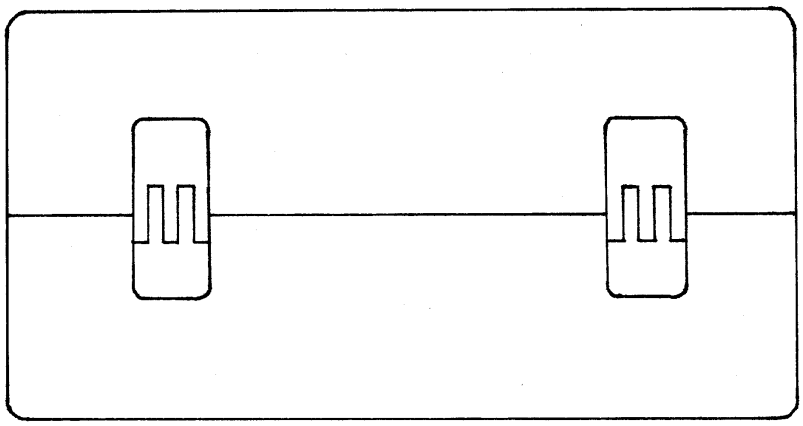
Plan #1—Wooden hinge, single action

COL HOSIE WOODTURNER PTY LTD
GIFKINS DOVETAIL

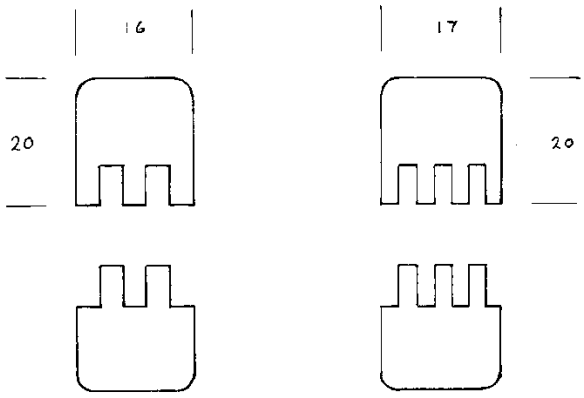


There are two types of wooden hinges, a single action hinge (that is in effect a finger joint with a pin through it) and a double action hinge which has two pins. The advantages of the double action hinge are that it will open out 180°, and you can set it in flush with the back of the box. With the single action hinge, it will only open just past 90°, and it can only be rebated into the box to half its thickness, but it is much simpler to make than the double.

These plans describe, in detail, making and fitting the single action hinge. See the free download entitled ‘Plan #2—Wooden hinge plans, double action’.

They are best made as a small batch with pieces put aside for future use, rather than setting up to make just one pair. For work at this scale you need dial or digital callipers, as a ruler is not accurate enough. You will also need a small solid carbide spiral cutter (3.2mm diameter) and a 2.0mm spur point drill. These items are available from Gifkins Dovetail.

Hinge sizes



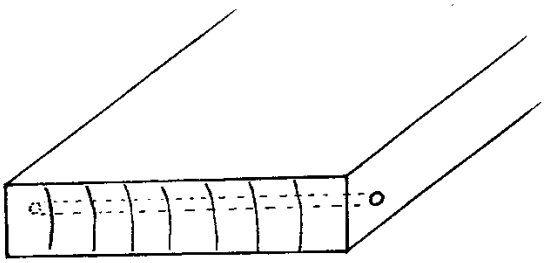
The example in this information sheet describes a hinge for small work—for a box 120mm x 120mm x 60mm. This same hinge can be used on a box 300mm x 250mm x 150mm. There is no reason why the hinge could not be scaled up or down to suit other sized boxes.

The actual dimensions will depend on the size of the cutter you use for the finger joints, as the width of the hinge will be an odd whole number multiple of the cutter diameter: e.g. for a 3.2mm cutter you might use stock 16mm wide (3.2 x 5), or for a 2.4mm cutter use stock 17mm wide (2.4 x 7).

We used a 3.2mm cutter and 16mm stock in the following description.

Selecting and preparing stock

As with all small work, the more accurately you prepare your stock, the better the end results will be. Ideally we want a timber that will not split easily. It is worth experimenting to see how your wood behaves, as most woods split more readily along the rings than across the rings.



