

The Parnham joint

Steve Coonick reviews an unsung hero of furniture making

Designers and makers are constantly faced with decisions about 'function and form'. The phrase, used in 20th-century modernist architecture and industrial design, means that the shape of an object should primarily relate to its intended function or purpose.

Many new makers tend to prioritise form over function; makers wishing to demonstrate their skill may 'throw' a complicated joint into a highly visible part of the design. I have seen multiple joints crammed onto one piece of furniture in the hope that this demonstration of 'skill' will add value to a piece. But is this approach correct and what is the alternative?

A pragmatic approach to furniture design is an ethos often overlooked. This approach can yield furniture that outperforms more 'complex' pieces, with respect to mechanical integrity and, with thoughtful design, can produce elegant pieces that will charm clients. I have always thought that there is something appealing about stripping down a piece to its core shape and essential elements.

I believe that discreet design details make a piece of furniture interesting and beautiful. Yes, it's important to delight a client, but for me, it's important to do so without detracting from the beauty of the materials used. To achieve this, I believe design is all about the 'edit'. Traditional joints are things of beauty and exhibiting them can add real value – but proceed with caution. 'Take away the extraneous and leave what is beautiful', is something I am mindful of when designing furniture.

With this design ethos in mind the following article describes one of the numerous unsung heroes of projects – the 'Parnham' joint. This deceptively simple joint, when used correctly, is strong and predictable. It allows designers and makers to 'stretch' designs beyond what is possible when only using wood. The potential for elegance is derived when form follows function.

The basic joint

A Parnham joint incorporates a threaded metal bar, in much the same way a wooden dowel is used, but with greater resistance to shearing. The bars are anchored into oversized holes using resin, the thread providing a larger gluing surface area. Under pressure, the resin is forced into the fibres of the wood surrounding the bar strengthening the joint.

This method is credited as being developed at Parnham Workshops; run by John Makepeace in the 1980s. Typically the joint is used as a replacement for a wooden dowel, where corresponding holes must be positioned, dimensionally, very accurately and drilled at 90° with a drill bit that matches the diameter of the dowel. The Parnham joint eliminates the requirement for accurate drilling, often a 'wet slack fit' is used to describe the engineering of these types of joints, as they provide 'float' that allows the metal bar to 'find the fit'.

Materials

The materials required for the joint are easily sourced. Threaded bar is available at most builder's merchants in a range of diameters

(typically from 5–25mm) and usually in 500mm lengths.

A slow-cure resin should be used. The slow-cure time allows a longer set-up and open time, providing an opportunity to adjust clamps and get everything spot on. A low-viscosity resin is designed to wet out, seep and bond to wood fibre and metals and is ideal for this application. The resin

should also be able to cure in a wide range of temperatures to form solid high-strength bonds, which have a high resistance to moisture. A high-density filler is required to 'thicken' the resin and to maximise bond strength for high cyclic loads. The desired viscosity can be achieved by mixing approximately 40% filler with 60% resin/hardener.



Swap wooden dowels for steel bar for extra strength



Ingredients for a strong bond

Preparation

Cut the metal bar to the desired length. This can be done by hand using a hacksaw. Hacksaw blades are inexpensive, so always work with a sharp blade, and protect the jaws of your vice by using an offcut of hardwood to hold the bar. Alternatively, an angle grinder or chop saw can be used with an appropriate metal cutting disc.

It is important to 'flute' the metal bar by cutting a groove into the rod perpendicular to the threads, allowing air to escape. If the air cannot escape, the bar will not engage into the joint effectively, limiting the bonding area and weakening the bond. Air may also prevent full engagement leading to gaps between the wooden surfaces.

The success of any bond depends on the strength of the resin and how well the resin adheres and mechanically 'keys' into the surface. The following steps of surface preparation are critical to the bonding operation.

Clean all surfaces. Carefully de-grease the metal bar with a chemical solvent (thinners). I have seen hot soapy water used,

however, this method produces an inferior bond as the soap remains on the surface and introducing water to a metal surface is never a good idea. For an improved bond, abrade the surface of the bar with 80-grit paper.

Abrade and clean all wooden surfaces inside the oversized hole and on any secondary surfaces that will form part of the gluing surface. Bonding to wood requires a mechanical, as well as chemical linking. The adhesive must 'key' into pores of scratches in the surface – think of a microscopic version of a dovetail joint. Good preparation provides a surface texture that will help link the cured resin to the surface.

Primary bonding of resin relies on the chemical linking of adhesive layers. All the layers of adhesive must cure together to form a single fused layer. The ability to chemically link layers diminishes as the previous layer cures. Bonding stages must be completed in good time to ensure a good bond, don't rush the glue-up but also don't go and make yourself a tea halfway through.



Prepare a block to hold the bar and protect the vice jaws



Make a cradle to hold the bar for fluting



Cut a flute across the threads



Drilling can burnish the inside of the hole so key it up with some coarse abrasive



A simple jig may also be a viable option for accurate drilling



Protect the surrounding area of the first stage in a two-stage glue-up

Method

Referring to your design drawings, establish where the bars will be inserted and mark their exact location on your work. If I am using two or more fixings in the same area, I prefer not to rely solely on these marks to drill the oversized holes. Alternatively, I recommend making a simple double-sided jig which guarantees that the holes line up on all faces. Remember to mark the jig so you can identify which way it should be placed on each surface. Typically, this joint provides a good amount of 'wiggle' room, however, this is finite, so accuracy is still important.

