No Cramping

John Lloyd is challenged by new technology to try his hand at gluing without cramps

Last issue I had an interesting encounter with Lamello's Invis jointing system (BW17:54), blending world-renowned engineering prowess from Switzerland with the magic of Hogwarts. Invis relies on the hocus pocus of a spinning magnetic field, with an impressive ability to draw joints tight without cramps. This got me thinking that I should produce my own a low-tech no-cramp equivalent. Admittedly there's the glueless pegged mortise and tenon, but this is a ruse that was used extensively to enable gargantuan, French armoires to be broken up into smaller, more manageable pieces, perhaps with a hammer!

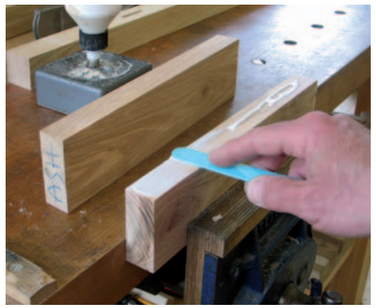
Rubbing joints

The lowest-tech is the rub joint, without doubt as simple as any, and one of my favourites. The principle is that two surfaces are prepared with a nice sharp plane so that there's no visible gap. Coat the surfaces with hot animal glue and rub together using as much pressure and vigour as can be mustered. The rubbing action combined with pressure ejects surplus glue from the joint, and during the 'rubbing' process the glue starts to cool and 'grab', at which point alignment is checked and the joint left undisturbed for a while to cure completely.

If performed accurately and correctly, a rub joint results in an enormously strong joint with an invisible glueline and doesn't need any cramps. This joint was used extensively in the past for jointing tops and for adding glue blocks, another of my favourite low-tech jointing solutions, perhaps to hold a bracket foot together or just to reinforce another joint. Not always very practical when gluing large, heavy, unmanageable pieces of wood together but sometimes it's easier to resort to this ancient cramp-free technology, particularly when gluing oddly shaped pieces together that aren't easily cramped.

So the rub-joint's simple, easy, cheap, invisible, doesn't need cramps and can be dismantled (if you're patient). Not the instant strength and instant dismantling of the Invis, but not a bad start!

Having gone so low-tech I thought I'd investigate bringing it up to date a bit with a modern glue. I know that many modern cabinetmaking types don't like to contaminate their workshops with the offensive odours that come from a simmering pot of animal glue, feeling much more at ease with a nice sanitised gluing option that just involves removing a cap from a bottle and squeezing the desired amount of adhesive onto a joint; no mixing, no bad smells and no burnt fingers!



Rubbing **The traditional rub joint with animal glue being used on bracket feet (above and top right) and for the apron of a table (above right). Spreading PVA to attempt a rub joint with modern glue (right)**

It seems pretty obvious that using a modern adhesive like PVA will work on a rub joint, after all it's a bit like 'sticking' two pieces of glass together with water. My concerns were that the 'grab' associated with animal glue as it cools might be critical to a successful rub joint. Would a PVA rub joint give an invisible glueline, and does PVA rely on pressure from a cramp to make a thin enough glueline to give it maximum strength? Time for some tests. As with all rub joints an undetectable glueline relies initially on accurate planing of the two jointing surfaces. If the joint line is visible when the two halves are perched on top of each other without glue, adding glue won't make things any better and the joint won't be strong.

I tried a couple of glues. Titebond III was my first contender, surmising that because it is a relatively thin adhesive it would squeeze out nicely when the joint was rubbed, and indeed it did! Next I used some of the standard D3 PVA that we use extensively in the workshop, a little thicker, certainly, but with plenty of pressure and vigour when rubbing the joint the glue squeezes out nicely and, rather impressively, the gluelines for both glues were indiscernible.

The initial tack of both glues was also pretty impressive after only a matter of minutes, so the final test would be strength; not a scientific analysis involving rigs, stress meters and high speed photography, just a large hammer and a vice! All I was looking for in this rather primitive test was for the glue line to be stronger than the surrounding wood. A clean break along the glueline would indicate that PVA does indeed need cramping pressure to achieve full strength, but both test pieces were to prove that the gluelines were 'stronger than the wood itself'. So the conclusion is that PVA is fine for rub-jointing, the only obvious benefit of animal glue is if reversibility is important!

Success **It turns out that you can produce a strong rub joint with PVA (above and right). The next step is to try screw slotting with a keyhole router bit**

Screw slotting

Another idea is a joint that doesn't require cramps, but does require a router and a clever tungsten tipped cutter, so is not actually terribly low-tech. It's known as screw slotting. The Wealden cutter (wealdentool.com) is designed to cut a keyhole-shaped recess in the back of a cabinet, allowing it to be hung on a screw protruding from a wall. My idea was to use a series of keyholes in one half of a joint and a corresponding series of screws in the other.

