Impossible Dovetails

With surgical precision, Theo Cook shows how to cut dovetails with complex angles and achieve a perfect fit.

The first time I saw a picture of a Japanese dovetail joint was when I was studying at the College of the Redwoods back in 2002. It blew me away that a joint like this was possible and at that stage I didn't have a clue on how it went together.

Many years on I saw another photo and decided to give this intricate joint a try. Here are some of the steps, techniques and tools used.

Prepare yourself

For this kind of joinery it really does help to have a steady hand, good eyesight up close, and a pinch of patience. They're not essential but they sure do help.

It may be useful to use the techniques outlined below to make a rough joint first, just so you can see how the mechanics of it work before investing the time in a very accurate joint. For example, you might want to try just cutting to the line and not using a scalpel to get the joint finished a bit quicker.

Design and layout

Laying this joint out differs from other dovetails as you need to work off a template or 'spacer' that shows the full extension of the joint, that is, the imaginary point where the joint angles would meet. The thickness of this spacer will determine the angles of the tails and the size of the pins. The drawings shown in the photo

opposite above are diagrams for joints with 10, 12 and 19mm spacers. You can see how they alter the angles.

The number of angled dovetails you add will also change the steepness of the angles and the fineness of the pins. On the sketches you can see that I have shaded in the areas that will be removed, just as you would do on the wood when cutting the joint. On the third joint from the top I have pencilled in the width of each pin as well.

You need to create two almost identical spacers for each joint you design. The difference between the two is a mere 0.03mm thickness, but you will need that clearance to achieve a well fitted joint. The spacers are essential for marking out these joints with the extreme accuracy required. In the joint shown, the spacer for the pin board is 0.3mm thicker. If both spacers were the same thickness the joint would be too loose. You can tune this clearance to your own requirements.

You'll also notice on the sketches to the right of the joint a broken 'ghost' line. Create this by drawing 90° up and then down at the same angle as the joint it is next to. This line indicates the angled path of the tails as they exit the wood at the flared end. Take care that your joint doesn't extend into the side of the workpiece.

Step by step

The numbered photos show the main steps:

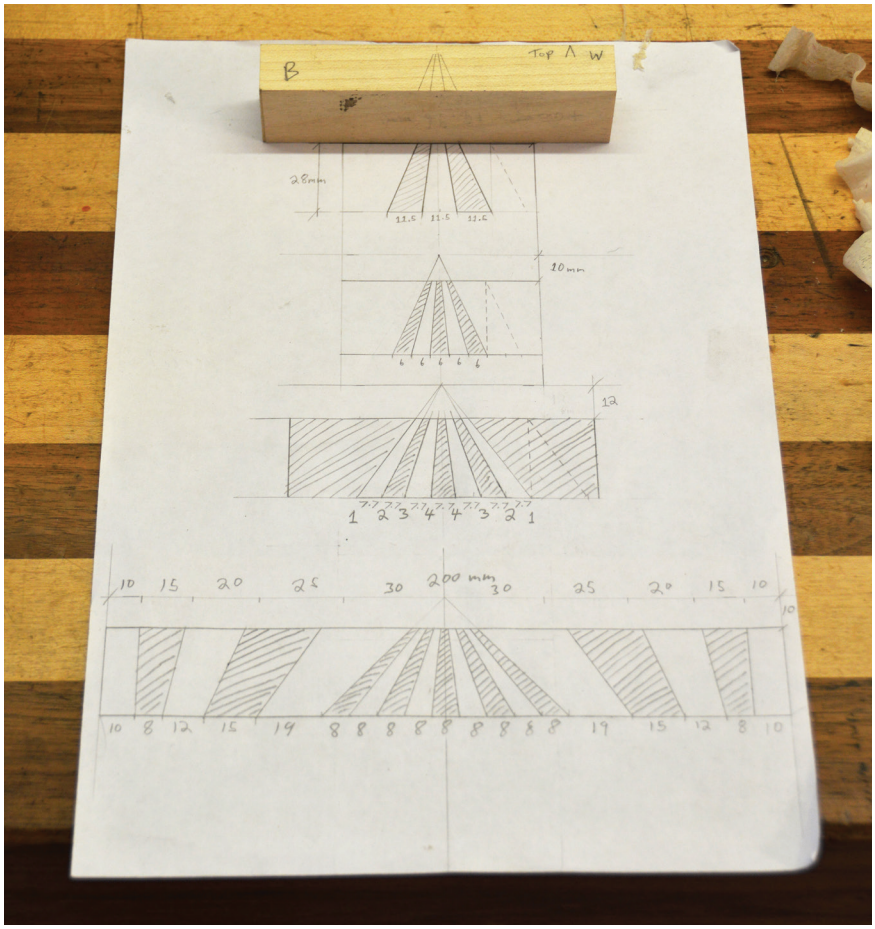
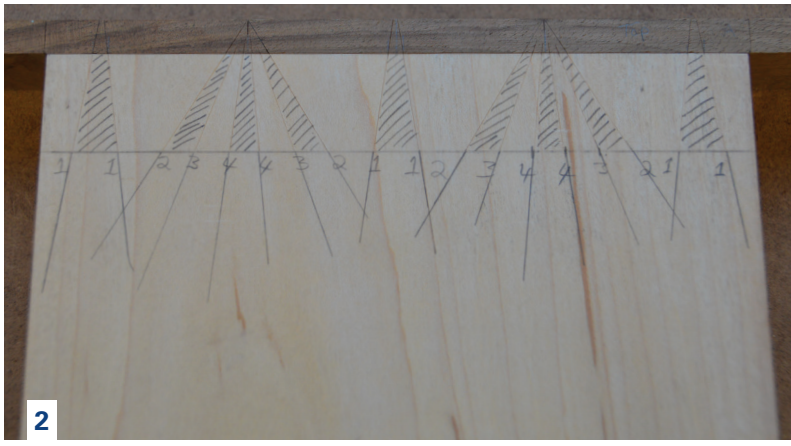


