Ouicker Frames

In making a linen chest for his daughter Celia, David Fellows explains how to choose and use paired scribe and mould cutters for making the frames more guickly

ast issue we explained how to produce the tombstone panels for the linen chest 1 made for my daughter Celia. Now it's time to produce the frames, and this is done with 'scribe and mould' (or 'cope and stick') type of frame joinery, with the addition of Festool Dominos to strengthen and align the joints. Of course you could use conventional hand or machinecut mortise and loose-tenon (or solid tenon) joints.

The stock for the frames may need to be reduced in thickness to suit the capability of the 'mould and scribe' router bits you are using. These often comply with a material thickness range of 18mm-24mm. Thickness your stock to slightly less than the maximum, to avoid tedious trimming of machining slivers left at the faces. Cut the stiles to exact lengths. The rails can be left a little long to allow for trimming at trial-assembly or after glue-up. Prepare some scrap pieces of the same thickness to set up the cutters and to practise on.

Mouldings

The 70mm-wide middle stiles are moulded on both edges but the 65mm-wide end stiles are moulded on just one edge. Write yourself a warning message on the non-face side

near one edge of these pieces. 1 suggest 'don't mould'.

Make a template for marking and trimming the curved cutouts in the top rails. It is better to make only a single section of this because any slight inaccuracy will be repeated in all three cutouts and will be much less obvious on the finished piece.

The centre of the curve is outside the template so butt-up a piece of scrap MDF to support the point of the compasses. Pencil a line at right angles to the stile right across the template and scrap. This will be used to show where the centre was when fitting the template to the stile at three locations successively.

Saw, trim and seal the edge of the template. Mark the centerlines of the three cutouts on the top edge of the rails at the centre and 198mm from each end. Place the template line on each of these in turn and pencil in the arc on the bottom edge. Using a bandsaw and spokeshave cut the edges to within about a millimeter of the line. The closer you can get without crossing the line the better it will be. Do not use any abrasives. Now fit the template with carpet tape at one of the three locations and trim to the line using the pattern bit. Use a starting pin and pass the workpiece from right to left



Fig.1 Cross section of a 'rail and stile' joint



across the cutter, starting and finishing well before the ends of the template. Have a practice run first with the router switched off to ensure that there the scalloped edge. is no obstruction.

Beware of the effective change of grain direction when you pass the midpoint of the cutout because the danger of breakout increases steadily. The risk is this occurring is reduced if you make a series of radial 'nibbling' cuts before sweeping along the second half of the cutout. Repeat for all the other

locations on both side rails. If you have a long plane then set the mouth and cutter fine and take off a shaving right along

Prepare the end rails in the same way, but with only one cutout each (BW27:45, Fig.7).

Scribe and mould

The scribe cuts are made on the ends of the stiles first. This is mainly because the edge profile moulding cutter will subsequently remove any spelching at the end of the



Pic.1 For the chest David uses one set-up for the long grain edges on the rails and stiles (above), and the other across the end grain of the stiles. He adds a Domino to the joint for better alignment and strength (below)



scribe cut. The cross section of a stile and rail shows how the parts fit together. Here the moulding profile is a roman ogee but several others are also available. Note that the ogee profile profile is symmetrical in the thickness because the same or an identical cutter is used to make both parts of the joint. Although frames made by this method can be glued without any reinforcement 1 chose to use Dominoes to deepen the joint and register the positions of the stiles at assembly.

There are three types of cutters for these joints and they trade cost against convenience of use. If you have only one router table the best (but probably the most expensive) bit choice is a single combination bit. This has two moulding profile cutters and a slot cutter stacked on single shaft with a quide bearing. The diagram shows how these are used for the end-grain scribe, the subsequent realignment and the side-grain profile moulding cut. Examples of this type of cutter

British Woodworking February/March 2012

Setting Up

Understanding how scribe & mould works



There are surprisingly few explanations of how the nomenclature, let alone the procedures of cutting stile and rail cutters. For a start the joints are called many things. In Britain 'stile and rail' is the most common term, but 'scribe and profile' or 'scribe and mould' are also chosen. Profile relates to the edge profile along the stiles (verticals). rails (horizontals) and muntins (vertical dividers). Scribe relates to the ends of the rails and muntins matching the edge profile on the stile and rail (when there are muntins). Americans refer to this framing joint as 'cope and stick', and less often as 'cope and pattern'.