As with the rub joint, accurately prepared jointing surfaces are the key to success, but with this technique the idea is that the screws and keyhole slots do actually generate a cramping pressure over the joint. Cutting the keyhole slots is pretty easy, especially if you have a pair of fences for your router. This makes routing on a narrow edge much less precarious. I was a little

Keyhole **The Wealdon keyhole cutter creates a slot into which a screw will fit and slide (above). You then knock the boards and they will automatically tighten (below right)**

concerned that the accuracy of positioning the slots and screws would be critical, but using Wealden's smallest keyhole cutter that is designed to be used with a No.8 or No.10 screw, and using a No.8 screw means that there is enough tolerance to get the adjacent surfaces in register without having to position the slot perfectly central on the edge.

Having routed the slots and fitted the screws it's just a question of adjusting the amount the screws protrude so that when they engage in the keyhole slot and the two halves are slid together they apply some pressure to the joint. I found that the best results came at the point when the joint just requires a hammer for assembly.

If no glue is added to this joint it is in many ways doing the same thing as an Invis joint, generating pressure over the jointing surface and easily dismantled, although it is rather less versatile and could slide apart at an embarrassing moment. Adding glue to this joint would of course solve the coming apart, and the cramping pressure generated as the screws engage on the narrow part of the keyhole slot seems quite considerable, resulting in a very strong, screw-reinforced joint. It is very definitely not possible to dismantle the joint without resorting to a small thermo-nuclear device or a bandsaw fitted with a metal-cutting blade.

Taking into account these limitations or 'features', I rather like this jointing method which is surprisingly quick, easy and forgiving and particularly useful in situations where it is not possible to use cramps.

Draw-boring

I touched on my final jointing technique earlier, the pegged mortise and tenon; a method that is as old as the hills and does of course rely on being able to cut mortises and tenons.

Adding a peg to a mortise and tenon can be pretty much just a decorative thing, being added after the joint has been glued together and will of course hold a joint together, allowing cramps to be removed before the glue has cured, but initial cramping is required.

The alternative method, which is almost as clever as the Invis and doesn't have to resort to using devices from the Dark Arts, is to use draw-boring when fitting the pegs. This is a method that has been used for centuries to hold oak barns together, so it obviously works and must be pretty strong.

Draw-boring is just a way of applying pressure by slightly offsetting the holes in the mortise and the tenon and inserting a wooden peg, otherwise known as a trenail or trunnel ('tree-nail'). The effect of the offset holes means that when the peg is inserted into the assembled mortise and tenon it has to, in effect, wiggle to get through the hole in the tenon, and this applies pressure to the tenon and 'draws' the joint together, as long as the offset is not too extreme and is in the right direction. Only a very small offset is required to have the effect of pushing the joint together with really quite an impressive force; if the offset is in the wrong direction it will of course have the reverse effect and open the joint, and if the offset is too great it can split the tenon!

Of course none of these ideas are quite the same as the Invis and they can't really compete for speed and convenience, but they are woodwork!