Photo 1 Plane your components and spacers perfectly to dimension before shooting their edges perfectly square. You need to be extremely accurate. Use digital calipers to check thickness and width.

Photo 2 Lay out out the joint with the aid of spacers. By extending the lines onto them, the spacers determine how far off the points begin. Remember you need two of these as one has to be 0.3mm thicker then the other to make the joint tight.

Photo 3 Mark out the shoulder line of the joint with a pencil gauge. This should be 0.5mm less than the thickness of your wood. Set your marking gauge to this measurement too. Fine pins in particular can be harder to clamp up during assembly, so to lessen the pressure I make them a fraction shorter to sit just below the surface of the tail board.



Toolkit

As shown in the photo above, you don't need a huge number of tools for this kind of joinery but I used the following:

Sliding bevels The number you need depends on the complexity of the joint and number of angles involved.

Scalpel For marking out these and other joints I use a Swan scalpel. These come with replaceable tips.

English style dovetail saw Many other makes of saws would be fine however.

Fretsaw Mine is made by Faithfull.

Chisels You'll need a range in varying sizes.

Marking gauge Here I'm using a Veritas wheel gauge.

Engineering square

Digital calipers Essential for this kind of work.

Photo 4 Use double-sided tape to adhere your spacers centrally to the top of both parts of the wood. Draw the joint on the front face of one of the pieces, extending the lines from the spacer through to the base line. Then set your sliding bevels to the correct angles – for this joint I used four. I numbered the cuts and labelled my bevels 1 to 4 as well to avoid confusion. Once you have set your bevels up you are ready to scalpel or mark the front of that joint using the right bevel.

Photo 5 After you have scalpeled all the lines you can put the other part of the joint on top so the two spacers meet. Then you can transfer the lines from spacer one to spacer two. Scalpel the other part of the joint using the same bevels. When scalpeling any of the lines they need to be extremely accurate.

Remove the spacers and scalpel the rest of the joints using the front scalpel lines as a guide. Again this will be done using the sliding bevels. Extra care has to be taken to make sure the scalpel lines line up to the front ones.

Photo 6 Shade in the parts of the joint to be cut away.

Photo 7 Use your marking gauge to score on the shoulder lines.

Photo 8 Saw into the shaded parts about half a millimetre away from the scalpel lines.

Photo 9 Do this on all the shaded parts.

Photo 10 Remove the waste with a fretsaw.

