together (**photo 6**).
- After the glue is cured, drill and countersink holes and cut the strip into buttons as before.

## Make buttons by hand

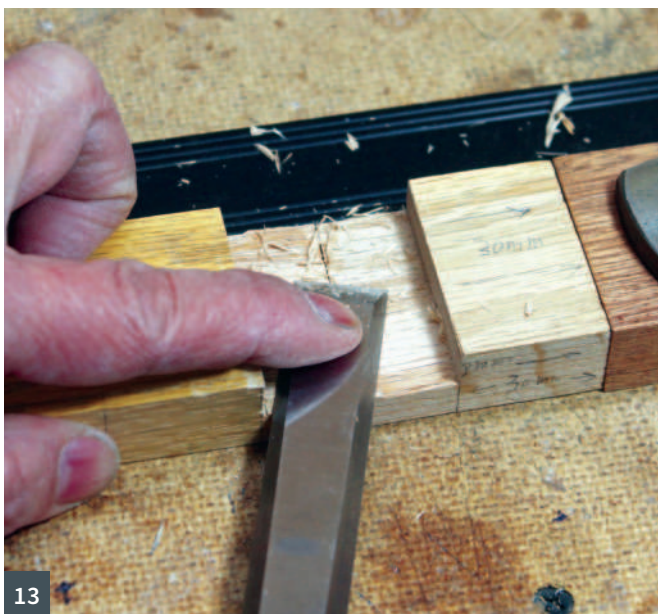
For a small batch of buttons, they are satisfying to make with just a few hand tools in these steps:

- Start the layout from one end of the strip by running three pencil lines around the strip, the first line 30mm, the second 50mm, and the last 80mm from the end (**photo 7**).

- Scribe a centre line with a marking gauge on the edges between the first and second pencil lines (**photo 8**).
  - Mark an arrow from each face towards the scribed line as an indication of a stop cut (**photo 9**).
  - Saw on the first pencil line, stopping at the scribed line (**photo 10**).
  - Flip the strip and cross cut on the second pencil line, again stopping at the scribed line (**photo 11**).
  - Overhang the end of the strip on a block, and give the strip a wreck to separate the button from the strip (**photo 12**).
  - Clean up the rebate surface as necessary (**photo 13**).
  - Cross cut the second button from the strip (**photo 14**).
- Repeat the above procedure until the desired number of buttons is cut for drilling.

Store-bought fasteners such as Z-clips or figure-8 washers are handy to use. But when you want to add a touch of workmanship, try using buttons with your next heirloom table or case top project.





# TURNED RECTANGULAR WEED POT

Chris West shows how to create a small rectangular flask for displaying grasses and stems

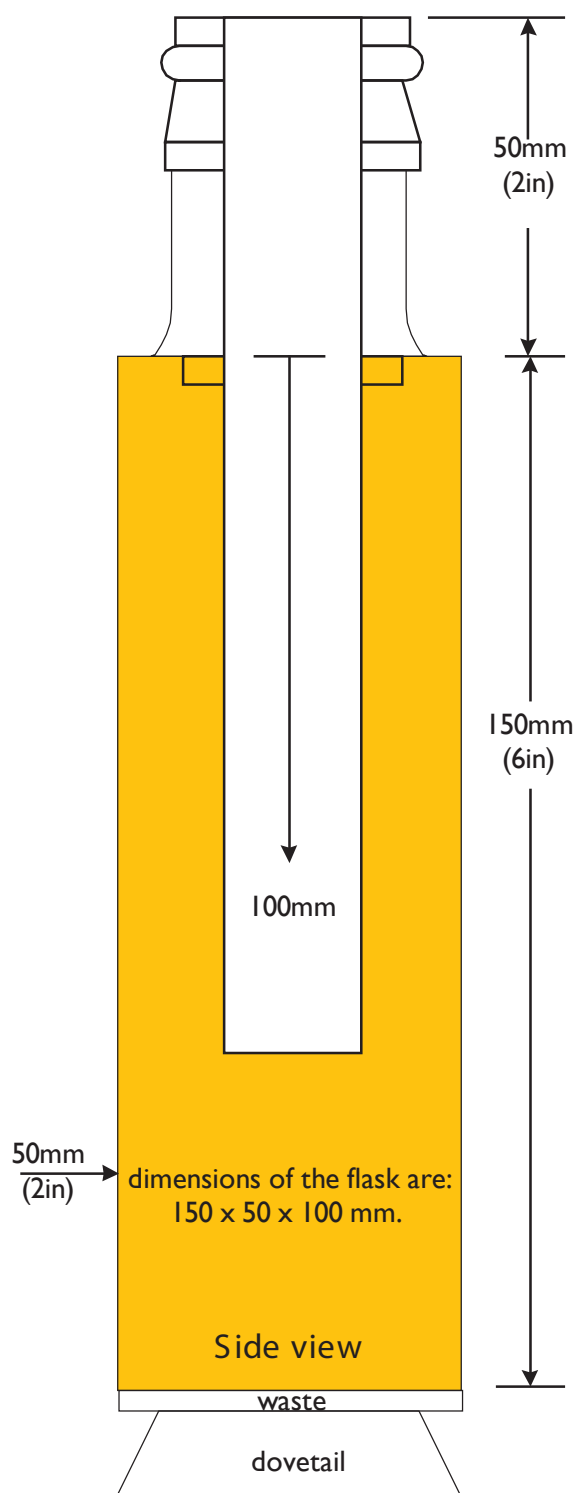
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Not every woodturning project has to be totally round, corners are allowed! I'm sometimes asked where my project ideas come from. In this case, a glass bottle was the inspiration.

As far as the bottom half of the flask is concerned there is no turning other than that of a dovetail at one end. A neck is turned from the same hardwood and is joined to the flask with a spigot. This is glued into a recess in the top of the flask.







## YOU WILL NEED

### Woodturning tools:

- 1/4in spindle gouge
- 3/8in spindle gouge
- 5mm beading and parting tool
- 2mm parting tool
- 5mm parting tool

### Peripheral equipment:

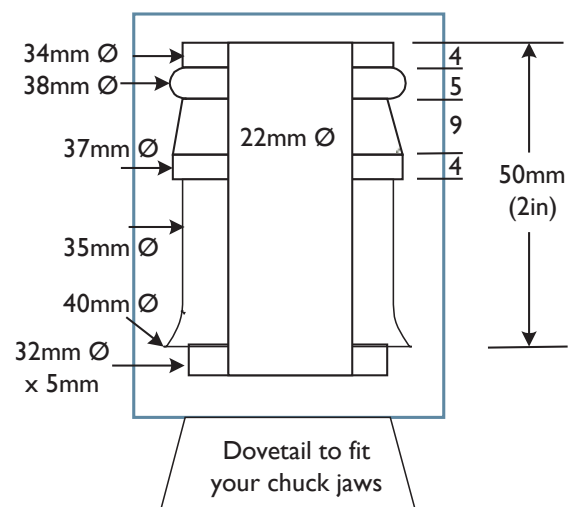
- Jacobs chuck
- 22mm sawtooth bit
- Bandsaw
- Thicknesser
- Belt sander
- Buffing mops

### Consumables:

- Abrasives
- Cellulose lacquer

Figure 1 Side view of the flask

Figure 2 The neck of the flask





## Flask blank preparation and turning

The blank measures 105 x 51 x 175mm, including the dovetail. Where possible the grain direction between the flask and its neck should align. In this project I have chosen spalted beech which I felt would take away any blandness that could occur with some woods. Lining up the grain where possible is still an objective.

- 1 Use whatever means you have to prepare a hardwood blank measuring 175 x 50 x 100mm. Two methods to use are: a planer/thicknesser or a bandsaw and belt sander. Whichever method you use, mark the centre of each end and mount between centres. Form the dovetail at the tailstock end. A  $\frac{3}{8}$ in spindle gouge is used to finish turning the dovetail.
- 2 As you can now see, the purpose of the dovetail is for holding the blank while the hole is drilled. With the dovetail held in chuck jaws, and centred, the 32Ø x 5mm recess is drilled. Next the 22Ø x 25mm hole for the grasses and stems is drilled.

- 3 The second purpose of the dovetail is to support the blank along with the lathe's headstock in the locked position. Then with the live centre in place for support, a course cut file is initially used to curve the four long edges of the flask. Follow up with a finer file and eventually lengths of 120 through to 320-grit sandpaper.

## Removing the dovetail

If you have a chop saw, the flask can be locked down on the bed of the chop saw before cutting the flask to its required height, removing the dovetail in the process.

An alternative to the chop saw is to bandsaw the dovetail off to give the correct height for the flask. The base will require sanding to give the required smooth bottom. A belt sander is a way of achieving this.

## Turning the neck

- 4 Between centres rough turn and add a dovetail at what will be the top of the neck. Reverse, holding this dovetail in your chuck jaws





and when running true face off the bottom and drill a 22mm Ø all the way through the blank. Shown here is the blank about to be drilled with the 22Ø sawtooth bit.

- 5 The 34Ø x 4mm flat edge at the top of the neck is first turned followed by the 5mm bead. A 5mm beading and parting tool was used here to achieve this. Following the drawing in Figure 2, the rest of the neck is turned, mostly using a 5mm parting tool.
- 6 On completion, sand the neck using grits from 180 to 400. At this stage sanding sealer is brushed over the neck, prior to removing from the lathe by parting the spigot at the base of the neck. A newly sharpened 5mm beading tool was used to achieve a clean cut. The neck was completely finished to the point where it could be parted and buffed.

Once the neck has been completed and is found to have a fit into the flask, the flask itself can be finished before the two parts are glued together. Twist the neck round before the glue dries to find the best position for it in relation to the flask.

## Finishing

Given that the weed pot is likely to be handled often it is important that it is both hardwearing and waterproof. One answer is to apply at least five coats of a 40:60 mixture of clear polyurethane and food safe oil (mineral oil). Be warned that while each coat will dry overnight it takes a month to become fully cured.

An alternative and the one I used is to apply a sealer and spray it with a cellulose lacquer. Follow this by buffing using both brown and white polishing compounds and wax.

## Optional enhancements

- 7 Shown here is the same flask bottle holding a tapered LED candle. The techniques for turning this are the same as for the weed pot.
- 8 Here is another weed pot, but with inlays. As you can see, it has been enhanced with two 50mm diameter inlays, one on each side. Another article would be required to explain how these are turned.



# REBATE JOINTS

Anthony Bailey looks at the deceptively simple rebate joint which is often used, but frequently overlooked

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I love taking a sideways look at the mundane and ordinary and putting a new spin on it, so to speak. Nothing typifies this better than the humble rebate. Not of itself particularly impressive or difficult, or even a joint necessarily, but if you look around you, everything from a car door, to a window, to a lid for a tropical fish tank, all these and many more demand a rebate of some sort. So the first observation is that a rebate acts as a 'stop' – a means of containment or preventing further movement in a given direction.

A rebate allows a pane of glass to fit into a window frame with a glazing bead added to keep the glass in place. A wooden panel can sit in a rebate, either as a tight fit or a loose one, depending how it is fixed. A rebate can also effectively be half of a lap joint.