As a rule of thumb, the oversized hole should be drilled giving a 30% clearance around the metal bar. For example, for a 10mm bar a 13mm hole is required. A drill press will give a straight hole, making it easier to glue up. If drilling into an end grain on a long section of wood, ensure the wood is square to the bed of your drill press, using a set square and the bed as your datum.

The strength of the joint relies on the ability to transfer loads from one part to another. Three factors will influence how successful your joints are.

1. Careful measuring, and thorough mixing of the two-part resin ensure full cure strength – digital scales are a must.
2. Correct surface preparation, for the best adhesion and load transfer. The bonding area must be adequate for the load on the joint. Reinforcing additives can be used to increase bond strength.
3. Drilling oversized holes provides greater strength and stability to the final joint.

I prefer to glue-up the joint in two parts. First, I set the bar into one of the faces and let this cure completely. I have found that one oversized hole on the second face gives me more than enough flexibility.

You can do the glue-up in one step if it's a simple design, however, if the piece has multiple parts which need to be fixed



Threaded bar is not always exactly the size it's supposed to be



Use a fence attached to the drill table to square the component up for drilling

at the same time, why make life harder?

If you are going to 'pre-set' one face it is important that surfaces surrounding the hole are kept clean. You can achieve this by covering sections of the timber with tape. Once the bar is inserted use a jig to centre the bar(s) ensuring that they are set straight.

Alternatively, drill a pilot hole in the bottom of the oversized hole. The pilot hole serves to hold/clamp the rod in position until the resin cures.

Wet-out hole(s) with a basic resin/hardener mix. Allow the resin to thoroughly soak into the exposed grain of the wood. Thicken the remaining basic mix using a high-density filler to a moderate consistency (similar to mayonnaise). The correct level of viscosity will cling to vertical surfaces but has peaks that will fall over. Blend in small quantities of filler until the desired consistency is reached. Spread resin onto all surfaces of the hole, evenly cover half of the rod with resin and insert it into the hole. Ensure all air is expelled by pressing down onto top of bar. Clean any resin overspill and hold the joint in place with the jig and allow to set. Once set remember to remove the

tape before the final stage of the glue-up!

Before this final stage of the glue-up, prepare your clamps and dry fit all components. Make sure all surfaces are abraded and are cleaned to ensure they are free from contaminants. As before, wet-out the hole(s) with basic resin/hardener mix and allow it to briefly soak into the timber. Wet any other surfaces that will form part on the joint around the hole.

Thicken the remaining mix and apply into the hole and onto the rod. The resin should be thick enough that it does not drip from the rod. Apply enough pressure via clamps to hold the joint in place, it is normal for a small amount of resin to squeeze out and this should be removed while wet. Do not overtighten, as resin can be expelled from the joint under excessive force. Allow the resin to cure thoroughly before applying a load.

The only potential issue with this versatile joint is positive location of parts. I have therefore adapted the original method to include Dominoes to overcome this problem. My 'improved Parnham' makes use of Dominoes, which helps to locate and align the joint.



A cut-away section showing the pilot hole to support the bar



Use a basic resin to completely wet out the hole



Carry out the same procedure on the corresponding part of a single-stage glue-up



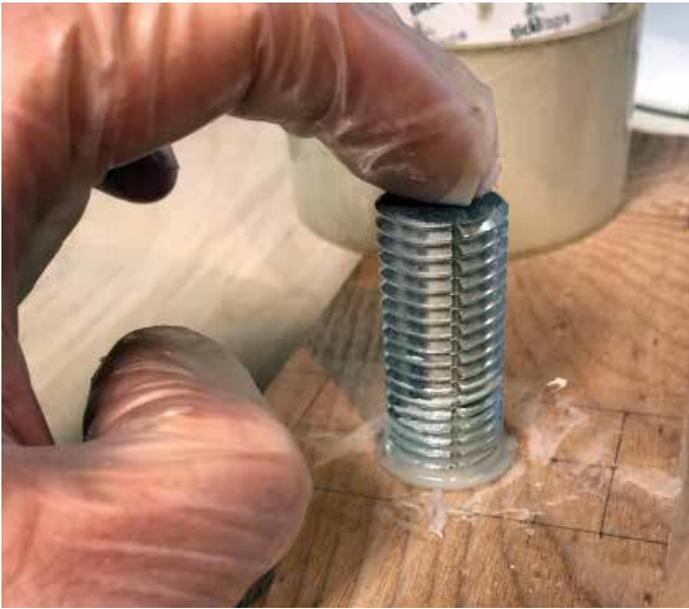
Add filler to the resin to bulk it out and strengthen the joint



Apply directly onto the basic resin before it cures



Apply the thicker resin mixture to the bar



Press the bar home firmly to expel any air from the joint



Ensure sufficient resin is applied to fill any voids



For a single-stage glue-up and easier alignment use a Domino