

A refreshing project with heirloom potential



Tea Boxes

By Geoff Birtles

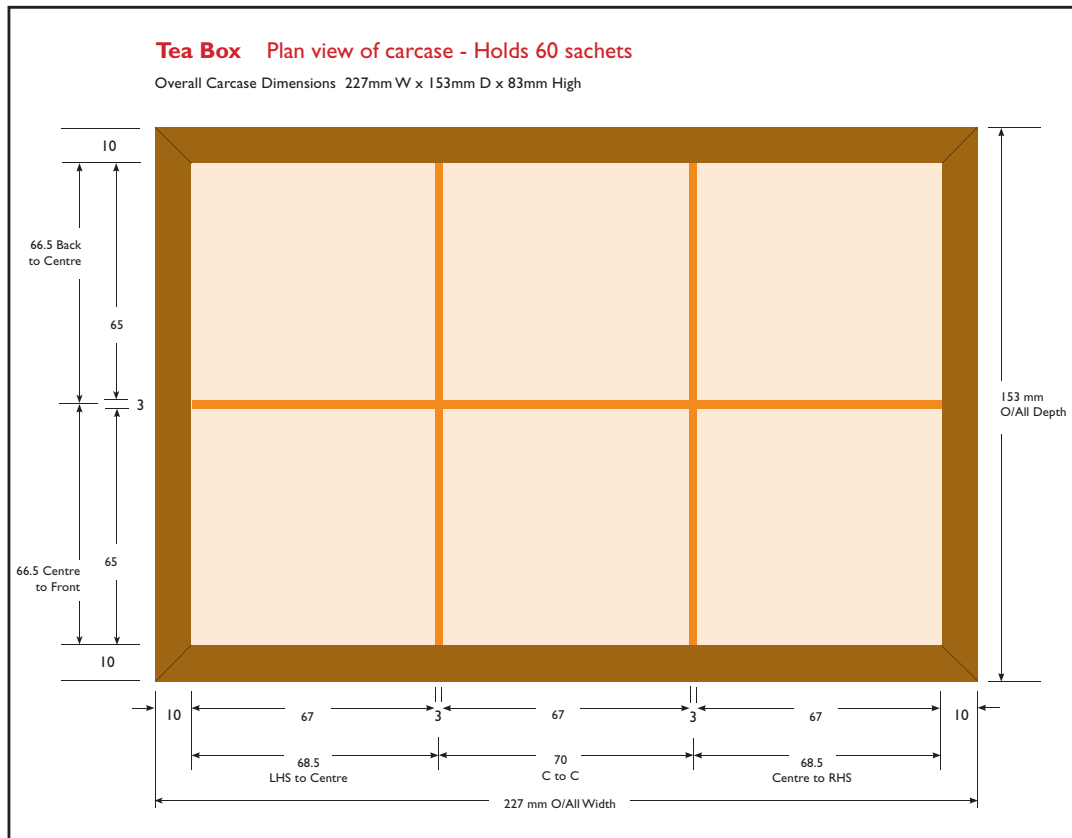
After water, tea is the most popular drink in the world. Its consumption equals all other manufactured drinks, including alcohol and coffee, put together. The Chinese have been sipping it for tens of thousands of years and it continues to play an important social, medicinal and commercial role to this day.

Back in 1907 an American tea merchant, Thomas Sullivan, began distributing samples of his tea in small bags of Chinese silk, with a drawstring. Consumers found they could simply brew the tea while it remained in the bag - the early beginnings of tea bags as we know them today.

Not surprisingly, the popularity of tea boxes is remarkable. They provide a memorable and special gift, one that will endure as an heirloom piece and increase in intrinsic value long after we move on.

FORM & FUNCTION DETERMINE SIZE & DESIGN

Twining tea sachets are one of the more popular brands and their size pretty much dictates the carcase size. At around 65mmW x 77mmH they are sold in packs of ten. Six varieties of ten packs seems to provide the most pleasing and practical proportions. This requires an overall carcase dimension of 277mmW x 153mmD x 83mmH, allowing for 10mm wall thickness, 3mm thick dividers and a 5mm thick bottom insert. A plan view of the carcase and dividers (alongside) provides all the critical dimensions of a snugly fitting box. Note: Snug leaves little room for error, add a couple of mil to the width if this is new to you.