Counter-intuitively, perhaps, the scribe is machined on the end of the rail or muntin first. The most likely reason for this is that cutting across the grain is guite likely to lead to breakout, which will to some extent be cut away by the profiling pass. Note that normally the stiles will go across the ends of the rails, but in the case of David's linen case the rails go across the ends of the stiles.

Because the work is guided by the bearing, the only adjustment to make is the height of the cutter in the router table. This joint can't be cut with a hand-held router, and is best done with 1/2in shank cutters. To get the height right it's a guestion of balancing the tenon shoulder that abutts the inside face of the board, and the tip of the scribe that covers the profile. If the tip is too thin it will feather, and looks a bit feeble. If the tenon shoulder isn't wide enough the joint won't be as strong.

Once you have cut the ends of the rail you can change cutters or adjust the one you're already using to cut the profile on the edges. It's now just a case of trial and error to get the height right. Make a cut on a piece of scrap and then try the end of the rail for fit. Both front and back faces should be flush. This is when a fine adjuster on the router table is really handy.

With a combination cutter (top) it's just a case of keeping the same cutter in the table, but if you are using a pair of cutters (below) or a reversible cutter you will need to make further alterations before making the profile cut.



Pic.2 With single operation cutters, make the scribe cut first on the end of the rails, then switch to the moulding configuration

Cleaner routing

Coping with tearing and breakout



Pic.3 Making a zero-clearance false fence to reduce chipping when profiling. Ideally the cutters shouldn't be aligned like this, but at 90° apart

The most common problems associated with rail and stile joinery are breakout on the ends of the scribe cuts, and tearing along the grain on the profiling cuts. Both are potentially caused by under-powered routers, a lightweight table, poor set-up of fences, cheap cutters, lack of support to the workpiece or use of inappropriate wood (or a combination of the above). Assuming your router has a 1/2in collet and is larger than, say, 900w, and you've bought recognised brand cutters (which haven't been over-used), then most of the causes can be resolved easily for no extra cost.

When it comes to machining the scribe across the end of a rail or muntin, you need a sled or a scrap block to support the back edge of the cut. Stacking up a row of rails in one go means that the next rail will support the previous one, and you only have to support the back edge of the final one. You do have to make sure all the rails are pressed up against the bearing on the cutter. It's best to rely solely upon the sled or sliding mitre fence for this operation, and set the main fence back a fraction behind the bearing so that it doesn't disrupt the cut.

Tearing or chipping is a problem on profile cutting. Generally these profiles are made with one pass, which is why you need a powerful router and ideally good extraction to remove as much waste as possible. Choosing a benign straight-grained, even textured timber like sycamore to start with, you can at least give yourself the best chance of success. If chipping does occur then you'll need to make a zero-clearance opening in the fence to support the cut (above). With a split fence you can do this by moving the two halves into the spinning cutter. Without this you can add a sacrificial piece of hardboard or similar to the front of the fence, having cut an aperture for the bearing and nut part of the cutter. Then push the fence back against the revolving cutter until it breaks through. Make sure the fence is just behind the bearing by positioning a rule across the gap. Of course you can only do this once the cutters have been adjusted for the perfect joint.

Finally add appropriate featherboards to keep the workpieces firmly pushed down on the table. You can add a lateral featherboard as well, but these can get in the way of a pushstick or your hand when it comes to pushing the wood across the cutter.



are: Wealden T4000 1/2 and Axminster 666220.