If I was putting together a first set of cutters for routing, based on my experiences I wouldn't go for a mixture of moulding profiles and a rather redundant dovetail cutter, which is what you normally get in starter sets. Instead, I would choose a series of different diameter straight cutters and a rebate cutter with interchangeable bearings! Why? Because they are needed far more than the occasional ogee or ovolo moulding. You can then create grooves and rebates of all sizes and make joints if you need to; the selection shown here are the ones most suitable for rebating. Those with bearing guidance can work along curved edges.

## Types of rebate

### FRAME REBATE

While this is not strictly a joint, it forms the basis for holding doors,

panels, glazing and the like. Usually part of a larger construction that is jointed by a suitable method.

### CORNER REBATE

A rebate, at its simplest, extends the jointing surface for the purpose of fixing with glue and nails or screws. It gives a reasonable amount of strength and location to the joint. The component that runs through to the corner covers the rest of the joint and is therefore normally the 'presentation face' hiding the construction. It can therefore be used for basic drawer boxes.

### LAP REBATE

The same, but with an additional step in the middle. This can seem a bit unnecessary; however, if you have a relatively easy means of making it, you can try it instead of the basic version as it does add a bit more rigidity.

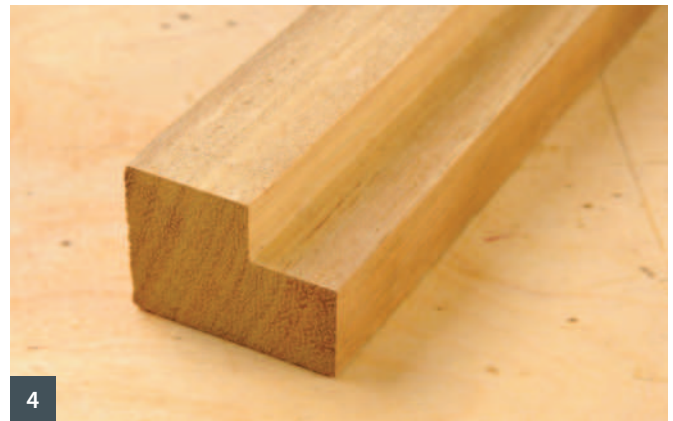
### MITRED REBATE

This presents a clean corner and generally looks better in a good piece of work. It does need careful machining to get a good joint using a bevel cutter as well as a rebater.

### REBATED TONGUE AND GROOVE

By rebating a component end you can create a tongue of a specific width to match a straight cutter or groover, so it can locate as a corner joint. This is handy for drawer box construction with the grooved components at the side and a 'planted on' drawer front to cover up the joints.





**1** Here I am fitting a glazing bead into the rebate **2** A useful set, but why have a dovetail cutter? **3** I find that I can do a lot more with these cutters **4** Frame rebate **5** Corner rebate **6** Lap rebate **7** Mitred rebate **8** Rebated tongue and groove



**9** Hand tools for making rebates, from top to bottom: cabinetmaker's shoulder rebate, carriage-maker's rebate and a small shoulder rebate **10** Cleaning up a rebate is quick and easy **11** There are different ways to machine rebates **12** Routing using a 'breakthrough' fence and pushblock **13** Wider boards can be easily rebated **14** Narrow stock needs safe support **15** First, an outfeed support to fit the rebate

## Making rebate joints by hand

The rebate is generally better done by machine than by hand, however, it is possible to hand saw rebates using a decent backsaw and a bench hook to hold the workpieces. The problem with this method is that it is hard to do this really well and repeatedly.

Whether you hand saw most of the waste away or not, a proper rebate plane will give better results. A large shoulder rebate plane is expensive, but a smaller version won't break the bank. There are also carriage-maker's rebate planes either vintage or brand new and duplex rebate planes. Personally, I just stick with the small rebate plane for hand work. Using a sharp, well set rebate plane makes cleaning up or trimming a rebate quick and easy. It can be used in both physical planes, either end grain or across the flat grain.

## Machined rebates

First, a word about safety. Machine rebating is an operation that has often been done in the past under unsafe conditions. Rebating on a saw table is NOT permitted as it requires removal of the crown guard, unless an alternative approved guarding system and safety hold-downs are fitted. A spindle moulder with chip-limiting tooling may be used

with hold-downs, or preferably a power feed unit or a sliding and table work clamp for end rebating.

Visit the Health and Safety Executive website and download these documents for further guidance: [www.hse.gov.uk/pubns/wis16.pdf](http://www.hse.gov.uk/pubns/wis16.pdf) and [www.hse.gov.uk/pubns/wis18.pdf](http://www.hse.gov.uk/pubns/wis18.pdf)

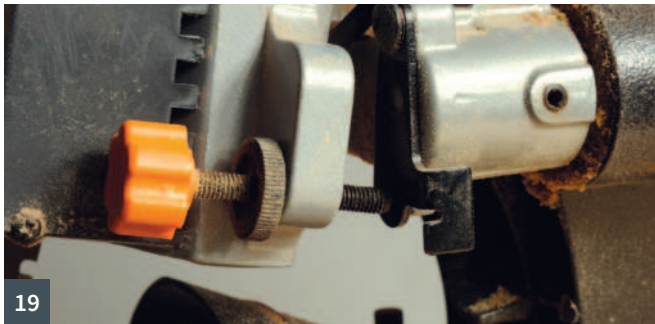
## MACHINING SOLUTIONS

There are several choices for machining rebates: compound mitre saw, hand power planer and fence, bandsaw, freehand router using a T-square fence, router table and fence or bearing-guided rebate cutters for working curves.

## ROUTING END GRAIN

End grain joint machining done on the router table only needs a pushblock or a protractor fence with a wooden sub fence for support to contain any tendency to 'breakout'. Take several passes to final width and have a 'through fence' to act as an end stop to control the width of the rebate. Hold-downs in this instance interfere with the progress of the workpiece, downward hand pressure alone should be enough.





**16** Followed by hold-downs to enclose the workpiece **17** Make up a simple T-square jig **18** Clamp it in place before making cuts **19** Set the trenching and stop before cutting **20** The result can be uneven **21** Power planing is a rough and ready method **22** Here an end stop is in place for the rip cut, shoulder cut taking place

## ROUTING LONG GRAIN

Wider boards that need a rebate aren't a problem, but the problem with long grain rebating of narrow stock is 'chatter' causing it to jump around and the tendency for it to turn over as it has mostly passed over the cutter when using a static machine, like a router table or spindle moulder. Therefore, we need to devise ways to support the workpiece as well as use hold-downs and at the same time feed it through safely. It isn't as difficult as it may sound. The methods shown here can be replicated on a spindle moulder too.

## OUTFEED SUPPORT

The key is to machine stock to an exact common dimension. This allows you to do two things: one, fit a support to the outfeed fence that matches the dimensions of the rebate, so the freshly machined workpiece slides over it. Two, make a 'tunnel' or close fitting guards that act like one. The tunnel is the same size as the stock exterior dimension. It holds the workpiece down on the table and gives complete cover guarding. Each workpiece is pushed through by the next one so fingers never get near the cutter.

## FREEHAND REBATES

A router can sit on the workpiece, guided by a T-square, which can be moved after each pass until you reach the final rebate width. You need to make sure the T-square is truly square when you make it. You can sight the correct cutter position rather than measuring the T-square offset distance.

## OTHER MACHINE METHODS

The compound mitre saw can be set to machine rebates by adjusting the trenching stop. The cut surface may not be entirely flat as the saw head will bounce slightly and repeated side-by-side cuts are needed to create the full rebate width.

Power planers are only any good for long grain rebating as they need a long edge to run against. A bandsaw that is well set up and with a sharp blade can cut neat rebates repeatedly. Shown here are an end stop to limit the length of the rebate and the protractor fence being used to cut the shoulder, thus creating the rebate.



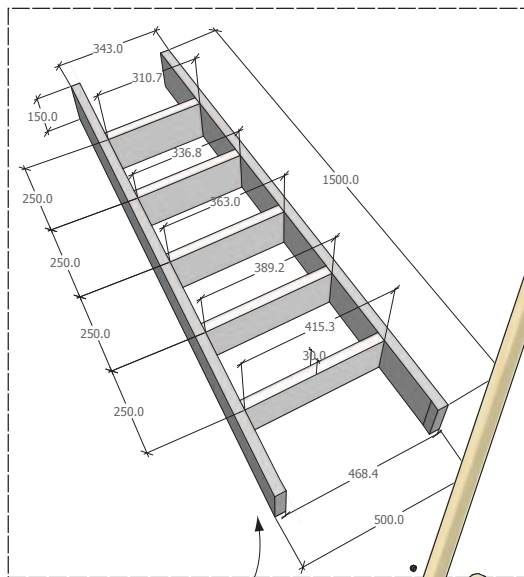
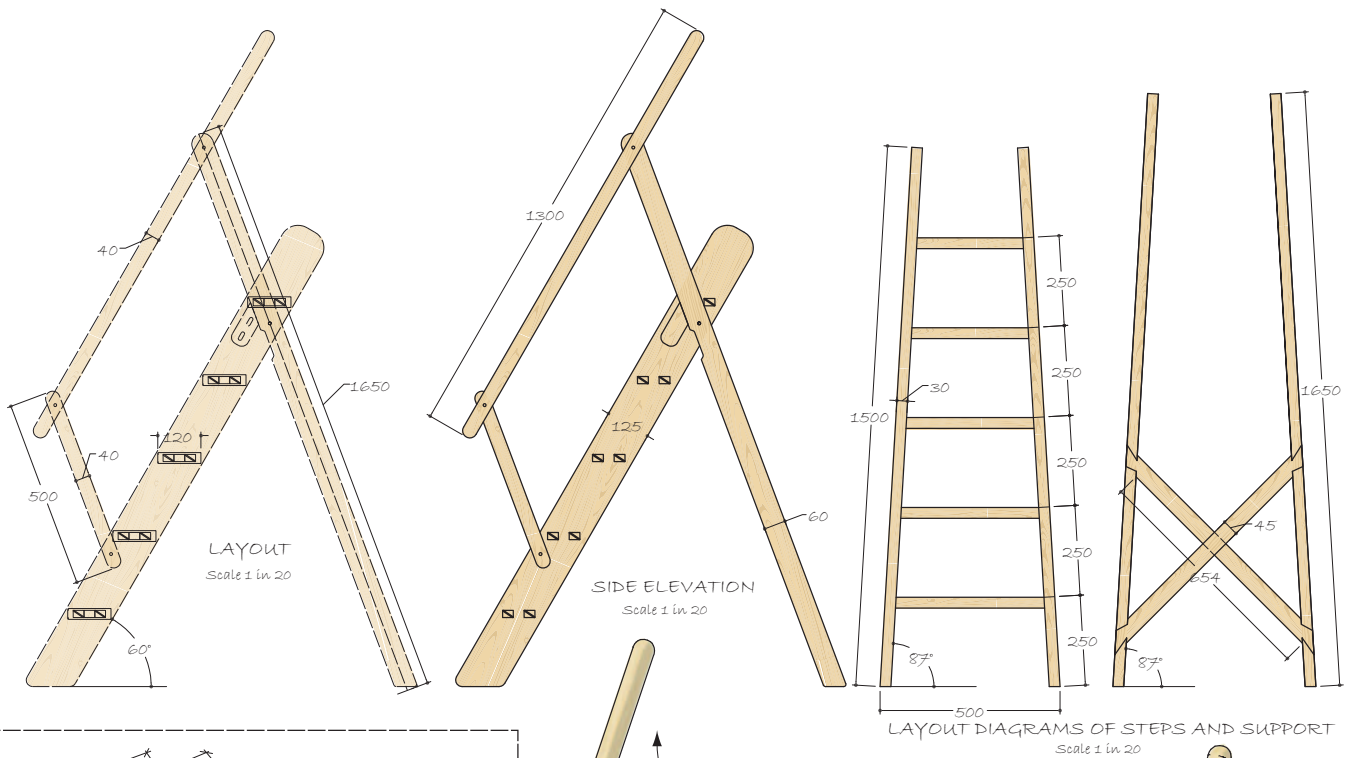
# WESTMINSTER-STYLE LIBRARY STEPS