As we will be drilling holes from one side to the other, the timber will be less inclined to split in line with the hole if we use quarter sawn timber.

Timbers used successfully for these hinges include: Ebony, Hornbeam, Satin Box, Jarrah and Rosewood. You could also use softer timbers like Red Cedar and Mahogany successfully, but they may not wear as well as the harder timbers. 'Thickness' your wood to 6.0mm, trying to get as clean a finish as possible on both sides. The thickness needs to be uniform, so it is best not to use the end 50mm or so from either end of the board.

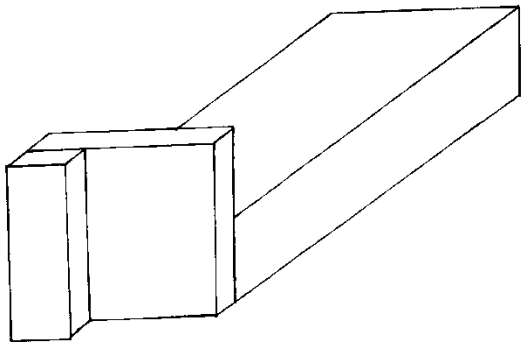
> **TIP:** For thicknessing stock less than about 13mm, you will get better results if you use an accurately thicknessed board under the work piece, so that the two pieces are fed through together. A piece of 18mm pine that is longer and wider than the work piece is ideal. Don't forget to add 18mm to the thickness you want when setting the thicknesser! Keep this backing board for future use. You don't need cleats on the bottom board to hold the work piece—they will feed through together nicely stacked on top of one-another.

Once thicknessed, joint one edge flat and square and then cut a strip at 16mm width or just a bit over. It can be cleaned up to width later.

> **NOTES:**
> When work pieces are this small, it is much safer to cut to width on a bandsaw (with a fine blade, say 6 or 8 TPI) than on the table saw. Dock your stock to lengths of about 150mm or 200mm, ready for finger jointing, making sure the ends are cut accurately square.
>
> The drop saw is ideal for cutting small pieces accurately. See fence ideas for the drop saw at www.gifkins.com.au.

Jig for slotting

Whilst you could use an Incra jig for slotting, you will get better results with a fixed fence on the router table and a set of shims that are thicknessed to twice the diameter of the cutter.