The cheapest alternative is to use a reversible cutter set. This has a single profile cutter, slot cutter and bearing. These have to be stacked on the shaft in a different order for the two types of cut. The great disadvantage of this arrangement is that there are (easily lost) shim washers to adjust the spacing of the ogee cutter from the slot or tongue. You may be lucky, but you may have to adjust the shimming of the stack several times to get a good set-up for the second cut. Examples are Wealden T4200¹/₂ and ATC 666216.

A better solution is to have specific cutters for each type of cut. If you have two router tables and two cutters, the set-up is easier than with any other combination. A matched

pair of cutters is included in the Rutlands TR15 set. If you have a reversible cutter and find set-up tiresome then buy another of the same and set up the shims permanently.

For these frames, the scribe cut is made by moving the end of the stiles, face down, across the cutter. For doors or panelling where the stiles are full height you will scribe the ends of the rails. The face of the fence is set up level with the cutter guide bearing and parallel to the motion of the carriage. The support beam on the carriage has a sacrificial wooden block on the end to control breakout at the end of the cut and runs against the fence. If you do not have a sliding

carriage then hold the stile at right angles to the fence with an accurately-squared and much





Pic.4 Checking the template for the curved rail against the tombstone panel (above) and routing one of the stiles

larger sacrificial block; you can clamp this to the stile for additional security. A third alternative is to construct a coping sled; consult Bill Hylton's books for this. The cutter elevation above the table surface is set so that the vertical quirk above the ogee is a millimeter or two wide. Make a trial cut on a piece of scrap. Whichever way you quide the cut it is very important that the end of the workpiece runs tightly against the fence, the cutter bearing and the table surface. It is not necessary or useful to continue the cut very far into the sacrificial piece. Go far enough to completely cut the stile end and then back all the way out of the cut. If you have thicknessed your stock to suit the cutter then the cutting edges will extend above the top

and below the bottom of the workpiece and very little clean-up will be necessary. Scribe all the stile ends.

Change the bit to the mould profile and set the fence tangential to the bearing. Use a coped stile end to set up the elevation of the bit. Cut a trial mould (face down) on scrap and test the fit with the stile. The faces of the two parts should be level and there should be no gap between them on either face. Adjust the elevation of the cutter if necessary and mould another scrap piece. Since the mould is normally cut in a single pass there is a risk of breakout, particularly along the edges of the slot which accommodates the panel. If there is any runout on your router or extension collet it will show up as breakout on this



ROUTING



type of cut as the wide slot cutter wobbles in the slot. Inspect the edges of the trial pieces to assess the risk. On the stiles you can control this defect by re-setting the fence so that a very shallow cut of about a millimeter is taken first. This works because the exit angle of the cutting edge to the wood is to be lying on the floor! much greater than with a deep cut and therefore much less likely to lift the surface fibres.

On the subsequent full-depth pass the surface fibres are not cut. Mould all the edges of the stiles to full depth in one or two flat surfaces of the panels, passes, except for the plain second edges of the end stiles. With the same setup mould the upper edges of the lower rails and the lower edges of the upper rail, in either one or two passes, as before. Remove the fence, fit the starting pin and

mould into the scalloped recesses. Again there is the risk of breakout, particularly on the second half of the cut, so do not feed too fast. Slight breakout can be repaired and instructions follow. To see into the edge of the slot in the finished piece you would have

Panel cleanup

Last issue, in part one, we allowed the panels to equalise their moisture content after machining. Plane or sand the according to your prejudices. 1 used flat and curved scrapers extensively on the fielded borders and finished off with a random-orbit sander starting at 120grit. Take care to preserve all the crisp features when sanding. Test the fit of the panels into

LINEN CHEST

the slots in the rails and stiles and fit by chamfering at a shallow angle on the flat side, if necessary. Apply coats of Danish oil to both sides of the panels while preparing other parts.

Trial frame assembly

Cut Domino or mortise recesses on the ends of the middle stiles and at the marked locations 'D' on the top and bottom rails.