(Side bar)

Setting up a mitre saw for accurate cuts and perfect box joinery

Even minute carcass cutting errors translate into big problems for box makers. A half of one degree error on mitred corners will make the difference between nice joinery and something you are less than proud of. I have learnt not to trust defaults on any compound saw and not to rely on free hand cutting to mark up lines for repetitive machining.

An auxiliary fence (jig) which positions and clamps the work pieces solves 50% of potential problems. Saw tune up solves the rest.

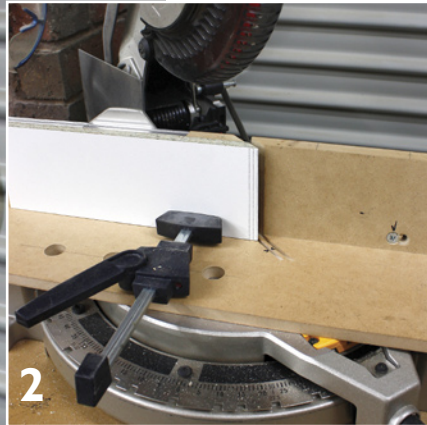
The primary purpose of the auxiliary fence is to hold the work piece firmly and eliminate any vertical cutting creep. This is almost impossible to achieve without clamping of small work pieces, at least with any degree of safety. You may not notice it, but inevitably the error is there. The second function is to enable spot-on repetitive cuts eg. Carcase sides of equal lengths.

Now it's time to tune the saw. You should only need to do this occasionally, but I check for each project. Remove the sliding stop block, and position the saw at 45°. Chop a largish piece of scrap (about 50mm square). Use your compound square to check for an accurate 45°. If it's off, scrub the detente position and manually adjust until it's perfect. (You will need to fix this sooner or later as it means your 90° cuts are also out!)

Now for the sneakiest and most common error, cuts that are not truly vertical ie. At 90° to the long axis. Rip some 16mm melamine chipboard to about 80mm wide. Use a square to mark some set up lines near one end of one face. Position a set up line a whisker to the left of your fence's cut line, secure with a Festo or toggle push clamp. Then chop (Inset pic 2). Do not be surprised, if you have a compound saw, to find the cut not truly parallel to the set

up line. Even a whisker is not good enough for small boxes. The fix is simple. Back off the blade head's tilt lock screw a little, tilt the blade fractionally to the right, and use a crescent wrench to adjust the tilt stop upwards in tiny incremental steps, testing with repetitive cuts on your set up lines. When you nail it, lock it all up. I found that my digital angle gauge could not achieve this degree of accuracy.

Now you're ready for truly accurate cuts. When working with four (overlength) pieces you do not use the sliding stop for the first cut, just line up your mitre cutting mark to the left of the auxiliary fence's kerf line and clamp. But ensure you use it for the second cut when targeting perfectly matching work piece lengths (See pic3).



Build an auxiliary fence from 16 or 18mm MDF (Refer main Pic1). This fence is sized for my 10" chop saw; it's 100mm high, 120mm deep and 610mm wide, glued and screwed square. It secures to the saw's aluminium fence with countersunk bolts and wing nuts. The height of the auxiliary fence is sized to act as a depth stop, which beats chopping right through the base! The LHS of the MDF fence has shop-made T moulding to secure a sliding work piece stop. The base is drilled with 20mm holes to position a Festool MFT SP clamp.

Continued from P1

The box lid is essentially 5mm wider and deeper than the carcase. It overlays each side by 2.5mm and the front by 5mm. Flush at hinged back.

Tea Boxes are rather utilitarian items and I feel that the design should reflect this - they are not jewellery or keepsake boxes - and shouldn't look like them. A hinged flat solid lid with contrasting "bread-board" ends provides a distinctive and appropriate look and helps keep the box height down.