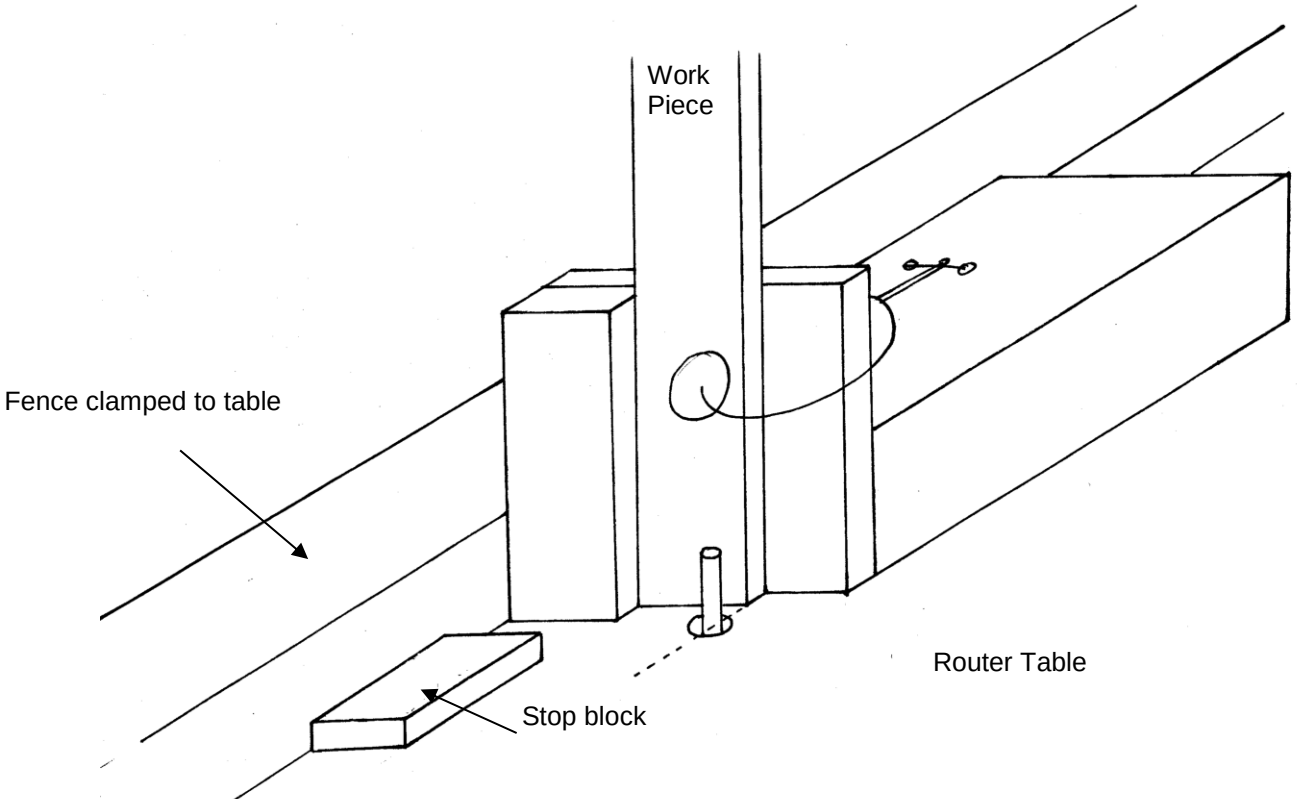


These need to be prepared very accurately, but once done they can be used time and again. You will need to cut trial finger joints when thicknessing these shims, so it is best to make up the jig for the finger joints before thicknessing the shim. The dimensions given for this jig are only a guide, and do not need to be followed accurately.

Use a block of 100mm x 50mm hardwood, jointed flat and square before thicknessing. Cut one end flat and square, and glue and screw a piece of 12mm craftwood to the end as shown. A strip of 12mm craftwood is then glued and screwed to the edge such that it is accurately vertical. Make sure any screws are safely above the cutter.

To use the jig, the work piece is clamped in place as shown, and a straight fence is clamped to the table. Set the height of the 3.2mm cutter slightly higher than the thickness of your timber, say 6.25mm for 6mm stock. Position the fence to get the layout of the joint that you want, so that the outside of the cutter is in line with the outside of the work piece. With the router going, run over the cutter, cutting through the work piece and into the craftwood.

A stop block clamped to the table is worthwhile so you don't go too far. Instead of sliding the jig back off the cutter, lift the front of the jig off the cutter (with the cutter still running) and then move the jig back away from the cutter. This way there is no risk that the cutter will widen the slot as you slide the jig back. We would then insert one shim (which we haven't made yet!) between the jig and the fence and repeat the cutting, then a second shim etc.

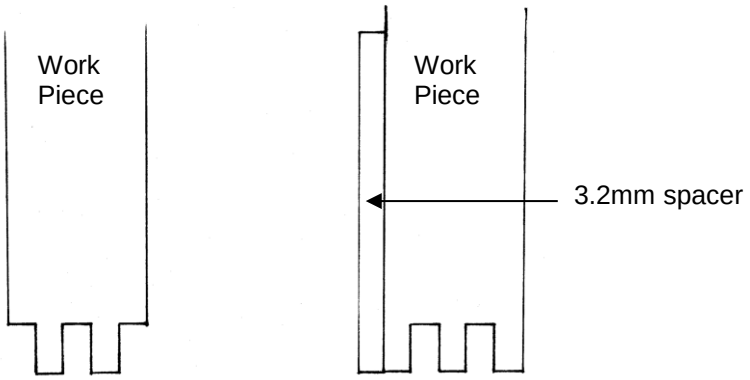


Shims

We can now get back to the shims. Thickness some strips of hardwood for the shims (running through the thicknesser on a backing board) to a little thicker than twice your cutter diameter, say, 6.6mm, and keep this setting on the thicknesser. Cut two trial sets of finger joints and test for fit (they should be too tight). Now, using the same setting on the thicknesser, run the shims through again with a sheet of paper between the shim and the backing board. This will decrease the shim by the thickness of the paper. This method gives you very fine control over the final thickness.