Photo 11 Chisel to the scalpel lines on the top of the joint and sides. Pay extra attention to the direction of the grain to prevent breakout or accidental undercutting.

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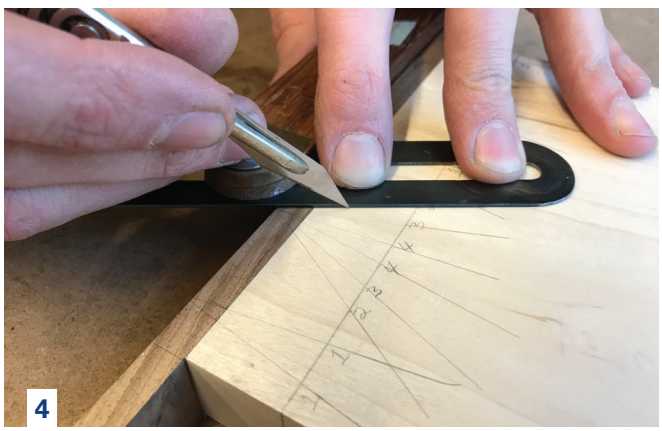

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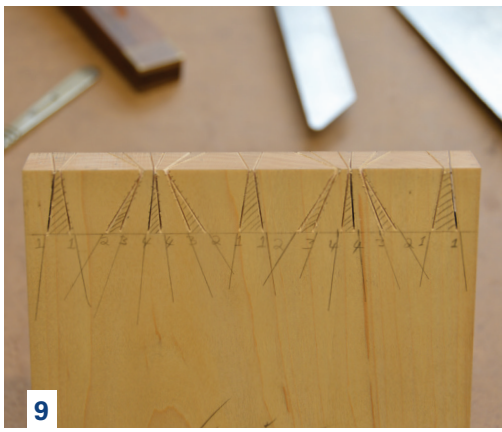
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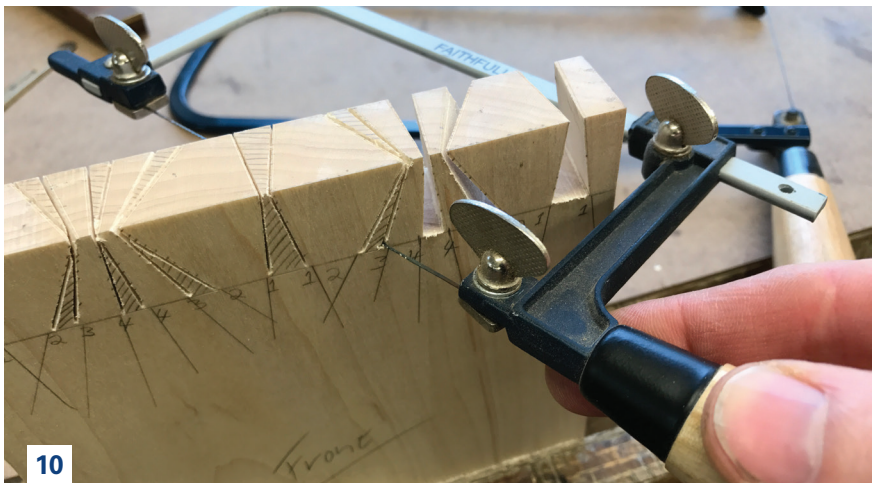
Photo 12 I then clean up the joint faces with a flat piece of metal (here a steel rule) with 320 grit sandpaper stuck onto it. This is only done in the final stage and then with great delicacy to remove tiny amounts of material only to achieve really crisp edges. I also use the rule to see whether the joint faces are truly flat.

Photo 13 Chisel to the marking gauge line on the shoreline making sure it is flat and square all the way through.