For this project I chose Silky Oak (*Ref: AWR, P96, Issue #63*) which had been destined for some one's fireplace. The lid came out of a fork and the sides out of another stump. The uniquely marked, contrasting wood grain will make a statement in any setting.

ACCURATE CUTTING CRITICAL TO GOOD CARCASE CONSTRUCTION

Step one is to resaw, thickness plane and drum sand the carcase stock to 10mm thickness and joint one long edge. 10mm provides a balanced look with enough glue surface area at the mitred corners. If you are working with one long work piece, machining is straight forward. If you are using 2 or 3 pieces, as I did, it is important to run all pieces successively through each thickening pass to ensure they all end up the same, and to eliminate additional machine set ups.

If your wood is nicely figured, lay out the pieces to get the grain to travel continuously around the box and mark each matching end clearly, along with the top or bottom of the work pieces (Pic 1). Masking tape works well when the wood grain disguises pencil mark ups. Now rip to final width.

Accurate end cuts are critical to achieving clean seamless mitres and squareness. Even small cutting errors translate into big joinery problems for box makers! Opposite sides must be cut exactly to the same length, with spot-on 45° mitre angles that are precisely at 90° to the long axis.

Using the jig in Feature#1 will reward you with perfect joinery and you will have pleasure in using it time and again.

At this stage you should have two sides each of 153mm length and a front and back each 277mm long - all pieces 83mm wide. All marked to indicate the top (or bottom) and end joinery.

Now is a good time to cut rabbets for the bottom panel because they can run right through the work piece ends. (Pic 2). Use your router table with a spiral up-cut or rabbeting bit set to 5mm high (half carcase thickness) with the fence set back to the thickness of your bottom piece (nominally 5mm). Caution: You only have to rabbet the top of a side, instead of the bottom, to painfully learn the importance of good mark-ups!

I use yet another piece of blue tape with a cross on the outside top face to ensure I cut the inside bottom. A small push stick keeps the work piece flat over the cutter head. You can use your free left hand to safely push the work piece into the fence.

Pic 1: Carcase pieces all thickened with end cuts marked up so that the grain travels continuously around the box. Ripping to final width and mitred end cuts are next.

Pic 2: Yet another piece of blue masking tape (with a cross), indicates which face and side not to rabbet when routing the base rebates. You can rabbet prior to cross cutting when working with one long piece, as the rebates can run right through the ends.



1.



2.

STRESS FREE GLUE UPS. NO CLAMPS, NO HASSLES

We are now ready to approach glue-up. Sand the the inside faces to #220 grit, place masking tape along the inside edge of the mitred corners, flip to face up and align the marked ends for chosen end grain orientation.

I have tried many different ways of clamping small mitred boxes, always with some apprehension. But that's all behind me. Clear packaging tape does the job quickly and fuss free. And, you can look forward to perfectly seamless joinery.



1.



2.



3.



This is the kind of mitre join made easy by packaging tape. And, there's a bonus! The clear tape essentially ensures that excess glue squeezes inward onto your masking tape. Peel the inside masking tape (not the outside tape) just as the glue is going rubbery.

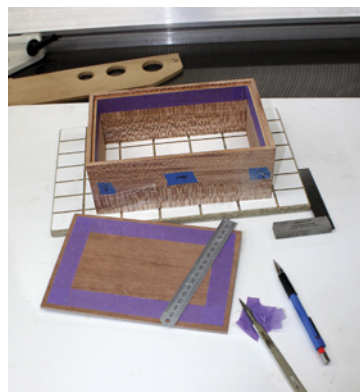
Push the ends of matching pieces together (Pic 1) and take care with bottom and top alignment. Secure with a short length of tape along the top edge. Then run a second piece overlapping this flush to the bottom. You shouldn't see any gaps. Repeat for the remaining two joins. The top pic shows our carcass laid out, taped and ready to fold into a box. Do a dry fold to ensure you have it right and then apply generous glue to each mitred edge.

Pic 2 shows it all coming together. Snug the remaining corner together and secure with tape. The joints will already be looking pretty good but to pull them tighter, run more packaging tape continuously around the box (pulling firm on corners). Two layers should do it.