> **NOTES:** Standard photocopy paper (80 gsm) is 0.1mm thick. Keep decreasing the thickness (adding sheets of paper) till the finger joints fit together easily but without any free play.
>
> When using the jig, it is vital to keep the router table as clean as possible, as any dust on the shims or between the fence and the jig will destroy the fit.

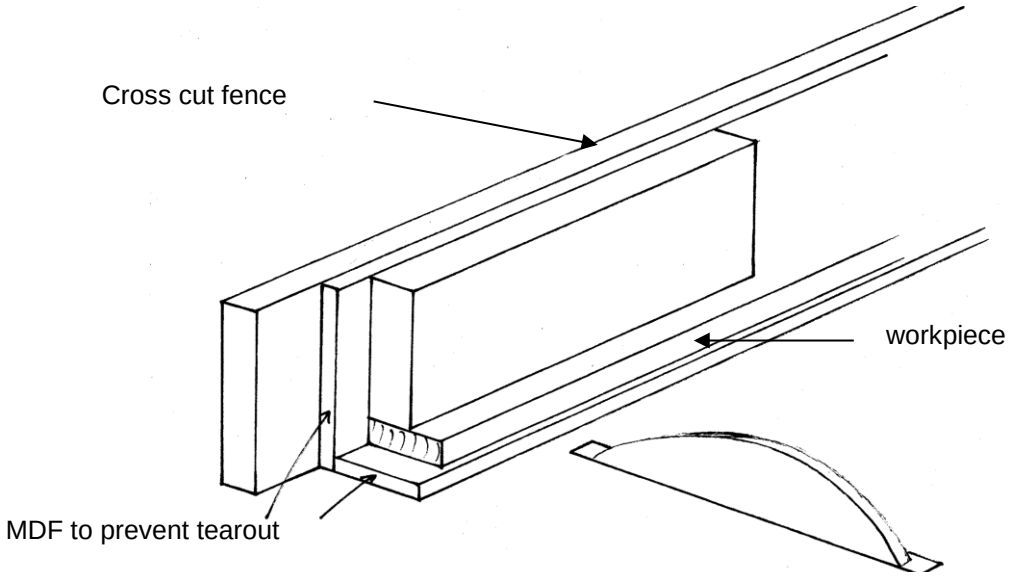
Once the jig is working the way you want, machine finger joints on one end of each work piece. We then turn the work piece end for end, but before we clamp it in place, insert a 3.2mm spacer between the work and the jig to move the work piece 3.2mm further away from the fence side of the jig.



This spacer will offset the second set of finger joints by the finger width, to give us two pieces that will go together with their edges flush.

If making lots of hinges, dock both ends off accurately at 20mm and machine fingers again on the shorter strips. Continue till you have enough, remembering that some pieces will be rejected in the drilling process, so have plenty of spares.

NOTE: When docking to length, we want the cleanest cut possible, so use offcuts of MDF underneath and behind the wood to prevent tear-out on the table saw. Also, because we are dealing with such a small work piece, use a hold-down block above the work piece to keep your fingers well away from the saw.

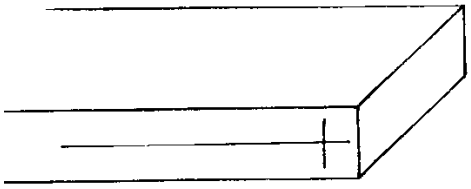


With small work pieces run the work onto the saw, and then stop the saw before you pull the work back off the blade. This is not only safer but also results in cleaner cutting.

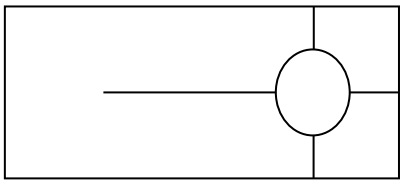
Drilling

For this you need a 2.0mm spur point drill, as an ordinary twist drill will run off line and tend to follow the grain. It is possible to grind your own spur points, but at 2.0mm diameter this is difficult to do accurately.