Matt Morse takes on a challenging  
project for a client's library

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Recently I was asked if I could make a set of steps for a client's home library. Picturing some kind of step stool I said: 'Of course I could make some library steps; how hard could it be?'. Chris Schwarz remarked: 'Careful, could be the Barnsley Steps!' While certainly not the Barnsley Steps (the unusual steps designed by James Ryan at the Edward Barnsley Workshop), this project was beyond a simple step stool and it included some compound angled through joints and mind-straining angles. Half an hour on Google and a field trip to see an example in an antique shop and I had an idea of what was required. The brief was: steps in the Westminster style, slightly stronger visually and literally, than the antique examples to allow access to floor-to-ceiling shelves up to 3m high. The Westminster style has two useful party tricks; first, there are handrails on both sides and second, they fold flat including the handrails. These tricks make them very useful in the modern setting as an elegant stepladder that can be folded away when not required.





6mm bead to front inside edge

All treads with through wedged tenons

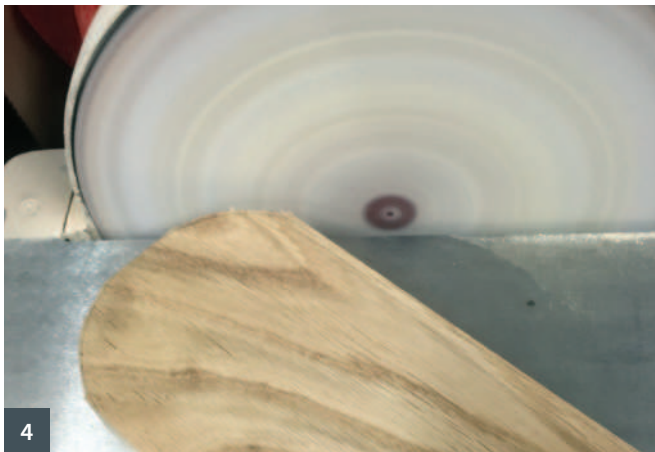
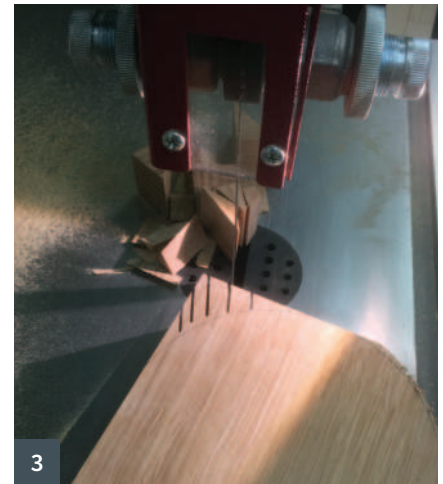
3mm bead top and bottom to front edges of treads

30mm thick handrails bolted into back support and handrail support

Back support stops domino jointed into sides of steps

Cutout in back support to allow steps to fold flat

Back support with crossed braces, lapped dovetailed into back edges of verticals, half-lapped across each other



**1** Mock-up of the full-size steps in softwood screwed together and left as square edge for speed **2** The polished hardware used in the steps **3** Making relief cuts at the bandsaw before cutting the curve is quicker than changing to a narrower blade for only one or two cuts **4** Refining the curve on the disc sander – the guard is removed from the right-hand side to allow the full arc to be faired in, but all the contact is on the left where the disc is descending into the table. The guard goes back on when the operation is completed **5** Inserting the shim to space the Domino off an additional 12.5mm and widen the mortise to 25mm – positively locating against stops and this shim is more repeatable, accurate and quicker than measuring

## Design

Breaking down the design is relatively simple. There is a ladder section with five treads, a back section to form the other main side to the A-frame, a small upright on each side and a handrail on each side. Complexity is introduced as the steps diminish in width towards the top and each tread is angled back at the same angle as the ladder. The angle of the sides to the floor was determined by drawing several variants to scale until it looked visually right. The angle of the base of the legs was finalised at 60° from horizontal. All the treads follow this angle so when the ladder is open the treads are parallel to the floor.

The tread heights were 250mm on centre making the whole ladder section 1500mm long. The material size for the ladder was 30mm thick by 125mm wide. Material for the rest of the structure was also 30mm thick to visually balance the design. Determining the length of each tread and the angle of the sides was problematic theoretically; at least for me! In the olden days I'd probably have drawn it full size on an 8x4 sheet of something and used it as a rod for the build. These days I tend to use SketchUp. The tape measure and protractor tools meant in very short time I had a cutting list and all the required angles. This method was more accurate and quicker than full-scale drawing and gives a 3D model to play with.

Once the angles were established the next step was to determine the correct pivot points to allow the steps to support weight and fold easily. Initially several scale models were made from scrap. Then a full-size mock-up in softwood was quickly cut out and screwed together. This proved the size and proportions were correct but more importantly allowed the mechanism to be tested at full scale.

The steps could be scaled up or down but the main principle for the folding mechanism is to keep the pivot points equidistant in all the uprights and in all the diagonals.

## Design details

The hardware used was stainless M10 carriage bolts with dome nuts and nylon bearing washers. The stainless hardware was selected to allow polishing to a mirror shine without concern about removing any coating or plating. The dome nuts were designed to prevent catching clothing or users on the steps and gave a good visual finish. The rim of the bolts was counterbored just enough to make the 90° section disappear and to give the illusion that the bolt heads blended into the surface. Between the moving parts, 2mm nylon bearing washers were used. These gave a tight clearance and allowed the bolts to be relatively tight but still allow easy movement.





**6** The resulting mortise has rounded ends and needs to be squared up **7** Paring the 3° shoulder line using a guide block secured to the piece and the bench with a holdfast **8** The full dry fit **9** Tear-out reduction strategy for beading – define the extents of the quirk with cutting gauges, round with a block plane with the grain, use lots of wax on the beading plane and blend it all at the end with some Abranet **10** Easing the sharp edge of the quirk on the bead with a miniature shoulder plane

## Building the ladder section

In this project 90% of the joinery involved is in the ladder section. Using the mock-up components as templates it was relatively simple to mark out and prepare the final stock from 32mm rough sawn boards.

The first challenge was encountered here when one of the two quartersawn boards for the ladder sides turned out after planing to be full of shakes making them unusable. The spare contingency stock was not quartersawn resulting in one quartersawn side and one crown cut side.

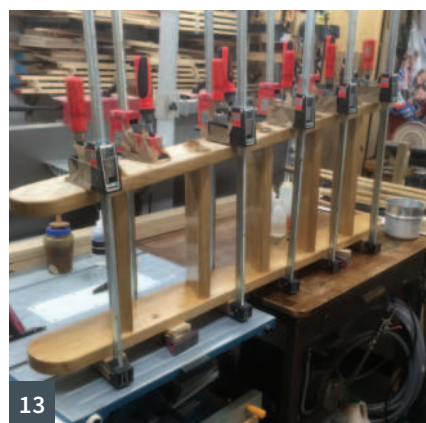
The base needs to be cut at 30° across the board with a 3° compound angle. This gives good bearing surface in the finished steps for stability. The top end was simply rounded over to a pleasing radius on the bandsaw and the disc sander. I normally find something roundabout the right size and trace round it to give a line to cut to. The base had its points rounded over in a similar way this time by tracing round a 13mm socket from the socket set.

The centre lines of each tread were laid out in pencil and a jig was used as a fence to guide the Domino. In my experience the simpler the jig, the more likely it is to work; this was a stick with some pencil marks on it and another stick as a shim. Lining up the pencil marks with the layout put the Domino in the right place for the first run of

mortises, using the shim offset the Domino to give the final width of the mortise. The two ends were mortised right through to a clamped-on backer board to prevent blowout on the face side. The centre web of each mortise was cut to 10mm depth only; enough to give full support to the tread but not detract from the strength in the side. All the through mortises were 25mm wide, 30mm long and separated by 35mm from the other mortise for that tread. There was a 5mm shoulder on all sides of the tread's tenon.

The mortises were cut at 3° to accommodate the 3° angle of the sides of the steps. The Domino was tried on a test cut set to 3° but in the test cuts it didn't achieve a 3° mortise owing to the fence on the machine protruding slightly. It was probably not designed to operate this way but from trial and error it was found that by setting to 4°, a 3° mortise was achieved. Layout lines were then transferred and the mortises were squared using a chisel and gently flared towards the outside for wedging.

From the SketchUp model and the full size mock-up the shoulder lines for the treads were marked out and a generous tenon added before cutting to length. The tenons needed to be long enough to go through the mortises and leave some length to allow a chamfer. This is lost in the final clean-up of the outside but is invaluable during dry fit and



**11** Wedging the tenons – the fixture in use on the shooting board **12** Showing the wedge to the mortise and marking the length **13** Glue-up with angled clamp head packers to allow clamping without bruising the timber **14** Trimming the tenons flush with a flushcut saw before smooth planing the outsides of the ladder section **15** The ladder section shimmed up by 6mm to allow the angle and length of the rear section to be scribed to exact length and angle with a 6mm block

final assembly to prevent blowing out the face sides of the mortises. The cheeks of the tenons were cut on the router table staying well clear of the shoulder lines. The shoulders were cut a few millimetres from the line with a hand saw taking care to preserve the 3° angle. The final few shavings were pared back to the line using a large guide block cut to 3° to help cut the upper and lower shoulders accurately at 3°. The shoulders are one of the structural elements that prevent racking and needed to be cut accurately.

With the angled shoulders cut, the remaining parts of the tenons were cut with a handsaw and chisels. The individual width of each through tenon was determined by showing the tenon to the mortise and taking the sizes directly from each mating piece. No measuring for increased accuracy! Each tread had to be marked from the outside of the side and placed upside down for marking out. When turned over and put on the inside the sizes corresponded. The treads were then individually dry fitted after fine-tuning the fit in all dimensions with router plane and shoulder plane. After a full dry fit the parts were smooth planed to remove all the layout line and the decorative details were cut.