Now check for squareness by measuring the diagonals. (Pic 3) I use a small stick with a braid through one end. Push it into one corner and mark the opposite inside corner on the side of the stick. (No sighting, positioning or memory errors!) Then I place the stick across the other diagonals. If the measurement is the same, and it probably is if you paid attention to the cutting, you have nailed it! If one diagonal is a little longer, apply pressure across it and recheck. Your story stick will help you keep track of corrections.

THE LITTLE BITS ARE THE KEY

Mitred corners are inherently weak end grain joints. A well fitted, glued base and mitre keys strengthen the structure. The keys provide a nice decorative element.



Masking tape keeps difficult inside areas clean when glueing the base.

Mitre keys add useful structural support but what I enjoy most about them are the creative opportunities they provide. You can vary the number, length and angle, all to achieve different visual effects. I opted for three keys, each of different lengths grouped closely toward the top of the box.



Hold the jig and box tightly to the fence throughout the cuts for consistent kerfs and well fitting keys. Remove the set-up block before you start.

Select a contrasting wood for your key stock, mill to thickness and rip to a width just wider than your deepest key slot (for more on this go AWR Issue #63 P59, Trivets). You are targeting a snug but not tight fit. Trim to oversize length and glue, firmly seating each key into the back of each slot. After an



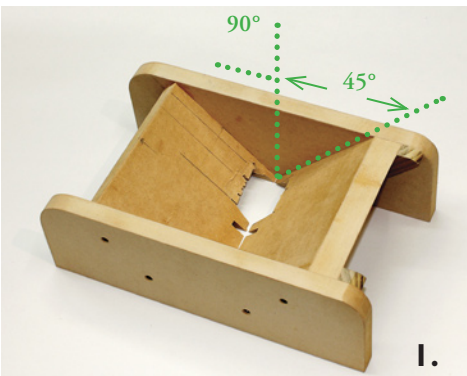
hour you can trim to about 1mm proud with a Dozuki hand saw. Flush trimming to the carcass sides with a stationary belt sander works well with care, but a sharp chisel and hand sanding works too.

It is important to seat keys right back into their slots. Long keys such as these will run across the inside corners and require trimming with a chisel.

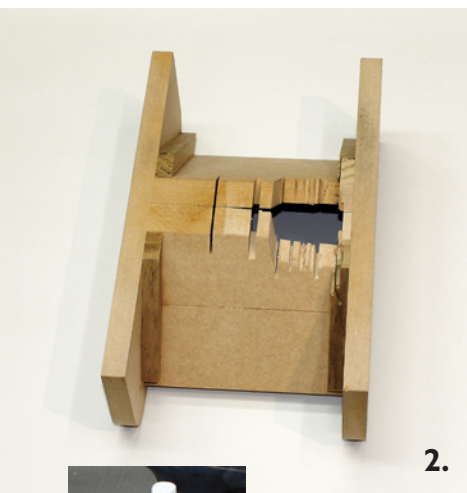
(Side bar)

Box Mitre Key Jig

Mitre keys are an important structural element and point of visual involvement. They can be cut by hand but a table saw jig, which runs along the fence, will do the job neater, quicker and more easily for most of us. If you're planning on making more than one box, build a solid jig, as you will use it time and again. As you can see from these photos, mine has had plenty of use since I built it in 2004 and I never expect to have to build another one. Here's a deceptively simple construction process.



Dimensions are not critical providing the box cradle axis sits at 90° to the sides (Pic 1). All work pieces are from 18mm MDF. Rip the jig sides to around 130mm, cross cut to 310mm length. Rip the cradle support stock to around 150 mm width and cross cut to two lengths of around 200mm with a 45° mitre at one end of each piece.



Then butt join the mitred ends of the two cradle pieces at 90° to each other with an instant assembly glue. I use two-pack Mitre-Pro which is one of the best kept secrets in the wood gluing business! Squeeze a modest amount of adhesive onto one face, spray activator onto the other, and bring the mitred faces together using a 90° angle for guidance. Hold together for 30 seconds and the bond is good. Do not be tempted to nail or screw if you value your table saw blades!