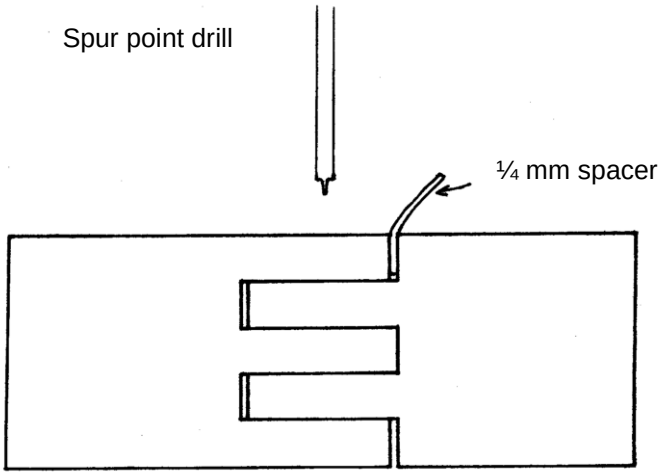
Set a marking gauge to the centre of the wood (3.0mm) and scribe a line from both sides. Re-adjust the gauge if these lines do not overlap. Once set to the centre of the wood, scribe a line along a trial piece and also across the end as shown. See page 5 for alternative hole position.



Using a fence and stop block on the drill press, drill a trial hole and check that it is central to the scribe marks both top and bottom:



Positioning of the hole is critical for the hinge to work well, so the drilling should be done as slowly as possible. Whilst it is possible to drill the two halves of the hinge together—the drill is more likely to run off. Try it both ways and see which works best for you. If drilling the two halves together, it is necessary to use a 0.25mm spacer (paper or cardboard) to stop the fingers going right home:



Remember that we allowed 0.25 extra depth when cutting the fingers. This extra depth allows the hinge to swing freely without the ends of the fingers catching on the bottom of the corresponding slot.

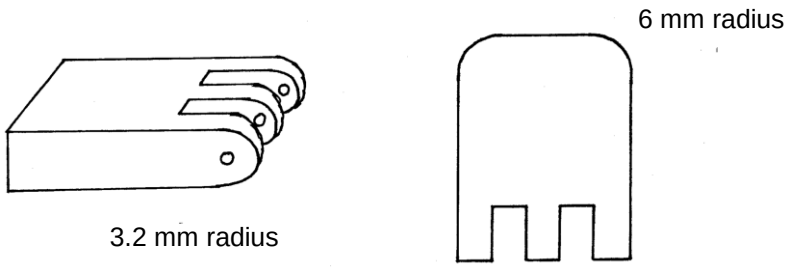
Hinge pins

Whilst you could use brass, stainless steel or sterling silver for the pins, having gone to the trouble of making a wooden hinge, it should be all wood! Try using bamboo for the pins, as it has long fibres and is less likely to break than solid timber. Remember you are working at 2.0mm diameter here!

Buy bamboo skewers from the supermarket which are about 3.0mm diameter (look for ones that appear solid with no loose fibres). To bring them down to 2.0mm, hold a 50mm length in the drill press and plunge it through a 2.0mm hole in a piece of mild steel, with the bamboo spinning. This shaves the outside off, leaving a perfectly round 2.0mm bamboo pin. Some bamboo twists as it goes through the hole. If this happens, try a different brand of skewers!

NOTE: To get exactly the fit for the pin (firm without being tight), use a 2.1mm hole in the steel and then hand sand the pin to give the required fit. You can get fractional sized drill bits from engineering suppliers. Before assembling the hinge it is necessary to round over the hinge fingers and the outside corners of the block.

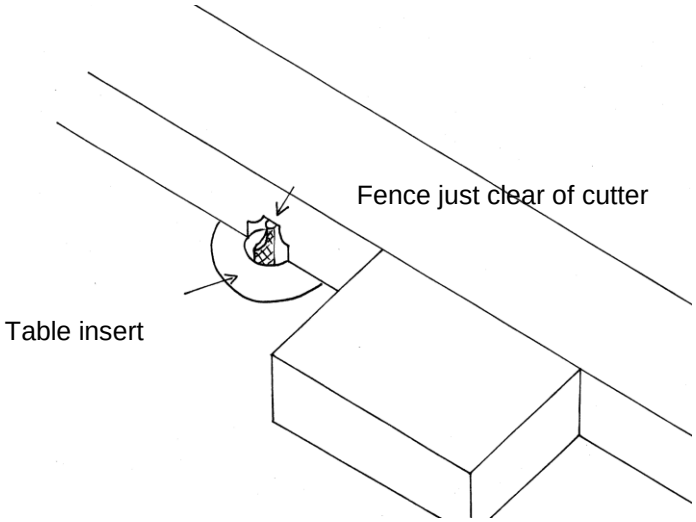
Round-overs



We need to round-over the ends of the fingers (both sides) and also the outside corners of the hinge pieces.