At this point the holes for the hardware and the counterbores were cut and the square recesses for the square shank of the bolts were cut with a chisel. Inking the shank of the bolt with a marker and giving it a tap in the hole marks the cut perfectly. I aligned the square sides on the diagonal with the grain to allow easy cross grain paring for all sides of the hole.

The inside front edges of the ladder sides in the original examples I have seen are beaded. This gives a nice smooth edge with a decorative

detail but also gives a shadow line. This can be an important visual cue as to where the edge is so I included this in the sides and on the treads. I cut the bead using an old wooden side bead plane. One side was cooperative and the other was not so I had to plane against the grain. It's best to minimise the tear-out in some way when going against the grain so I used two cutting gauges to define the sides of the quirk to prevent surface tearing. I then rounded the edge with a block plane with the grain to minimise tear-out on the rounded section. Care is needed here not to round over too much or the beading plane will struggle to engage on the edge – because it's been taken off!

All other edges including the feet and the rounded tops of the ladder sides were then rounded over using a similar radius round-over bit in a hand-held electric router. The exposed edges of the treads were all beaded with a slightly smaller beading plane. The quirk from the beading planes can be a little sharp so I used the tiny Veritas shoulder plane to bevel this back on all the beads.

All the rounds and surfaces were then blended together using Abranet on a sanding block and the pieces were sanded to 320 grit by hand for pre-finishing. Sanding sealer followed by multiple coats of shellac applied by rubber was used to give a prefinished surface before assembly.

## Wedging the tenons for the treads

The tenons for the treads needed some mechanical lock for maximum strength in this part of the steps that would take the user's weight and be subject to racking forces from side to side. Normally wedges go





**16** Marking the dovetail sockets with the rear section clamped to the ladder section over 2mm spacers for clearance in the final assembly **17** Cutting the sockets and kerfing the waste prior to chopping out **18** Cleaning the base of the dovetail sockets with a router plane to final depth **19** Dovetail socket cleaned out ready for dry fitting **20** Dry fitting a pair of dovetails together changed the fit of the joint slightly and tightened everything up

across the tenon and across the grain of the mortise component. In this case the two parts were at an angle and so diagonally across the tenon was close to straight across the grain of the side piece. This has the advantage of being able to flare the tenon in two directions making it tight with all walls of the mortise. It has the disadvantage that the wedges need to be shaped to fit the corners of the mortises and the wedges themselves are at a 3° taper angle! After an hour freehanding with a block plane and achieving only one successful wedge and several shortened fingertips, I thought some sort of fixture might be in order. Using the chapsaw I cut two blocks for the shooting board at compound angles – 3° in the width and 87° and 93° for the length. I used these like a mitre shooting board to accurately put the correct angles on one end before marking the length and putting the angles on the other. The fixtures needed to be recut with the 3° the other way for the other side of the ladder.

## Glue-up

My usual first choice of glue for oak is Titebond III as the dried glue is a reasonable colour match. The open time is only about 15 minutes though so a bit short for sinking 20 wedges in the five treads! I opted instead for liquid hide glue, which has about double the open time. I warmed the glue in warm water for 10 minutes before use to make it flow and soak into the wood better. As these mortises are cut on the diagonal the majority of glue surface in the mortise is end grain. I applied a size coat for all the end grain surfaces before going back five minutes later with a

second proper coat. The size coat fills the pores and allows the glue coat to take hold, rather than wick away down the fibres.

The tenons had all been fettled to give an easy sliding fit and the assembly came together reasonably well with only a few taps from the rubber mallet. Before assembly I'd made up some angled clamp heads and taped them to the clamps to allow clamping of the sides without bruising the timber. With the sides clamped tight and all the mortises completely closed the wedges were glued and hammered in to the same depth in each mortise.

After the glue had set the tenons were trimmed with a flushcut saw and the sides were planed smooth. Finishing was left until after the other moving sections had been test fitted.

## Building the handrails, uprights and back section

The small upright sections and the diagonal handrails are simply rounded sections with holes and counterbores at the appropriate locations. The ends were rounded in a similar way to the top of the ladder section with a bandsaw and disc sander. A pleasing oval cross section was achieved using a thumbnail profile bit in the router table followed by blending of the surfaces with hand sanding.

The back support is where the remaining joinery is and first of all the pieces were roughly shaped leaving a little overlength at the base for fine-tuning. The top sections were taken to the oval profile as for the handrail sections above and the lower sections given the same



**21** Dovetailed back brace being glued up **22** Fitting the stops with Dominoes and hide glue  
**23** Final assembly with nylon bearing washers **24** Detail of the stops and clearance cutouts  
**25** The folded steps

roundover as the ladder section. The areas to be jointed were left square at this point.

A test assembly of the whole piece determined the final length and angle of the back piece. By shimming the main ladder up by 6mm and levelling the whole structure it was possible to scribe the angle and length on the back pieces using a 6mm spacer.

A simple cross halving joint was cut on the two oak battens for the rear brace. This assembly was dry fitted and clamped to the ladder section to mark out the shoulders for the joints. The shape of the dovetail was marked out in pencil and cut with a tapered wedge on the bandsaw. The bandsaw was chosen as it's difficult to start a cut with a handsaw on a corner. The pieces were cut back on the bandsaw to reduce the thickness of the dovetail to half the thickness of the stock. This was to maximise strength in the rear uprights. The dovetails were cleaned up with chisels and router plane ready for marking out the sockets. The acute angle on the inside of the tails was cleaned out using a combination of knife, saw and the raker tooth on the end of a Japanese pull saw. The cross brace was dry assembled again and laid onto the back section of the steps for marking the dovetail sockets. The components were prefinished as far as possible prior to final assembly to give an even finish in the tight angles of the brace section.

## Final assembly

After final sanding and polishing all the components, one dry fit was needed to determine the locations of the stops. These prevent the steps from closing up in use and the location is critical to allow it to open and close but stop at the required angle. These were located, cut and shaped and jointed with two 14mm Dominoes each. Clearance cutouts were needed in the back brace to give maximum bearing on the stops and allow clearance for folding. These were cut with a crosscut saw and chisels and refined with abrasives.

Making these steps pushed the boundaries a little for me with the angled mortises and diagonal wedging. The models and the prototyping made it a similar project to designing a chair – the first one takes all the time! Next time I would make sure I had quartersawn stock for the main components for a better visual match. I'd also take better care of the dovetails and sockets as the very delicate points on two of them became softened with handling. Overall, though, the steps were a success and were delivered on the day of the deadline in time for a surprise 70th birthday present!







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# PRACTICAL ILLUSIONS

Canadian woodworker Ryan Hawkins  
tells *WWC* about his thriving business,  
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The brick pattern cutting board made for Ryan's wife from maple and walnut

Ryan Hawkins is a self-confessed wood obsessive. From his workshop on Vancouver Island he creates intricately patterned cutting boards and furniture and has recently set up a YouTube channel to share his making process. Here, he tells us about his career and craft.

## WHAT FIRST DREW YOU TO WOODWORKING?

It all started as a young man working on a construction site. My first experience with wood was moving some simple 2x6s and sheets of plywood around and watching others nail them together. When I watched the first wall stand up, I was simply in awe at how some sticks of lumber and sheets of plywood had been cut and stitched together to create something that looked like, well, something. At the time, I wouldn't have been able to tell you why I was so intrigued by what I saw. Looking back now though, I realise it was the simple act of creation that drew me in. The idea of taking a pile of raw materials and transforming them into something useful had really grabbed my attention.

## TELL US ABOUT YOUR BACKGROUND AND TRAINING.

When I was 19, I stumbled my way into a carpentry apprenticeship. I was simply looking for work and had found employment as a labourer for a small construction company. After a few weeks of doing the kinds of jobs that a 19-year-old labourer gets the luck of doing, such as wheelbarrowing concrete, I got to take part in framing a small house. Working with wood, I was instantly having more fun than I was behind the wheelbarrow and, after finding out that one could be just a full-time framer, I went and signed myself up as an apprentice. It was the time spent in trade school, specifically the afternoons in the wood shop, where I was introduced to woodworking, inevitably falling in love with the craft. It was here where I learned various skills, techniques, joinery and experience working with different species of woods with hand tools and machines. Since then, I've been self-taught through a variety of ways such as watching other talented creators on YouTube, purchasing plans and, arguably the best (but usually most painful) way, through trial and error in my own shop.

## WHAT MADE YOU DECIDE TO SET UP YOUR OWN BUSINESS?

I've had an entrepreneurial mindset as long as I can remember. Throughout my life, I've experienced getting out of bed to go to work for another company, aka the 9-5. I've also experienced getting out of bed to go to work for myself. It's the thrill of the hunt of the latter that I always find myself going back to. It adds a certain spice to life. Throughout the years of trying on different jobs, woodworking has always been a constant. When I put my first cutting board together, I didn't know that my evening and weekend hobby was going to turn into West Coast Boards. A short 18 months later, it came to the point where I was putting in just as many hours outside of my day job as I was at my day job. At the same time, the year-long project I was part of at my day job was coming to an end, and although the perfect time to jump is never, this was about as perfect of a time as one could ask for. Having been at that juncture in my life before, I made the decision to jump into the world of self-employment once again.

## WHICH WOODS DO YOU MOST LIKE WORKING WITH AND WHY?

The woods that I use quite often in my projects are some of the



traditional hardwoods: maple, cherry, walnut and white oak. Out of those four, I find cherry the easiest to work with, therefore making it my favourite hardwood. On occasion, I'll find a piece of figured cherry at the bottom of the lumber pile at my supplier and the grain never ceases to blow me away. It's amazing what goes on inside of trees during their life span. Oak is a close second. It can be stubborn to work with, but for the kind of work I do, the end grain of oak is unlike any other. Another wood that I really enjoy working with, but due to the nature of my main products, rarely do, is western red cedar. I live on Vancouver Island where there is an abundance of it, and I love everything about it; the grain, how easy it is to shape and especially the aroma. In my opinion, there are few things in this world that smell better than freshly cut western red cedar.

## WHAT KIND OF FINISHES DO YOU USE ON YOUR BOARDS?

Since the majority of my products need to be food safe, I keep it pretty simple. For anything that will be coming into contact with food, I use a food-safe mineral oil, followed by a beeswax to polish and seal up the wood. I've used various brands of each one over the years, but my favourites to date are from a couple of wonderful companies. The first is Clark's, who offer scented oil and wax, in orange/lemon or lavender/rosemary. The added touch of a scented product is an excellent way to cap off a custom project. The second company is called Clapham's, who are fairly local to me. They are a family-run business and have been since their startup in the 1970s. They've had a long time to perfect their technique and it's quite evident in their products. On the recent end grain table I finished, it didn't need to be food safe, so I decided to try out pure tung oil for the first time. I like the result it gave me, and I plan to use that more in the future.

## WHAT TYPE OF TOOLS DO YOU LIKE TO USE AND WHY?

I enjoy working with machines more than hand tools. So much so, that I rarely use hand tools except for the occasion that I need to pull out a chisel and mallet. I suppose I'm the opposite of most woodworkers in that regard. I can appreciate the relationship that one has with the wood when the only thing between you and it is the tool you hold in your hand. I've worked with hand planes, saws, and marking and measuring tools in the past and I certainly respect and appreciate them. But they don't hold my attention like a machine does. A machine commands a certain level of respect. When I'm running wood through and operating a machine, I'm fully engaged in the present moment with the only thoughts in my head being what is the blade doing, what is the wood doing and where are my hands? For me, working with machines is meditative.