Now position one side of the 'V' cradle upright against one jig side. The bottom 'V' of the cradle should be sitting on the bench top, centred front to back and flush to the bottom of the side. Use a combination mitre square to position one of the faces at 45° to the side. Mark it up with a pencil, apply adhesive to the cradle side and spray activator onto the marked up jig side. Then bring the two faces together, and

hold for 30 seconds. You have around around 10 to 15 seconds to wiggle things into place before the glue goes off.

Apply Mitre-Pro to the other cradle side and inside jig face and bring them together. Sit all pieces upright on on your workbench during the assembly. Flip the jig on its side and flush up the top by ripping it through the table saw with it's bottom against the saw's fence. Then flip it again and reposition the saw's fence so that you can rip off most of the 'V' cradle bottom (See Pic 2.) This minimises table saw blade height in use and consequently blade flex. (Once again, you will need two passes, flipping the jig end-to-end between passes). Final dimensions are around 100mm high x 310mm long.

Reinforce the structure with glue rub sticks (PVA glue) and screws through the jig sides. Take care to keep metal fasteners well away from the table saw's cutting area. I have found my jig easier and easier to use as the cutting area erodes (Pic 2) because I can visually sight the blade against set up marks. Use of the jig could not be more simple and this is described in the text. The jig can be used for angled mitre keys by simply tilting the table saw's blade to the desired angle.

BREAD BOARD LID ENDS BOTH FUNCTIONAL & DECORATIVE

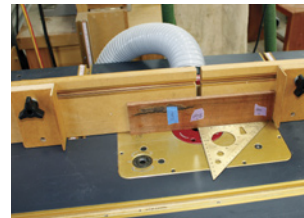
A one piece lid with distinctive grain looks good, but has the potential for bowing as the grain tries to straighten with changes in humidity. Bread board ends which run across the grain, essentially eliminate the problem and provide a warm decorative element which draws the eye to the lid. They are also visually well suited to mitred carcass keys of similar wood colour.

The lid overlays the carcass by 2.5mm on the sides to create a shadow line - it's also a little less formal, in keeping with our design objectives. The bull-nosed front overlays by 5mm. This provides an overall dimension of 232mmW x 158mmD. Deduct 34mm for the two 17mmW ends and we require a Silky Oak centre piece of 198 x 158mm. I had an oversize piece already resawn from another project so I simply had to thickness it on a drum sander and semi-finish sand to 10mm with #180 grit using a fine 2mm orbit small flat sander. The next step was to rip the piece to about 10mm over size (168mm) and cross cut to exact width (202mm) in readiness for Beefwood bread board ends. The Beefwood stock was thicknessed to 10mm, but other-size left unsized, at this stage.



This is my router set up for grooving the lid ends to fit a spline, with which we attach the Beefwood strips. The lid has been marked with groove extremities and the fence stop blocks set to limit travel to the outside of the 3mm router bit. Note the outside (top) face of the lid is against the fence for both end cuts.

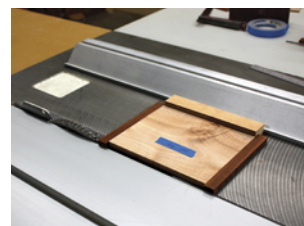
Note Please: These are set up photos. All tools, and the workpiece, are removed prior to switching machines on.



A similar set up applies to the bread board end stock. However it has not been cut to width or length in the interests of ease and safety. Once again the outside face is against the fence in the interests of perfect alignment. Having made one groove, rip the piece off at 15mm and repeat for the other strip. Cross cut each piece to oversize lid depth, (about 190mm) centering on the grooves.



A piece of spline stock is thicknessed to 3mm for a snug fit, ripped and crosscut to size. The groove, spline and work piece faces are glued as you would for a biscuit joint. Bring all together with light clamping pressure paying attention to a flat aligned surface. Clean up glue squeeze out immediately.



Now this is a pretty smart flush cutting trick taught to me by a retired furniture maker. We have a centre piece with two "wings" at each side. This makes ripping a bit hard! Insert a small piece of protruding scrap between the lid's front wings and set the saw's fence

so that you can cut through the wings and back line of the lid.