Fundamentals Fact File

No.6 Draw-boring tenons

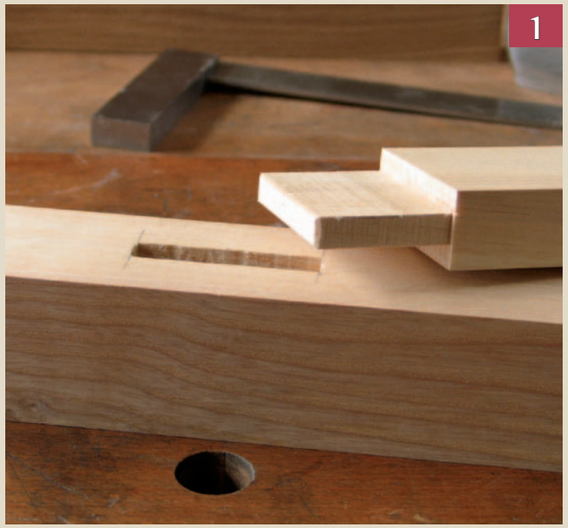
Assembling crampless mortise and tenons

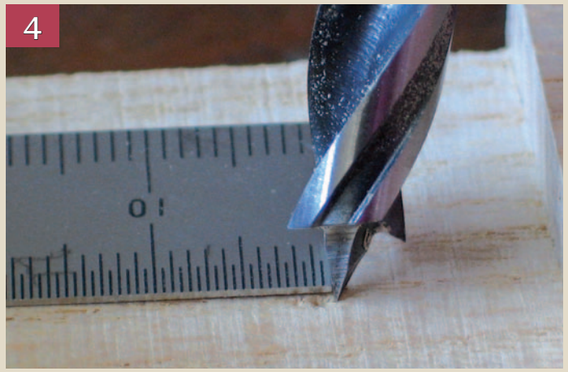
Successful draw-boring is largely down to having the correct offset in the right direction. To establish the offset, first drill a hole through the mortise, not necessarily right through and out the other side, but right through can be a good plan which will make dismantling easier at a later date if this is considered to be important. Use a lip and spur drill bit to make a nice crisp hole, assemble the tenon into the mortice and use the same drill bit to mark the centre of the hole, then just put the drill into the hole in the mortise, give it a tap with a hammer and the point will make a mark on the tenon. Dismantle the tenon from the mortise and mark the offset, moving the centre point towards the shoulder of the tenon, but don't overdo it! In hardwood I would keep this offset to barely 1mm (1/32in), this could be doubled in softwood, but even in a huge oak-framed building constructed in nice soft green oak the offset would still only be about 6mm. So don't get carried away with the offset, and then use the same lip and spur drill bit to drill the tenon, centred on the offset mark. A pillar drill is a good idea for all this drilling, but a hand held drill will also work if a little care is taken. Pegs were traditionally riven from straight-

Spurred **Use a lip and spur bit to drill the hole through the mortise. You can insert a false tenon to reduce breakout inside the mortise**

Offset **Having established the offset on the tenon you drill through for the peg, which will have to wiggle its way through**

Marking **Use the drill bit to mark the position for the hole in the tenon. Timber framers have special offset markers for this job**





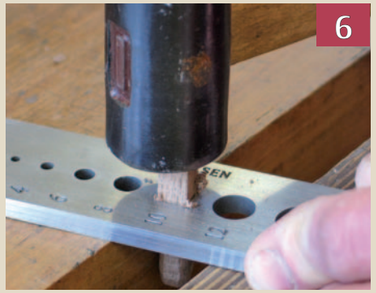
Measure **Mark off the 1mm offset for the hole in the tenon. Of course you could save the trouble of this stage by inserting a 1mm spacer between the stile and the rail shoulder (on the tenon). A credit card might do. This would move the tenon 1mm outwards, and you could drill straight through the mortise and the tenon at the same time to get the perfect positioning in one move**

grained timber to ensure that they followed the grain, making them less likely to fail; these pretty much square, riven pegs would then be whittled to a bit of a point to aid insertion into the joint.

You might think that square pegs and round holes just aren't going to work but a little persuasion in the form of a large mallet will usually work and the benefit of this clash of shapes is that the square pegs grip very securely. From a practical point of view, making riven pegs for holding pieces of furniture together is not ideal because the finished peg can be a bit rough, so as long as the timber selected for the pegs is straight grained and the grain follows the line of the peg, I would cut square pegs just a little oversize on a bandsaw and then whack them through a dowel plate to end up with a nice crisp, round peg of the same diameter as the hole. A little taper is required on one edge of one end of the peg, and lining this taper up with the offset will help the peg to wiggle through the tenon when it is hammered home.

Square pegs can of course still be used and the square ends to the peg can give a nice decorative effect. In this case just cut a square peg to the same size as the diameter of the hole, whittle away at the peg until one end is the diameter of the hole and the other end still square. As before, add a little chamfer to the round end to help the peg wiggle past the offset in the tenon, carefully orientate the square end of the peg to achieve the desired aesthetic effect when fitted and whack the peg in with a big hammer. Being a square peg, it will require a bit more effort than a round peg!

Glue can of course be added to the mortise and tenon joint when using this draw-boring technique, using the trenail to apply pressure to the joint without the need for cramps, but glue isn't strictly necessary, making it possible to dismantle the joint at any future date with relative ease.



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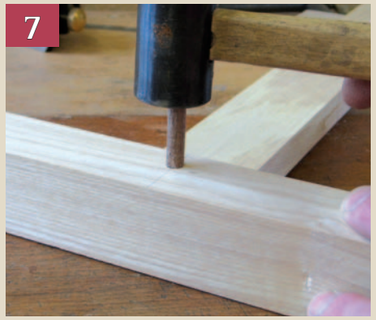
Dowel **Produce your own pegs from hardwood, exactly the right diameter with a dowel plate. This one is made by Lie-Nielsen**



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Pegs **The finished joints, with a round (above left) and a square peg (left). The latter is particularly decorative**

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Taper **Pare back the square peg to fit it into a round hole. It's a good idea to pare the end of the round peg too to help it into the hole and through the joint**

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