## TELL US ABOUT YOUR WORKSHOP.

This is now my third workshop and one that I consider myself very lucky to be in. My first was an unheated, uninsulated carport that had been framed in and the second was a single, one car garage. It was a big jump from 350 sq.ft to nearly 2,000 sq.ft! The space I'm in now was built in the 1940s and was used at that time as one of the main dairy barns on the farm that it's located on. Before I came along, it was being used for various farm storage. At the same time that I turned West Coast Boards into my full-time job, I moved into this workshop. Before any projects could start though, there was insulation, drywall and electrical to be done. I have a video of the whole process up on my YouTube channel. This is also the first shop I'm in that is properly

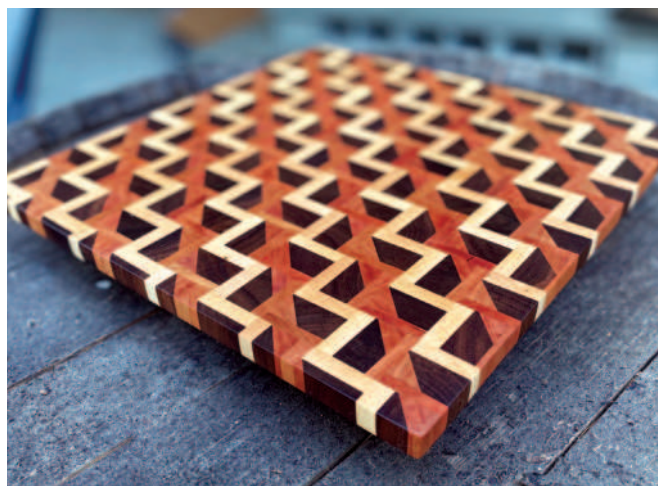


PHOTOGRAPHS BY RYAN HAWKINS

Chaos pattern cutting board



Illusion cutting boards



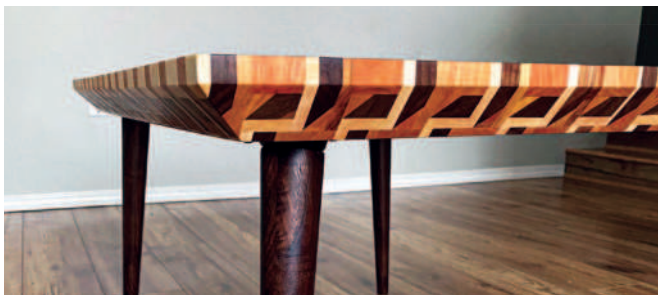
ZigZag pattern cutting board

wired for 220V, so I've been researching the various machines I'd like to upgrade. And of course, researching ways to enlarge my chequebook to enable such purchases.

## WHAT HAS BEEN YOUR MOST CHALLENGING PROJECT SO FAR?

I can easily say my most challenging project to date has been the patterned end grain coffee table I recently finished. This one pushed me far outside





End grain patterned coffee tables



of my comfort zone in every way. It tested my skills, my machines, my patience and taught me that no matter how long I think something will take, things always take longer. The top is made up of nearly 3,000 individual pieces of wood glued together over a series of eight different glue-ups. The base is solid walnut with mortise and tenon joinery. I hadn't made drawers since I was in trade school, so naturally, there were a few harsh reminders of what not to do. I also had a strategic vision with the orientation of the wood grain on everything in terms of how I wanted the heartwood/sapwood of the walnut to interact with each other. I book-matched the grain on the walnut drawer fronts and on the cherry drawer bottoms. There was a lot going on in this project and at times, I had a hard time seeing the light of the end of the tunnel. But I kept going and eventually arrived at the finished product. I learned so much on this one, and as trying as it was at times, I can't wait to do another project like it.

## WHAT HAS BEEN YOUR FAVOURITE PROJECT SO FAR?

My favourite project to date is an end grain brick pattern cutting board that I built for my wife in early 2020. I made it out of repurposed maple hardwood flooring that I picked up from a renovation and some walnut. The maple became the bricks, and the walnut the mortar. There was a wild diversity of end grain in the maple, which made for such a unique look. The main reason it's my favourite is because I get to see the person I love use something I made on a daily basis. The second reason is I get to see how something I made stands up through routine use and time. Our kitchen is our own little research and development department.

## YOUR ILLUSION, CHAOS AND ZIGZAG BOARDS ARE INCREDIBLE AND LOOK SO INTRICATE! HOW DOES YOUR DESIGN PROCESS WORK?

Here, I need to give credit where credit is due. The original design for the Illusion and the ZigZag boards goes to a man named Andrey Muntian from Russia. He can be found @mtmwood. When I first started making cutting boards, I came upon his work on YouTube and was amazed at the concept of making 3D patterned boards. I went over to his website and purchased plans for each. After getting the technique down, that's when I started experimenting with altering the dimensions of the patterns and scaling them up in size to create larger boards, and eventually tabletops. My latest table top was a result of me playing around with some pieces I had left over from my first table top. I realised I could orient them in different ways to achieve different patterns. I've also experimented with using different woods, specifically in the ZigZag pattern. The Chaos boards are a lot of fun to make because there's not a lot that can go wrong, and there's no real science to it, other than to keep things as random as possible. Depending on how many glue-up stages one wants to go through, some pretty wild patterns can be achieved. It's just a matter of patience, as most of the project is waiting for glue to dry. I have a video on YouTube walking through my process for a recent batch of Chaos boards.

## WHAT INSPIRES YOU AND WHERE DO YOU GET YOUR IDEAS FROM?

I draw a lot of inspiration from the maker community on Instagram.





Geometry cutting board

There are so many talented creators out there and watching others work through their process on their custom project often gets the gears turning about what I could do differently within my process. Imagination is important, and for my imagination to roam freely, my mind needs to be calm. A long walk in the woods is when the build ideas seem to come zinging at me. I also need to build what I'm interested in building. There's no quicker way to kill the creative flow than to try and build something that doesn't stimulate you. For example, I've taken on jobs where the word 'rustic' was used to describe the desired outcome, and as much as I appreciate the 'rustic' look, it's not something I get all that excited about making myself. It's when I'm really excited about what I'm building that the ideas for the next build seem to come effortlessly.

## WHAT ARE YOU WORKING ON NOW AND NEXT?

At the time of writing this, I've just crated up the table I've talked about and sent it on its long journey to California. Before I start anything, a good shop clean and organise is in order. Next up is a large 16 x 20in ZigZag board that's headed from my shop here on Vancouver Island all the way to Norway. I also have two other large board commissions that I'll be starting on for clients located in the USA and Australia. When I have time in between customer orders, I'll start chewing through the various bundles of hardwoods and softwoods I've collected over the last couple years. I've kept nearly all the cut-offs from all my past projects and I've got some fun and unique build ideas ranging from boards to tables that I'm excited bring to life.

## FROM YOUR INSTAGRAM, I SEE THAT YOU HAVE A LOVELY BOXER DOG, DOES SHE SPEND MUCH TIME IN YOUR WORKSHOP?

Only on the days where I'm doing a lot of milling and the machines are going for long periods of time, does she stay home. The rest of the time she's with me in the shop. I actually have two dogs, but the other one doesn't come to the shop all that often. He's a Boston terrier that will be turning 13 this year and is much more content to stay at home and sleep. I have a dog corner with their bed and blankets set up for them in the shop. They hang out there throughout the day, but most often, they'll follow me around or flop over on the concrete floor where they see fit.



Ryan's dogs are regular visitors to his workshop

## WHAT DO YOU LIKE TO DO WHEN YOU'RE NOT WORKING?

I enjoy reading, mostly non-fiction. I play a little guitar, but not near well enough to be in a band. I live on Vancouver Island, home to some of Canada's oldest forests and with the Pacific Ocean a short walk from home, spending time in nature is a routine occurrence. And at the time of writing, my wife and I are expecting our first child in a few weeks, so that's been keeping me busy, and I imagine will keep me very busy for the foreseeable future.

Woodworking may or may not be a lifelong career for me, but for now, I feel very lucky that I get to build what I enjoy building every day. If it doesn't remain my career, it will certainly remain a lifelong hobby. It simply brings me too much joy to ever stop doing it altogether. If you'd like to see some more of the projects I've built over the years, check out my website:

[www.westcoastboards.ca](http://www.westcoastboards.ca)

Or to see what I'm working on right now, I'm on Instagram [@westcoastboards](https://www.instagram.com/westcoastboards) And for videos of my build process, simply search West Coast Boards on YouTube.





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# BACKSAWS

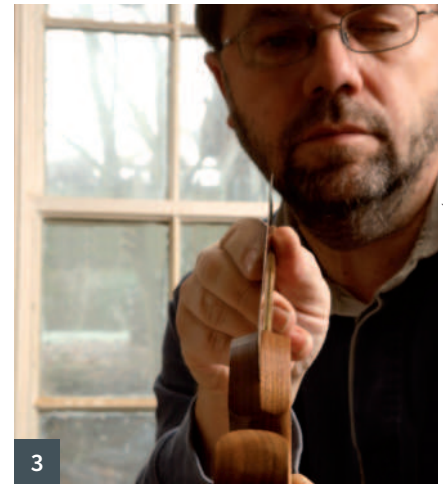
John Bullar learns what to look for in a backsaw and how to use it for best results

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The backsaw has a metal rib along the top edge of the blade to stiffen it and to distribute extra weight evenly over its length. This reinforcement allows the blade to be made light and thin so that it will produce a fine slot or kerf in the wood.

The large hand saw used for the hard work of cutting stock to width and length is nowadays largely replaced by the circular saw bench, either in the workshop or at the suppliers. However, backsaws are still used by most makers when they need fine work.





**1** This tenon saw has a 350mm-long, 75mm-deep blade with a D handle while the dovetail saw (right) has a 230mm-long, 30mm-deep blade and a pistol-grip handle **2** Although all described as pistol grips and looking similar, the dimensions and feel of different handles can vary a lot **3** Sighting along the blade and then the back of a saw confirm that both are straight **4** Brass backs can be milled or folded (right) in manufacture; some are made from steel **5** The blade must be firmly gripped before it can be sharpened, ideally in a saw vice

## Backsaw components

### TENONS AND DOVETAILS

Tenon saws and dovetail saws are the most commonly used backsaws, used respectively for cutting large and small joints. The tenon saw has a wider blade, allowing it to cut up to 75mm deep for large joints. The length is typically 300–350mm, providing a long action for rapid cuts.

It is unusual to cut dovetails more than 30mm deep, so the dovetail saw blade can be made narrower. This brings the back closer to the cutting edge, improving stiffness and accuracy for fine work. Length is normally no more than 230mm for smaller, more deliberate, strokes.