Now reset your fence to the required lid depth, test cutting on scrap. Turn the lid around so that the flushed back can ride along the fence and rip to final lid depth. Very cool!

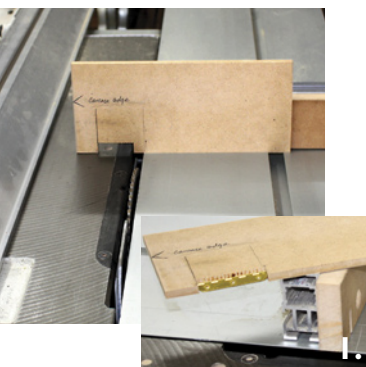
Use a small cove cutter to round the front edges (use care, back up the cut with scrap) and preliminary finish sand the front, back and sides with #220 grit paying particular attention to retaining nice sharp side and back edges.

HINGE FITTING. LESS FRUSTRATION, MORE ACCURACY

Hinge choice is important both to design and function. Traditional butt hinges look odd on a flat one piece lid and may not provide the long term stability required for frequent usage. Full width piano hinges look crass and compromise the finely hand worked presentation of the box. I chose to use two 50mm x 8mm round cornered hinges which are both fine and stable.

This is a very nervous step in box making for anyone, get it wrong and 30 or more hours are down the drain if you cannot live with a horrible fix or misaligned lid. In spite of much practise I have always been apprehensive, well until recently, when I read Doug Stowe's book, "Basic Box Making" (Taunton Press) available on-line, or mail order through AWR. I urge all Beginner or Intermediate box makers to read this book. You may not like his designs but you will love his work practises. It's a box making bible.

Doug uses a "hinge story stick" which essentially eliminates any carcass or lid mark ups and acts as a set up jig for the router table mortising cuts. I have refined the set up a little because this overlapping lid design requires four fence stop settings, rather than the two he describes for boxes with a cut off lid.



The first step is to cut a piece of scrap to the exact width of the box carcass. Mark the outside extremity of one hinge and nibble cut from this line inwards until the recess holds the hinge firmly, but not jammed in place (Pic 1).

Now set up your router table. I use a dedicated fence made from hardwood and T-track with two sliding shop made stop blocks. It pivots on a screw driven into the LHS of the table and adjust/clamps into T track on the right side (Pic 2).

Inevitably I use an 8mm up cutting spiral bit for most hinge sizes with the radius on this bit perfect for the corners of a 50mm piano hinge. Set the bit height to just under half the hinge barrel diameter and set the fence until the cut is just inside the hinge barrel area (Pic 2).

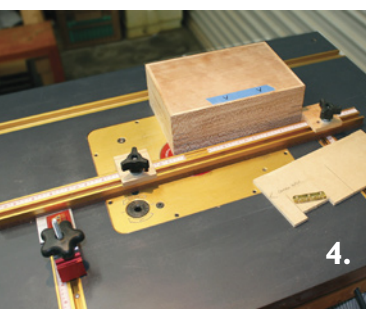
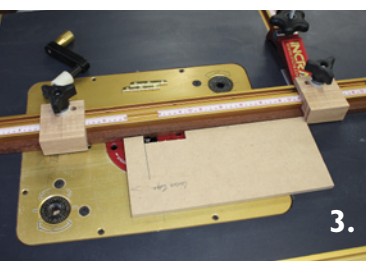
Now its time to use the story stick to set up the fence stop blocks. Pic 3 shows the set up for a RH carcass cut. The router bit has been rotated until its cutting extremity is to the left and the storey stick slid to the right so that the LHS of the recess touches it. The RH fence stop block is locked against the RHS of the storey stick. Now repeat this exercise to set the LH fence stop (after rotating the bit and sliding the storey stick to the left).

Cut your first mortice by lowering the back of the box between the stops and against the fence, slide it to both left and right a couple of times.

Now flip the story stick over from right to left, reset the stops for a LH carcass mortice and cut it (Pic 4). Note that this LH carcass cut is shot from the rear of the router table for clarity. (If our box lid was the same width as the carcass we would cut the RH lid mortice using the same setting. But it's not).