Photo 14 Time to test fit the joint. Regular dovetail joints go together at 90° but this joint fits together at 45° so you have to be very careful about which area you remove to get the joint to fit together nicely. Removing material from the top corners will also affect the fit on the opposite baseline, so you need to check carefully all over when fitting. To do some finetuning on the fit I would use that metal blade with the sandpaper on it to remove a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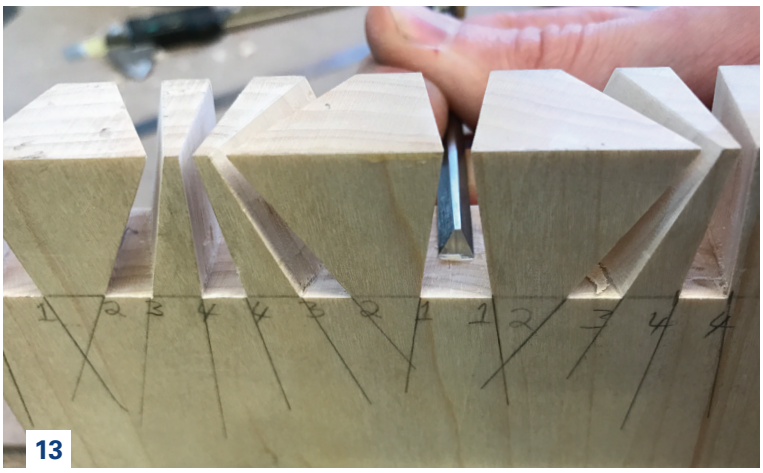
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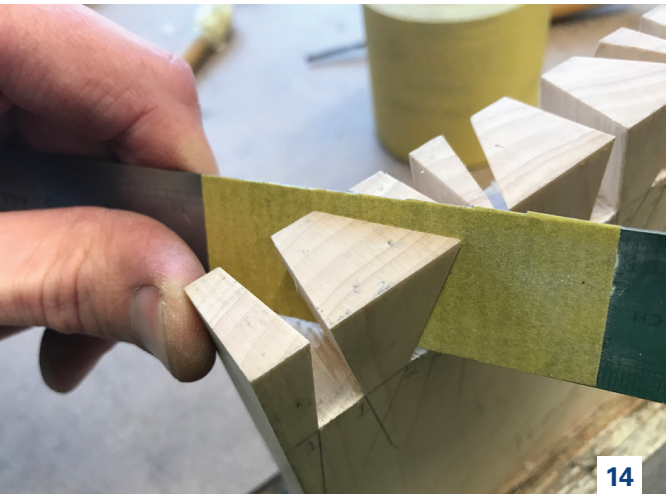
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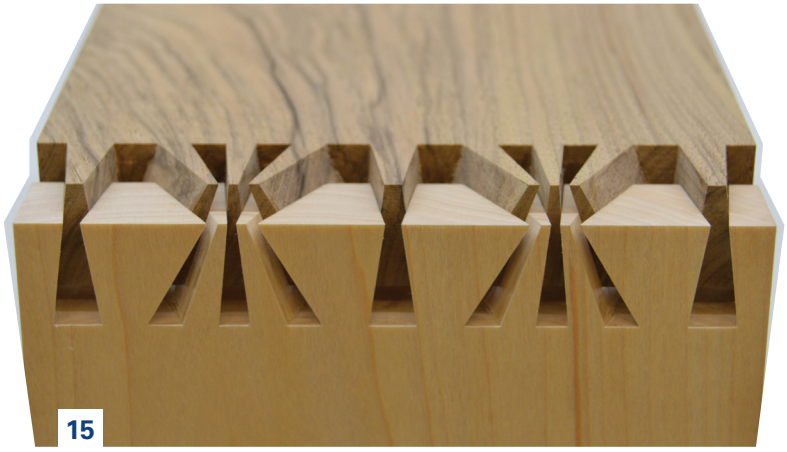
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minute amount of wood at a time, while keeping the joint face flat at the same time.

Photo 15 All tuned up, this joint is now ready for gluing.

Photo 16 I do a dry-clamp for most joinery just to be happy that it all goes together nicely. I wax my glue blocks so they won't stick during glue-up. For a complicated joint such as this, a UF glue will give you more pot-life or open time before the glue goes off. For a simpler joint I might use Titebond or PVA.

Photo 17 The fun part! Now clean the joint up by planing and then sanding before applying a finish. I used Osmo oil on this one.

I hope these steps were helpful and you do decide to have a go at making your own Japanese dovetail joint. I apologise if the steps seem a bit complicated but it is a very tricky joint to tackle. You can check out my YouTube channel to see me demonstrate some of the processes outlined above.

Photos: Theo Cook

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