The mortises should be approximately centred on the slots and tongues of the edge and end mouldings and be 8mm wide. For a 40mm long Domino or loose tenon the mortises must each be 25mm deep, to allow for the interlocking scribe and mould. Dry-assemble the centre panel, middle stiles (muntins) and top and bottom rails. Remove the bottom rail, fit the outer panels and re-fit the bottom rail. Slide in the end stiles and mark the domino/mortice centres across

both faces. Ensure that the front and rear assemblies are equal in length. Dis-assemble and then cut the dominoes or mortices for the end stiles. Repeat the fitting, trial assembly and morticing of the end panels.

Choose the bottom rail which will be fitted to the end where the lid stay will be fitted and chamfer the middle 170mm of the top inner edge at 45° all the way to the slot edge. This is to ensure that the lower end of the lid stay does not catch on the edge of the rail. Clean up the inner edges of all the frame parts and sand the mouldings. Apply a coat of oil to the inner edges and mouldings and repair any slight tearout at the slot edges by rubbing a wax filler stick against the grain.

When the panels have had three coats of oil, glue up all the side assemblies. The panels are not glued in. Check and adjust for square and



consistency of overall size and plane and sand to a finish. Mask off the ends where they will enter the corner posts and begin to oil the frames while continuing with other parts.

Corner posts

Laminate material a little longer than the height of the panels and plane to 75mm square. Select and label the posts, using

the best for the front side. Cut housings 5mm deep 15mm from the faces and width to accommodate the side and end panel asemblies. Cut the post lengths to match the frames. Recess the 63mm wide hinges with the top of the knuckle 1mm above the tops of the rear posts. The entire knuckle must protrude over the rear of the post to allow the lid to open by a little more than 90°. Ensure this by back-bending one leaf down the back of the post when marking the recess around the other leaf on the top of the post. Slightly chamfer the top edges of the recess to allow the moving leaf an easy entry. Mate the posts with the

frames in turn and mark the positions of Dominoes or loose tenons on both components.



Three 8mm Dominoes per joint will do. The depth of the mortise on one side must be increased by 5mm to compensate for the housing.

Plane, sand and apply oil to the posts. Glue the front and rear frames to the corner posts. When dry glue in the end panel assemblies simultaneously standing the whole assembly upright on a flat surface. Measure the overall finished length and width of the assembly to define the base and lid size.

Next Issue David makes the base panel and the lid, and then explains how to make the shaped feet.



The cheapest option when it comes to buying rail and stile cutters is to choose the reversible, which will cost you about £35 from Axminster (666216). A combination cutter (say ATC's 666220) costs about £50, but will save you a lot of time and hassle. Wealden's T4000 range of combination cutters cost just under £60, and their website features very good instructions on their use (wealdentool.com)

David Fellows' alternative, which he chose, is to buy a complete frame and panel set, with paired rail and stile cutters. This (the TR15) from Rutlands costs about £90. A further advantage of a separate side mould cutter for David is that he can change the guide bearing for one with a larger diameter to limit the depth of the initial cut. This also reduces the exit angle of the cutter and eliminates chipping and tearout, particularly on the difficult second half of each of the scalloped rail edges, where the cutting edges are progressively going closer toward end grain. The larger bearing may need a shim to keep it above the carbide tips on the slot cutters. The normal bearing can be returned for the full depth cut while the cutter is in the router table, without disturbing the set-up. Since this deeper cut is not disturbing the surface fibres of the wood they are much less likely to break away.



Pic.7 Rutlands' TR15 frame and panel set combines horizontal panel cutter with a pair of rail and stile cutters. It's especially good if you have two router tables to set up both cutter simultaneously



British Woodworking February/March 2012

ROUTING

Rail & stile cutter options

What can you buy and how much does it cost?



The rail or scribe cutter (left) is used for the end of the rail or muntin. The profile cutter (right) forms the groove for the panel and the edge profile. The scribe is cut face up, and the profile face down



The stile cutter fitted with a 38mm bearing and shim for a shallow initial cut to reduce the risk of tearout



Combination Axminster's 666220