The radius of the cutter for the fingers should be half the thickness of your stock, or a bit more. In this instance a 3.2mm radius would be fine. For the top corners of the block, the round-over should match the cutter you plan to use for the hinge rebate. So try a 12mm diameter straight cutter for rebate, and use a 6.0mm radius cutter for the round-over.

This round-over needs to be done carefully as we want the hinge to be a good fit when rebated into the box. Use a square push block and a good fence for these round-overs, and do trial cuts to set things just right:



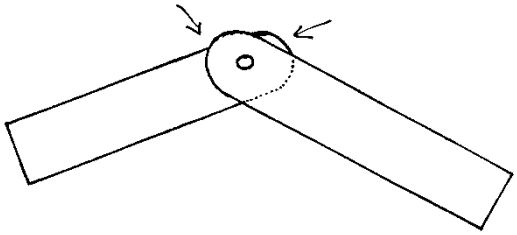
NOTE: The drawing above shows the use of a table insert to give support right up to the cutter. The fence is only cut away just enough for the cutter to spin freely. With such a small work piece it needs to be fully supported as it goes past the cutter.

Assembly

Now assemble a hinge and test its movement. With the fingers cut 0.25mm longer than the thickness, the hinge should open out just over 90°. If you want it to open further, you could allow more depth to the fingers when machining them. If the bamboo is a tight fit, sand it lightly till it is free to slide in and out easily.

If the outside edges of the two halves do not align flush, clean this up now on a shooting board before we make the following jig. It is vital that the fingers do not protrude on the inside face of the hinge as the hinge opens, as this would prevent the hinge from opening when it is glued in place. If they do protrude, hold one end of the hinge flat on a sheet of sandpaper and swing the other end back and forth till the fingers are flush. Repeat this process for the other end.

Check for protruding fingers



Jig for hinge rebate

The jig for the hinge rebate is a remarkably useful device that is easy to make. It can be applied to an assortment of hollowing out operations. To make the jig we need some 12mm MDF and some 25mm chipboard screws.

NOTE: For this jig to work you need a plunge router with a round base.

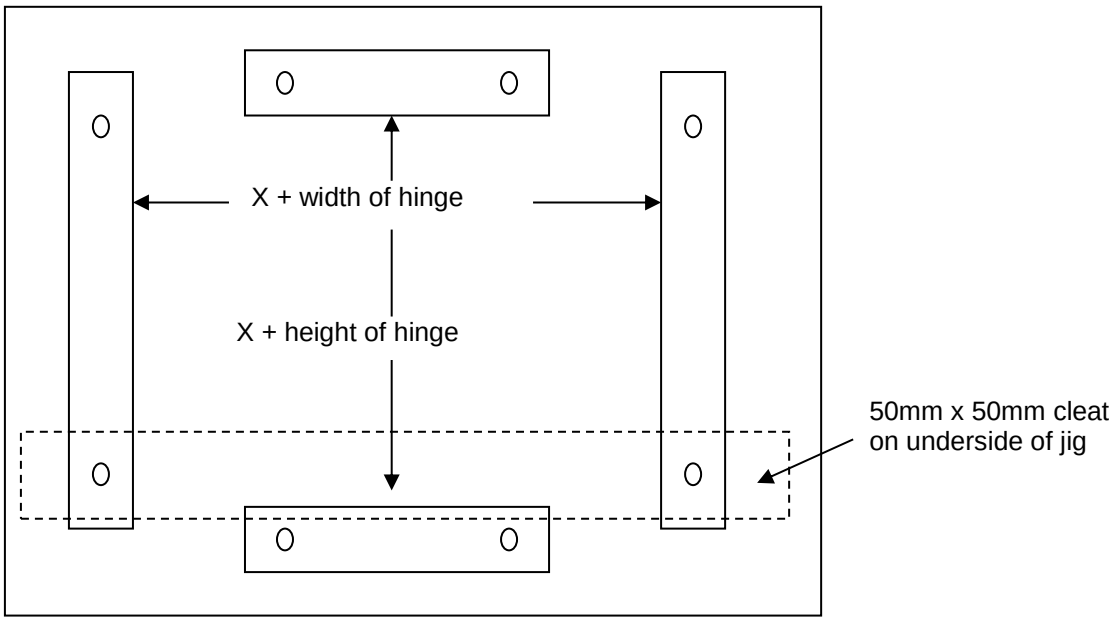
Measure the outside diameter of your router base accurately (for Makita 3600 this is 160mm). Subtract the diameter of the cutter to be used for the hinge rebate (12mm, as noted above in the round-over section), to give us the figure “X”. That is:

X = Diameter of router base – diameter of cutter

Start with a square piece of MDF about 200mm bigger than the router base. To this we screw down 50mm strips of MDF as shown below (pre-drill the strips at 4.5mm, there is no need to pre-drill the backing board if using chipboard screws).

TIP: Screw the left hand strip in place. With a steel rule and a knife, measure from this strip and put a knife mark at (X + width of hinge). Do this top and bottom, so we have two knife marks on which to line up the right hand strip. With the RH strip pre-drilled, clamp it in place along these knife marks and then screw in place.

With this method we can get the strips accurately parallel and accurately spaced. It is better to err on the side of too close together, as you then can adjust the jig to size by planing the inside edges of the strips on a shooting board. Repeat the process for the top and bottom strips, making sure that the third strip is at 90° to the first two.

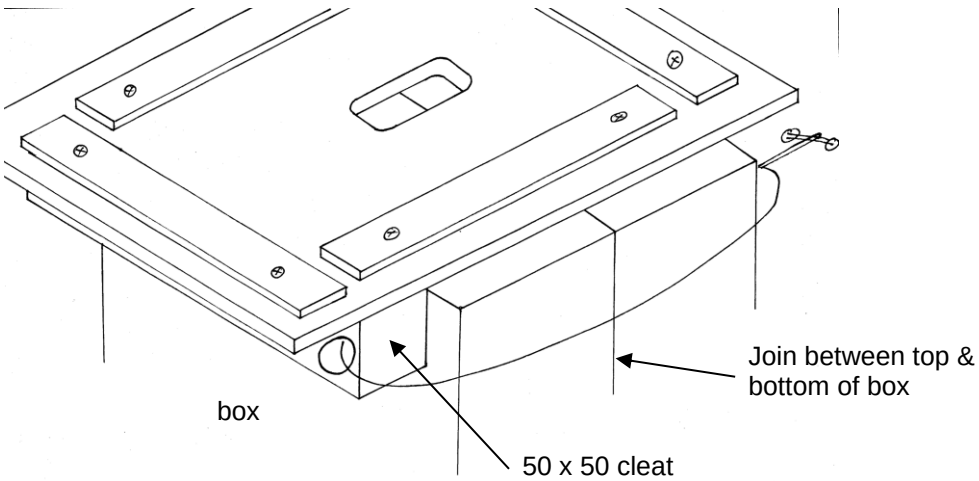


Clamp the jig over the edge of your workbench, or support the jig over some waste material, so that when we plunge the router through the middle we do not plunge into the bench. With the 12mm cutter in the router, run around the inside edge of the strips in a clockwise direction, cutting a hole in the board the same size as the hinge. Do this in two passes, only going half way through the first time. It is good to have dust extraction on your router for this jig. Try the hinge in the hole and adjust the position of the strips if necessary. We want the hinge to be a firm fit in both the height and the width. If the hole is too big, it is easier to shim the inside edges of the strips than to move the strips in.

Cutting hinge rebate

To locate the jig on the box, we will screw a 50mm x 50mm cleat to the underside of the jig, so that when the bottom of the box is against the cleat, the join between the bottom of the box and the top of the box runs across the exact centre of the hinge hole in the jig. It is important to do this accurately! This cleat is screwed down from above, making sure the screws are countersunk below the surface of the jig. Mark out the hinge positions on the back of the box, so that we can use these marks to position the jig.