### HANDLES

Wooden handles are warm and comfortable to the hand while easily manufactured in small volumes. Beech works and lasts well while walnut or maple woods are offered on upmarket saws.

Horns above and below shape the grip to fit the palm of the hand and are used as styling features to make the saw look elegant. Small variations in the width, depth, length and shape of the grip are very noticeable and it is worthwhile holding different saws to get their feel.

The handle front is slotted to accept the blade, with recessed bolts to grip it. The slot widens at the top to fit around the back.

Grain is selected by the manufacturer to provide strength in the narrow sections above and below the grip.

Dovetail saws commonly have a pistol grip, open at the bottom, allowing a small handle to be gripped in a large hand with lightness and flexibility of hold.

'Gent's saws', used for very small work, have a similar blade and back arrangement to small dovetail saws, but the handle is turned and secured to the back rather than the blade, with the result that the grip is around the axis of movement.

### BACKS

The backs on good-quality saws can be steel but are more commonly made of brass. Being denser and softer than steel it can be made in heavy gauges and easily shaped around the blade. Brass is also corrosion resistant and polishes up to look good. The standard back is made from a strip of sheet metal folded double and swaged onto the blade to form a friction fit. Some versions are machined from 6mm-thick rectangular bar with a slot milled in one edge to fit the blade, but there is no difference in function.



**6** Cross-cut teeth are sharpened with the file angled to the blade to produce a slicing action which severs the fibres ... **7** ... and rip-cut teeth are sharpened to keep the front of each tooth at right angles to the blade **8** A saw set bends or 'sets' every other tooth slightly off to one side then alternate teeth are set to the other side to widen the kerf **9** Hard-point teeth like those on the Japanese Dozuki pullsaw blade cannot be sharpened or set because the material is too brittle

## Teeth and sharpening

Even if you do not plan to sharpen a saw, it is worth looking at the process so as to gain a better understanding of the shape of the teeth.

The blade must be firmly gripped along its length before sharpening. The ideal tool for this is a saw vice that allows the blade to be tilted in two dimensions. Wooden saw chops are simple to make or improvise from two battens gripped in a conventional vice.

The first stage of sharpening is to top or joint the teeth by running a straight flat file along the top edges. This ensures the tips of the sharpened teeth will end up level.

Tenon saws typically have 12 teeth per inch or a pitch of 2mm while dovetail saws may have 15 to 20 teeth per inch or a pitch of 1.5 to 1.3mm.

The saw teeth are divided by V-shaped notches or 'gullets' with an angle of 60° between the front and back edge. Fine triangular Swiss files or needle files known as 'three-squares' are used; these cut with their corners as well as their faces, deepening the gutlets and restoring the teeth. The files are produced in bastard cut,

second cut and smooth cut versions but only the smooth cut is necessary for fine sharpening.

## Cross or rip cut

Backsaws are produced with teeth prepared either for cross-cutting at right angles to the wood grain or for ripping along the direction of the grain. To some extent the two are interchangeable but they work more cleanly and quickly when used in the direction intended.

Cross-cutting requires the teeth to slice through fibres, severing them cleanly on either side. Cross-cut teeth have their front edges raked at an angle of 75° to the direction of cut and bevelled at 60° to alternate sides.

To achieve this they are sharpened with the file held at a compound angle to the blade, shaping alternate gutlets on one side before turning the blade around in the vice for the other gutlets.

Rip-saw teeth gouge out the fibres following the line of the blade. They can be sharpened much more simply by keeping the front of each tooth at right angles to the sides of the blade and perpendicular to the line of the cut.





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11



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**10** Martin Grierson examines the teeth and feels the amount of set on a new dovetail saw **11** Martin's arm and sawblade form a straight line as he crosscuts a piece of walnut against a bench hook **12** Andrew Lawton stands with his feet well back from the bench while sawing in the vice

## Kerf and set

The thickness of a backsaw blade is typically just 0.5mm. Any friction between the blade and the kerf it runs in can cause local heating, distorting the blade as well as making hard work of the cut. To prevent this from happening, the teeth are bent with a small offset to either side.

This 'set' makes the kerf slightly wider than the metal thickness, typically 0.6 to 0.7mm. The set in the teeth is shaped using a tool called a 'saw set' which presses the tooth against a miniature anvil at the correct angle.

The set also gives the blade freedom to tilt in the kerf which is a mixed blessing – while it enables small corrections to be made in the first few strokes, it also allows the blade to drift from side to side, producing a wiggly line.

Makers often need to reduce the set provided on new saws to give them a finer cut. This can be ground out by laying the blade face down on a whetstone or it can be pressed out by squeezing the teeth lightly between metal plates in a vice. This latter method has the advantage that it does not reduce the width of the teeth.



**13** The finger and thumb pinch the board to guide the blade at the start of a cut **14** Cuts on marking lines that are made with a knife are normally guided down the waste side of the line while pencil lines are split

## Backsaw techniques

### SAWING

The backsaw handle is gripped with three fingers and a thumb, the index finger pointing along the back. The feet are positioned apart and well back from the bench, allowing the arm to swing in a piston motion with upper-arm, forearm and wrist all aligned with the saw back.

At the start of a saw cut, the blade needs to be positioned correctly and at the necessary angle for the intended cut. The saw must be pitched slightly forward for the first stroke so it enters the far side of the wood. This is where things often go wrong, the saw jumping from its starting position or tilting off line.

Taking most of the weight off the teeth while guiding the blade against finger and thumb of the free hand reduces the chances of jumping before the kerf is established. Locking the wrist and keeping

a hawk-like attention on every stroke is the best way to avoid sawing at the wrong angle and drifting off-line.

As the kerf develops, the saw is held level and the weight of the back is allowed to press on the teeth without risk of jumping. The arm now provides purely horizontal force, the saw guiding itself in the kerf. Constant attention is still needed to keep the angle correct because once a kerf has drifted even a couple of strokes off-line it is practically impossible to guide it back on again.

### JOINT CUTTING

Backsaws are primarily used for cutting joints. On tenons the critical cuts are the shoulder lines running across the grain, and that is why crosscut teeth are preferred. The critical saw cuts on a dovetail are the cheeks which run along the grain and these are best cut with rip-saw teeth.





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**15** Approaching the bottom of a cut, the saw must be held level to prevent overshoot on one side **16** Making a partial cut for a lapped dovetail, or in this case a secret joint, the face of the wood is tilted while the sides are gripped parallel in the vice **17** Sometimes it is better to tilt the sides of the wood while sawing an awkward angle, like this double-bevelled joint

Joints are marked out before cutting. Non-critical lines are marked with a pencil line 0.5–1mm thick which the saw blade can split down the middle.

When it comes to sawing the mating half of a joint, a knife line is used and the saw kerf is run against the waste side of it, so closely that the knife line forms the edge of the kerf. For more complex joints, sawing at a compound angle is a three-dimensional activity and to judge the start of the kerf accurately you need to be able to see it with both eyes. Positioning your nose above the saw back gives you this view, although it takes a bit of getting used to because each eye is watching the opposite side of the blade.

Wood is secured low in the vice or tight against a bench hook to prevent vibration. After a slow start the saw can progress quickly down the line, slowing at the end to ensure it does not overshoot.

## Pros and cons

Hand-cut joints are a matter of taste – some makers like using them and some customers are prepared to pay for their effort. On other styles of furniture, exposed joints would look out of place so machine-cut joints are more cost-effective.

Even so, the backsaw can reach into awkward places with no set-up time, producing angles and clearances a machine cannot achieve, so every maker needs some proficiency in using the backsaw.

Backsaws are precision instruments. Like most tool steel, the blades are not corrosion resistant and need to be kept very dry or lightly waxed to prevent pitting. Carefully chosen, used and maintained, a good backsaw will last a lifetime or more.



# AUTUMN COLOURS

Alice Johnson discovers the science behind  
the stunning seasonal change in leaf colours

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A yellow leaf shines brightly in the morning light, although its stem has the strength to adhere to an oak tree's branch for only a few more moments. A rush of wind finally breaks this remnant free from the structure's clutches, swirling it through the air until it lands on top of a pile of crisp leaves at your feet.

It's autumn, a time when forests produce myriad colours that culminate in remarkable displays to delight the senses. Fall is anticipated across the world for this reason, with the season occurring in the Northern Hemisphere from September to November, and in the Southern Hemisphere usually from March to May. Its rainbow display can seem magical, but there are fascinating scientific explanations for the altering scenery.

## All change

As autumn arrives, the leaves of deciduous trees begin to look different as they lose their exuberant, green summer growth and take on a dry, crisp-like texture. This alteration is accompanied by dazzling copper-gold tones that radiate across the countryside. The reason for the annual spectacle is survival. Broadleaf species cannot continue to grow and prosper in freezing winter conditions, because their leaf cells would rupture, and photosynthesis – the chemical process that allows plants to produce energy – would be hampered.

These changes are something in which John O'Keefe, scientist and emeritus coordinator of the Fisher Museum at Harvard Forest in the US, has much experience. 'Deciduous trees have evolved to seasonally drop all their leaves and go dormant when sufficient water is not available, because of frozen conditions or a prolonged dry season,' he says. 'Part of this process involves the breakdown of chlorophyll, the green pigment that enables photosynthesis.' The gradual variation in colour of the landscape follows this natural development, as the reduction of emerald shades, created by the presence of chlorophyll, allows the dazzling pigments associated with autumn to become visible. John explains: 'Carotenoids, the yellow pigments present during the growing season but masked by the green chlorophyll, provide the golden colours seen as the chlorophyll breaks down. Anthocyanins, red pigments produced using energy from sunlight during the fall, create the orange, red and purple colours. The shades seen depend upon the abundance of each present and will change as the process progresses.'





## Riot of colour

Carotenoids and anthocyanins are the natural complexion of the plant tissue responsible for autumn colour. Mature displays can be seen in ancient European woodland, as foliage transformation occurs in abundance, with beech, oak and silver birch creating a diverse yellow-copper canopy. In the US and Canada, mixed-species parades of broadleaf and evergreen trees, such as pines, form across the landscape producing a jigsaw of avocado and flame-like colouring. 'In north-eastern US, sugar maples, with their fiery red-orange colour, probably contribute the most to vivid fall displays,' says John. 'Red maples (bright red), birches (yellow), ash (purple), black cherry (pink) and hickories (yellow-gold) provide variety and contrast.' Along with wild species, ornamental specimens are much-admired at this time of year. Standout examples include 25m-tall maidenhair trees native to China, which produce golden hues, tupelo trees from North America with their ovate red-yellow leaves, and the varying ruby foliage of cherry trees.

But while the regularity of autumn can be guaranteed, the same cannot be said for its intensity, which is influenced by growing conditions and weather. The most desirable for colour development are bright days with plenty of sunshine. 'For a healthy tree going into fall, average rainfall and gradually cooling temperatures allow colours to steadily develop, and ample sunlight is especially important for anthocyanins,' says John. 'Cool nights and sunny days are ideal, and a lack of storms and strong winds help to prolong the display.'