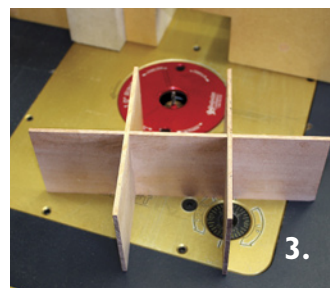
Because our lid is wider than the carcass we have a couple of extra steps. Mark dead centre on the back outside (top) face of the lid and on both sides of the recessed face of the story stick. Use pressure sensitive tape to tack the lid centre to centre on top of the story stick, set it back a few millimetres (Pic 5). Reset the stops as you did previously, but to the lid extremities (which overhang the jig by 2.5mm each). Remove the jig and cut your first lid mortice (face down!). Flip the jig, re-tack the lid and go through the process again for the other lid mortice.

The reward for what really is a quick process (once you get it!) are well fitted hinge mortices perfectly symmetrical on the lid and base with equidistant 2.5mm overhangs on each box side. Enjoy!



DIVIDING IT ALL UP

A snugly fitted box requires accurately positioned nesting dividers. Here's a simple approach that uses half lap interlocking joints for great looking results.



I use my router table with a stock feeding sled and stops (Pic 2). A 3mm bit is used to cut the slots. Use this set up to slot a piece of 6mm scrap - this becomes a thickening gauge for the next step. (You could use a mitre gauge with sacrificial fence, or a table saw)

Rip and resaw an oversize selected piece of timber (I used Myrtle to match the base) that's long enough for the three dividers. Then thickness on your planer and or drum sander (using a sled - Pic 1). When you get close to 3mm thickness start checking with the slotted gauge (top of Pic 1) until you achieve a snug fit.

Then rip to exact width (76mm) and cross cut to achieve the three dividers. Once again strive for an exact internal box fit.

The two shorter dividers are slotted flat on the router table at dead centre and to 42mm depth. Use a stop to prevent the work piece being pulled into the cutter (Pic 2).

Slots for the longer divider are each the same distance from the work piece sides so you can set the stop once and flip the workpiece for the second cut. But do check the cutting measurement against the plan as its easy to get confused on this one (if your internal box width is 207mm, the slots are centred on 68.5mm from the side).

Get it right and the three pieces will all firmly nest square (Pic 3) and snug into the box carcass with each of the cavities sharing the exact same width ie. a whisker over the tea bag widths.

THE END GAME



I used small feet (27mm square x 5mm) to lift the box and create a shadow line. (Once again Mitre-Pro works well here). A small ball chain secures an open lid.

Dismantle the box and start sanding. This doesn't take long as we have been sanding with #180 grit at each step. I use a combination of hand sanding with a block and my Festo 2mm orbit small base flat sander. Work up from #180, #220 to #320 grit. Dust off between grits. Then rub briskly with #0000 extra fine steel wool. This works so well you will want to stop right here!

I usually use 2 or three diluted shellac coats on the inside of a box and rub with steel wool. After masking off the inside with tissues and tape, I sprayed the outside carcass and both lid sides with two coats of Mirotone's Mirocat #3242, a pre-catalysed sealer, wet on wet. After 90 minutes a light hand sand with #320

grit followed by a rub with #0000 steel wool and the hard work is done. (You could use a few coats of Shellac and rub back with steel wool - it doesn't fill pores as well and provides less protection to abuse, but looks pretty much the same). Finally, I remove the internal masking and rub Mirotone's Mirowax #738 onto to all surfaces and allow 24 hours for drying. A brisk hand buffing followed by reassembly is next.

This very easy finishing process provides a beautiful soft sheen and silky smooth surface. The wax goes quiet hard over time and is surprisingly durable.

Time for a cuppa!



About the author.

Geoff Birtles is a marketing & communications professional who until he retired, headed his own business. He has worked with wood since his early school days and his workshop is an all abiding passion. He keeps busy with woodworking, writing, graphic design, vets road cycling and the odd corporate marketing assignment.

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