To use the jig, hold the box in the vice with the hinge side up, and place the jig on top, with the cleat against the bottom of the box. Position the hole in the jig over one hinge position mark, and clamp the jig to the box as shown:



With the

router sitting on the jig and NOT turned on, lower the cutter till it just touches the box, and lock the depth in this position. Now set the depth gauge on the router to 3.0mm below this point (half the thickness of the hinge lower). Unlock the router to bring the cutter up clear of the box. We are now ready to route the hinge rebate, once again going clockwise around the inside of the jig. Move the jig to the other side of the box and repeat for the second hinge rebate.

> **TIP:** If you place a sheet of paper between the box halves before you clamp it in the vice, this will make the finished hinge rebate slightly lower than the height of the hinge. This way the box will still close fully at the front, but the back edges will be clear by 0.1mm, which avoids any issues with the edges binding on one another.

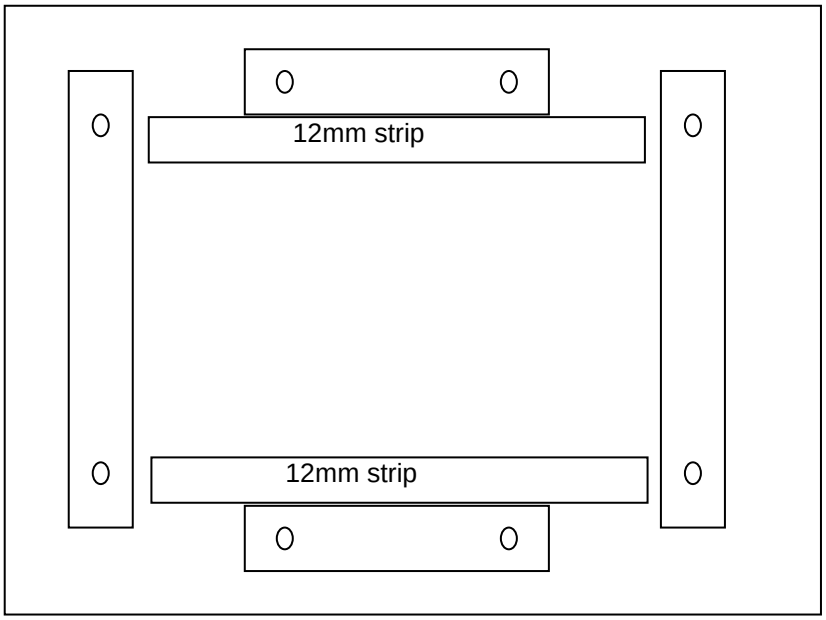
Fitting hinges

All that is now left to do is to fix the hinges in place. It would be possible to screw the hinges in place from inside the box, which would give you the option of taking the box apart again if adjustment is necessary. Another option is to glue the hinges in place, once again making everything wood rather than introducing metal. You do have to get everything right first time, as there is very little adjustment you can make once the hinges are glued in.

It is important that you don't get any glue on the finger part of the hinge, or it would glue the hinge shut, so only apply a light smear of glue to the top and bottom areas of the hinge rebate. use white PVA and clamp the hinges in place while the glue dries. You need to brace the inside of the box in line with the hinge if clamping the hinge for gluing. Make sure you will still be able to open the glued-up box with the bracing in place, as some bracing will prevent the lid from swinging open!

Alternative position for holes

It is possible to make the hinge stronger by cutting longer fingers (say 8.0mm long in 6.0mm stock). We would then position the holes 4.0mm in from the end of the fingers, so the hole is still located in half way back on the fingers. This means that when the hinge opens, the fingers protrude 1mm past the back of the hinge. When it comes to the round-over, only do this on the front (outside) of the hinge, leaving the back surface square. When you cut the rebate in the box, cut it as described above, then increase the depth of the centre section of the rebate to accommodate the protruding fingers. To do this, cut two strips of MDF that are 12mm wide (i.e: 20mm hinge block less 8.0mm fingers) and about "X + width of hinge" wide, and use these to block off the jig, top and bottom, as shown:



With these strips in place on the jig, increase the depth setting by just over 1.0mm and route the centre portion of the hinge rebate deeper. It is then necessary to clean up the corners for this deeper section with a chisel so we have square corners, rather than round from the cutter. This version of the hinge can now be finished off and fitted in the same manner as described above.

You have just read through the complex process for making wooden hinges for your boxes. Don't be discouraged with your first attempts…have fun experimenting!

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