Equally as awe-inspiring as this display of colour is a tree's ability to detach and drop its leaves from its branches, a feature that ensures broadleaf species live to the following year, as John describes: 'Deciduous trees have evolved to respond to decreasing day length and cooling temperatures in autumn to begin the process of dormancy. This includes colour changes in preparation for dropping their leaves, as the chlorophyll is broken down and its compounds are

stored in the buds to be used in the new leaves the following spring.'

The process by which leaves separate from the tree is called abscission. 'At the point where the leaf is attached to the stem and the bud for next year's leaf has developed, a layer of barrier cells [the abscission layer] forms,' says John. 'As these cells grow, the connection between leaf and stem decreases until, eventually, the cells form a barrier, the connection is broken and the foliage falls off.'

## Earthly powers

But where do these lush layers that carpet the forest floor go? After all, come spring they're often nowhere to be seen. Kirsty Elliott, an environmental scientist and a member of the British Society of Soil Science, explains: '[They're] broken down through a process called decomposition.' This decaying of organic matter can happen in several ways. 'The first is detritivore fragmentation, where organisms, such as earthworms, ants, flies and millipedes, consume the dead leaves,' she says. 'The second is saprotroph decomposition, where fungi and bacteria produce enzymes to break down leaves into smaller constituents, including simple sugars, water, nutrients and minerals.' In this way, the annual leaf fall boosts the organic matter in the soil system, which is essential to the health of the planet. 'It's vitally important for replenishing nutrients that are depleted when plants grow,' says Kirsty.

'Think of it as nature's recycling process. It's a circular system that sustains levels of important soil nutrients as well as contributing carbon to maintain soil structure and functioning. Without it, soils would become exhausted and unable to sustain life.' So, next time you see autumn leaves on the breeze, take a moment to appreciate their pigments, knowing that while their dazzling display of colour might be over, their work is far from done. They'll be absorbed into the soil, allowing the continuation of life, and another rainbow fall next year.



## Five top places to witness nature's wonders



PHOTOGRAPHS BY SHUTTERSTOCK

### ONTARIO, CANADA

Offering landscapes swathed in vivid colour, the province's popular destinations include the Bruce Peninsula and Spencer Gorge Conservation Area, situated on the Niagara Escarpment. Algonquin Provincial Park provides another great place to

marvel at the autumn landscape with its intense colour display, thanks to its red and sugar maples, bright cherry trees, yellow-leaved birches and coniferous pines. Visit from mid-September through October.



### WHITE MOUNTAINS, US

Ranging from New Hampshire to Maine, the White Mountains reach across 140km of the US and form a part of the Appalachian range. The maple trees are its autumn stars, as they create a peppering of bright red across the landscape. Visit from late-September until mid-October.



### NEW FOREST NATIONAL PARK, HAMPSHIRE

Famous for its deer and ponies, the New Forest features ancient deciduous trees, including beech and oak, creating a sumptuous display of hues from deep browns to orange, with a shimmering added from silver birches and their yellowing leaves. Visit in October and November.



### TOKYO, JAPAN

To witness the bright-yellow spectacle of maidenhair trees, also known as *Ginkgo biloba*, visit the 300m-long Ginkgo Avenue in Meiji Jingu Gaien Park, Tokyo. Enjoy the custom of treading on the golden foliage dropped from around 150 of these trees during the annual fall festival, which usually runs from mid-November into December. Ueno Park is another must-visit place to appreciate autumn in the city.



### NEW YORK, US

This world-famous city offers mixed species that produce a warming autumn glow. The Mall at Central Park is lined by American elms that create a sunshiny show of yellow before the cold of winter sets in. Cherries, birches, oaks and the yellow-red variation of the tupelo tree are also found in the park. Visit during October and early November.



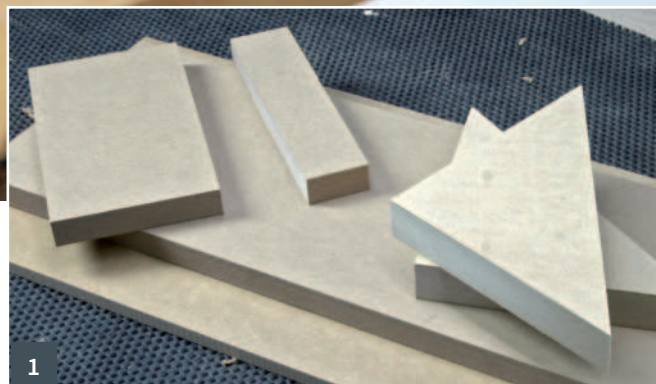


# MITRE BISCUIT JIG

Improve the function of your mitre saw with Alan Holtham's simple jig

One of the best ways of securing a mitre joint on a box or carcass is by fitting biscuits, but even with the proper mitre fences in place, cutting the necessary slots can be a bit hit and miss if you try to use a biscuit jointer. This simple jig overcomes the need for the biscuit jointer altogether and instead uses your router and an inexpensive cutter. It is just a means of holding the work at precisely 45° to a horizontal slotting cutter mounted in the router. It is one of the easiest jigs to make, but does require you to have the router mounted in a table of some sort. There is very little precision involved either, a few accurate 45° cuts and make sure the material stop on the jig is at 90 degrees to the table surface and the joint becomes foolproof.

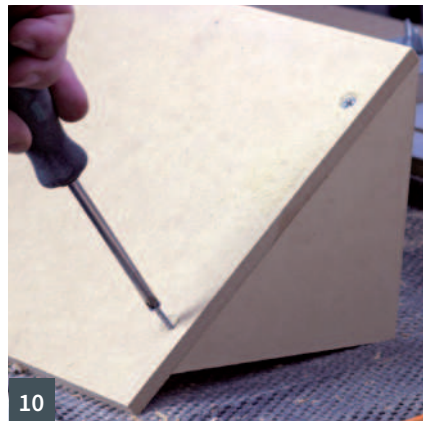
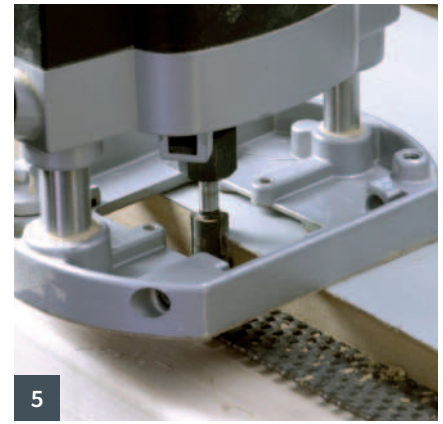
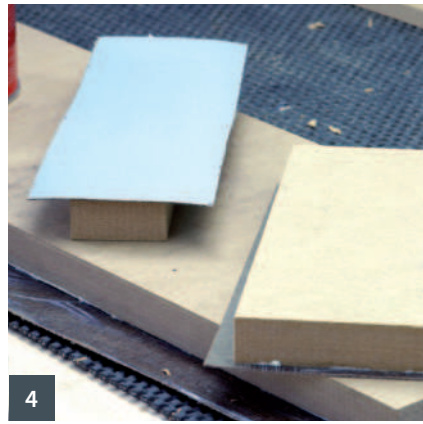
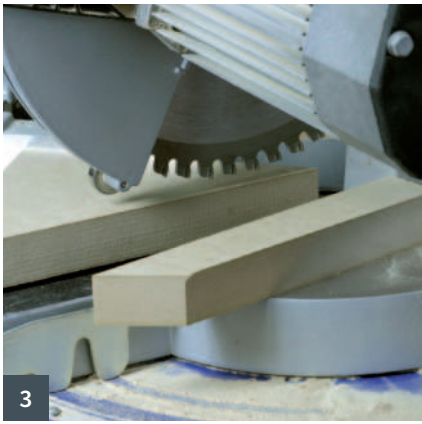
Another advantage of these jigs is that they are cheap to make and allow you to use up all sorts of scraps of material, the finished size to some extent being dictated by what you have available. I always use MDF as it is flat, stable and cheap, but use hardwood if you prefer. MDF is quite soft so I cover the wearing surfaces of jigs that I am going to use regularly with offcuts of laminate, but this is not essential for occasional use.



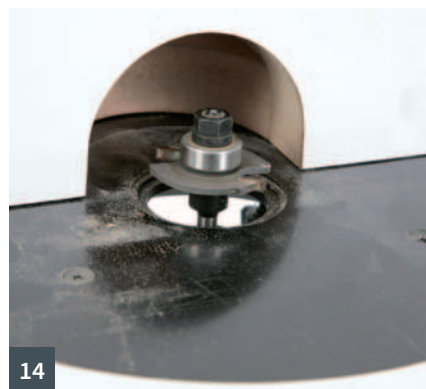
## Build the jig

- 1 Start the construction by cutting out all the necessary pieces. In this case the base is 10mm stock, the support board and stops are 16mm and the ends 25mm.
- 2 The support board has to be fixed at a true 45° to the base, so start by planing this angle along one edge.





- 3 The supports for this also need to have a 45° angle so ideally cut these on a chop saw, but do check the angle produced, it may not necessarily be spot-on straight off the saw.
- 4 The laminate is stuck on using contact adhesive, the new solvent-free ones seem to work well and are much more pleasant to use. Cut the laminate roughly to size leaving plenty of spare all round and stick it on firmly.
- 5 A tight squeeze in the vice often helps the bonding process. Then use a straight trimmer in the router to cut back the excess to a perfectly flush finish.
- 6 The support board needs two slots to take the adjustable stop, so cut these with a straight cutter suitable for the bolts.
- 7 The coach bolt head needs to be a sliding fit in the slot, but not so loose that it can turn. I used an 8.5mm cutter for 8mm bolts. Use the side fence to guide the cutter, and mark the start and stop positions with a pencil line.
- 8 A deep cut like this with a narrow cutter will have to be made in several passes, or there is so much vibration that the cutter chatters and may even snap. A cut of 5mm at a time is plenty deep enough, and with a little care you should hopefully end up with two perfect slots. Use these slots as a template to mark and then drill the bolt holes in the sliding stop.
- 9 This stop and the fixed one also need a 45° chamfer cutting on the end. With the bolts and wing nuts in place the stop should be a nice sliding fit without being too sloppy.
- 10 The angled supports need to be screwed to the base from the underneath, a little PVA glue will help to hold it all rigid.
- 11 Then turn the jig back up and fix the support board, screwing through the end stop as well at the one end, and just through the support board at the other. This fixed end stop must be at 90° to the edge of the support board or the biscuit slots will be angled, this is the only crucial part of the making.



**12** That is really all there is to making the jig. It should only take you an hour or so to knock up, but will save hours of frustration while trying to glue up mitre joints.

**13** The bolts should slide freely, but if there is any problem you can always access them from the back of the jig.

## Using the jig

**14** To use the jig you will need a dedicated biscuit cutter for the router. These are supplied with a range of bearings to suit the size of biscuit you are going to use.

**15** The router has to be mounted in a table and the height of the cutter adjusted until it is in the centre of the mitre joint. A fine height adjuster on the router makes this much easier.

**16** I initially just hand held the work in the jig, extending it down onto the table and used the bearing on the cutter to control the depth of cut.

**17** A few trial cuts soon showed up a tendency for the work to

‘creep’ as it was pushed into the cutter. This means the slot ends up slightly over-width so the effectiveness of the biscuit is lost, and the joint also goes slightly out of square.

**18** Instead set the work back in the jig so it lines up with the edge of the jig and use this edge as a guide against the table fence to control the cut. Put some pencil lines on the table fence to give you the start and stop positions. You will also need to clamp the work firmly onto the jig to eliminate any movement; it must stay fixed in place during the cut. With everything firm, just gently push the whole assembly onto the revolving cutter. With the weight of the jig and the massive area to hold, there is little danger of kick back. The result should be a perfect, clean slot in the mitre.

**19** Repeat the procedure for the other part, the pencil lines will ensure you get the matching slots the same length.

**20** The end result is a really strong and ‘frustration free’ mitre joint that locates perfectly and is dead easy to glue up because it cannot slide about.



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A detailed wooden carving of a lion's head with a large, flowing mane, mounted on a scroll-shaped wooden base. The wood is polished and shows natural grain patterns. The lion's head is facing left, and the scroll curves upwards and to the right.

# CARVING SCROLLS

Dennis Zongker explains how to  
add decorative scrolls on furniture

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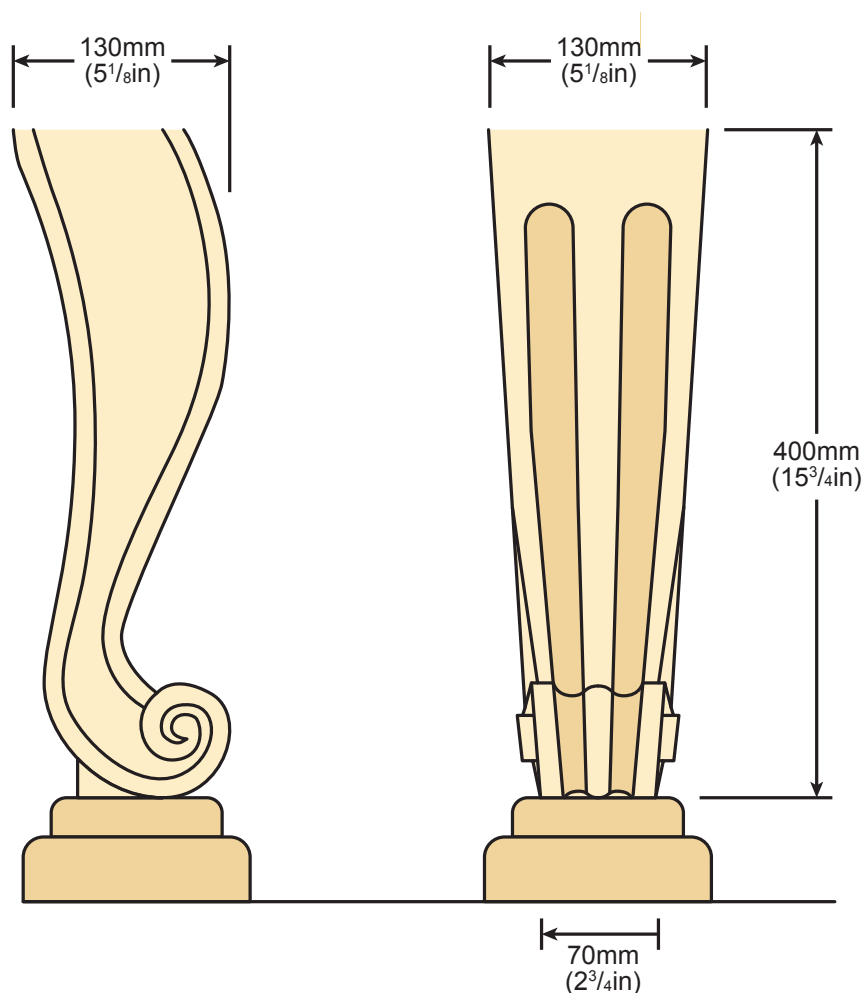
Carving scrolls into furniture is a technique that has been around for many centuries; its simplistic beauty and accurate clean lines combine to blend together several different radiuses. Scrolls can be incorporated into any style of furniture from a complicated baroque chair to a simple, modern-style table. In this article, I'll demonstrate how I carved scrolls onto the lower section of the legs for an end table.



## YOU WILL NEED

### MATERIALS:

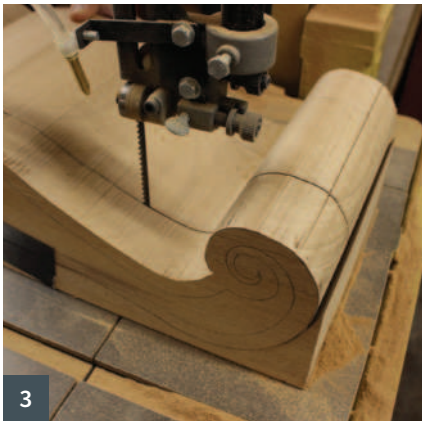
- Carving gouges: No.2, 20mm, No.2, 12mm, No.3, 5mm, No.3, 8mm, No.3, 12mm, No.3, 16mm, No.5, 8mm, No.5, 12mm, No.5, 16mm, No.7, 6mm, No.7, 14mm, No.8, 7mm, No.8, 18mm, No.9, 15mm, No.8a, 7-spoon gouge
- Bandsaw
- Mallet
- Detail riffler files
- Poster board
- Tape measure



## Carving the scroll

**1** After gluing up the block of wood, make a drawing template out of poster board, which is a thicker piece of paper for the pencil to follow when transferring it to the wood. Using a template is an important step as it will ensure that all four table legs will match up to each other. Using a bandsaw, cut out the side profile by following the outside edge of your pencil line.

**2** Once the side profile has been cut out place the back cutout piece onto your bench, then sit the table leg on top in order to draw in the two outside edges. Use a seamstress tape measure and pencil to make sure that both sides are equal distance with the lower scrolled foot smaller in width than the upper section where the flutes end.



- 3** Then tape the cut off bottom to the leg so that it rests flat and steady while you are cutting. Cut the taper off the front on both sides with a bandsaw.
- 4** Next, use the drawing template to redraw in the side profile carving lines.
- 5** For drawing in the front flutes I use a pencil and freehand the carving lines. Follow the same angle on the outside edge of the leg. Make sure that the lower section of the foot has tighter, closer lines, then gradually draw it bigger towards the upper section.
- 6** Starting at the centre of the scroll, stab cut with your carving knives at a straight 90° angle and work your way to the end of the scroll using a variety of different carving knives. Make sure you use a mallet and tap your knife lightly approximately 455mm deep into the wood.

- 7** Use a No.3, 12mm fishtail carving knife to relief cut up to the stab cut. Keep repeating these two steps, 'stab and relief' cutting, leaving the centre of the scroll as the highest point and carving deeper as you move outwards around the scroll.
- 8** Match up your carving knives to the scroll. Carve in a reveal around the edge that will blend with the side of the scroll.
- 9** Use a No.2, 20mm carving gouge to flatten up to the end of the scroll.
- 10** Use a No.8, 18mm carving gouge to carve the flutes into the face of the leg and lower scroll section. Follow the pencil lines and go deeper into the flutes towards the upper section of the leg and gradually carve shallower towards the lower scroll.
- 11** To carve into the smaller inside flutes on top of the scroll use a No.8/7 spoon gouge.





- 12** Use a No.9, 15mm gouge for carving the deep and wide section at the very top of the flutes. When carving this wider area you will need to slowly shave and blend the thinner mid-section of the flutes together.
- 13** On both sides of the table leg there is a centre recess with 11mm-wide edges that follow the front and back edges up to the scroll and follow into the scroll. The depth of the recess is approximately 4.75mm deep. Start off by stab cutting the border lines using three different gouges – No.2, 35mm, No.2, 20mm and No.2, 12mm – and use a mallet to cut into the wood around 3mm deep.
- 14** Use No.2, 20mm and No.3, 20mm gouges to remove the centre recessed wood. The goal is to have a flat recess, so the flatter the gouge the better the results.
- 15** Repeat steps 13 and 14 to get the right depth of 4.75mm. Use a

- No.3, 12mm gouge to clean and flatten next to the scroll.
- 16** The last couple of carving steps are to radius the corners of the flutes to blend with the other edges. Use No.5, 8mm, No.3, 8mm, No.5, 12mm and No.3, 12mm gouges upside down at different areas to arch the edges to where they will flow together.
- 17** Around the tighter radius of the scroll, use a No.5, 12mm to blend the concave and convex arches so that they also flow together.
- 18** Use an assortment of detail riffler files to clean up all the carving gouge marks. This is a great way to smooth the carving and also gives the project crisper details.
- 19** After all the carving marks are cleaned up, sand the carving with a 150-grit sponge block. I only sand enough to smooth and blend the wood evenly, this way I don't remove any detail but leave the carving looking clean and crisp.

# The vintage toolbox

Colin Sullivan looks at the scraper plane



1



2



3



4



5



6

**1** The Stanley No.80 scraper plane was in production from 1896 to the 1980s **2** The Record No.080 is almost identical **3** The 1869 Bailey designed No.83 scraper plane – I found this suffers from chatter and is difficult to use **4** The No.80 scraper plane was curved on the leading edge and slightly shorter when introduced in 1898 **5** The No.81 scraper plane introduced in 1909 has a rosewood sole plate and nickel finish but there is no way of adjusting the blade in the same way as the No.80 **6** The No.112 cabinet scraper plane by Stanley; copies are still made of this model

I love the two-handed scraper plane and feel it is my duty to promote it whenever I get the chance! With this simple tool you can produce a superb finish on any hardwood no matter how difficult the grain is. Unfortunately, they are no longer made, but there are plenty of used two-handed scraper planes available, especially the Stanley No.80 or the Record No.080.

If you know how to sharpen and use this tool together with a decent standard bench plane then you can produce a finish equal to any of the very expensive planes available today. I have a Stanley No.80 scraper plane that is in regular use. A cheap tool, easy to sharpen and simple to use, what could be better than that?

## THE HISTORY

Scrapers have been used in woodwork for many a century and there are various ways of holding them to avoid thumb ache and burn. One way is to mount them in a wooden stock, a bit like a very crude plane, but with the cutter almost upright. Leonard Bailey, in the USA,

was the first to design a metal holder for the scraper and Stanley USA took out a patent for it in 1869, manufacturing the Veneer Scraper No.12 right through to 1947.

This was followed in 1885 with the No.112 cabinet scraper plane, with a front knob and rear handle as used on a smoothing plane. The angle of scraping type blade can be adjusted to increase or decrease the cut and the blade can be turned around to make use of the toothing cutter. In fact, there were eight variations of the scraper plane made by Stanley USA to choose from up to the end of the 1930s. The popular and common No.80 was introduced in 1896, copied by Record in the 1930s and it is just as good as the Stanley, but both were dropped in the 1980s.

The scraper blade is similar to a normal scraper in thickness, but the cutting edges are ground or filed to 45°, honed sharp and turned with a burnisher or the back of a small gouge. I use an old knife steel that is smooth and not covered in fine grooves, easy to find at a boot sale and safer than using a gouge.



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