Photograph by **Dave Hutton**

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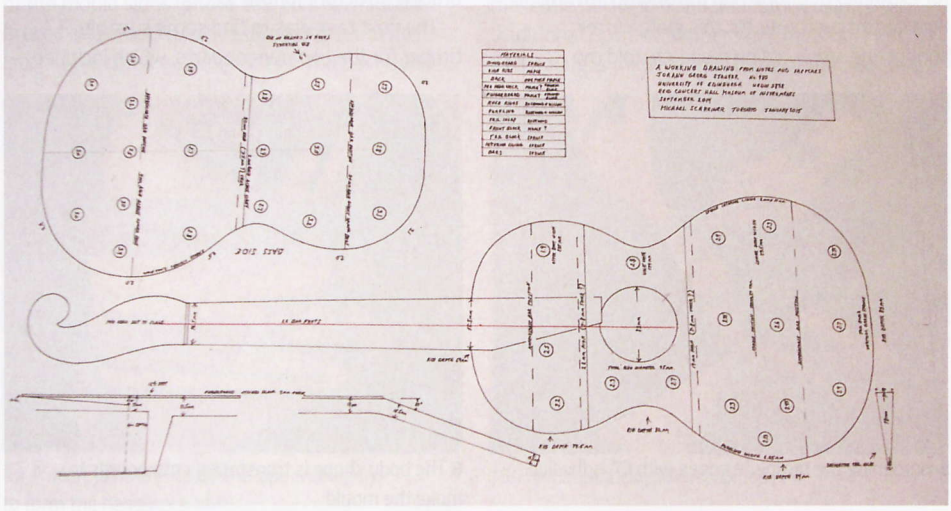
STRIKE A CHORD

In part 1 of this three-part series, **Shaun Newman** shows you how to make an early Viennese guitar in the style of Johann Georg Staufer

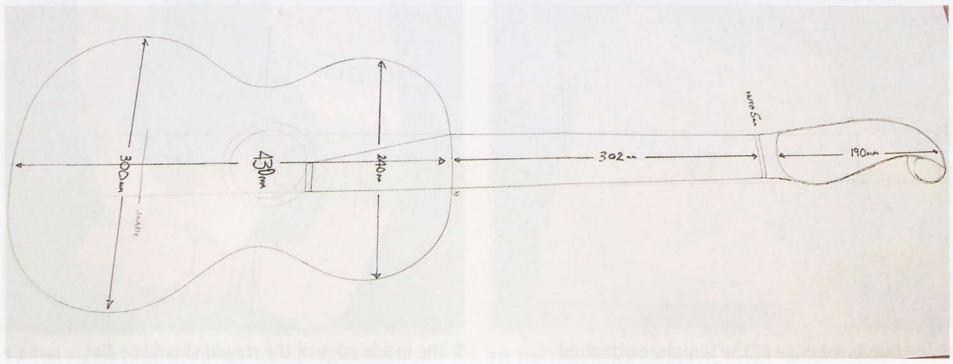
One of the joys of making musical instruments is that you never know what the next commission might be. When a call came in for me to make a copy of a 'Staufer Legnani' classical guitar originally made around 1830, I was thrilled at the prospect. I knew the job would be full of challenges given the unusual tuners and the highly decorative bridge, so although a little daunted I accepted the commission eagerly.

A little history

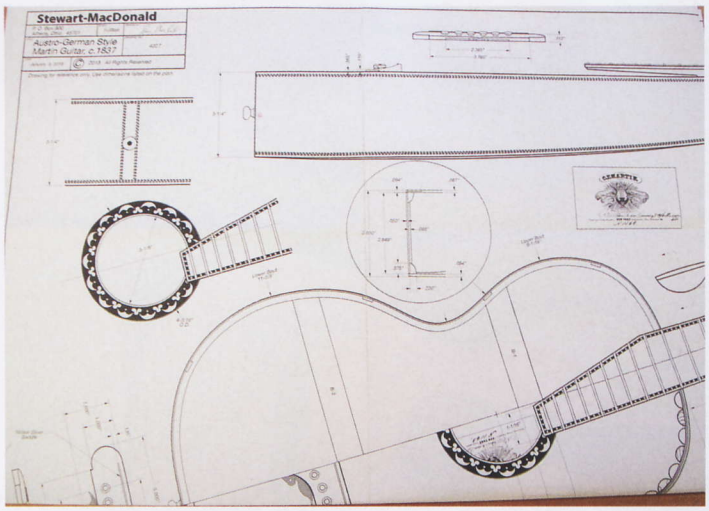
Johann Georg Staufer was born in 1778 and died in 1853. He was one of the foremost instrument makers in Europe and had workshops in Vienna. He made guitars for some of the leading players and musicians of the time including Regondi, Mertz, Legnani and Schubert. Luigi Legnani suggested a number of construction ideas to Staufer who was always looking to improve his guitars. It is thought by some musicologists that Staufer was the first to introduce a detachable neck for a classical guitar to aid portability and to allow for adjustments to the action (i.e. the height of the strings above the frets) to be made easily. He also invented the 'Staufer-Mechanik' in 1825, which was a set of metal tuners with the buttons running along one edge of the headstock rather than having three on each side. He was truly an extraordinary luthier in that he also made high quality violins and cellos, and invented a new instrument, the 'arpeggione',



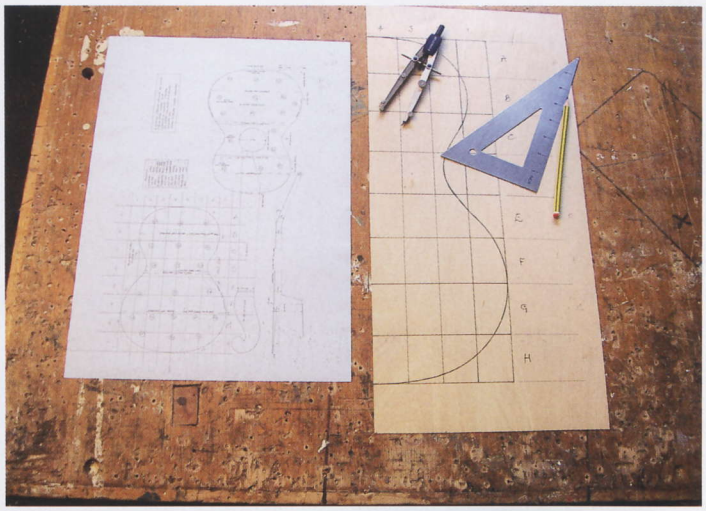
1 Drawings made by Michael Schreiner



2 My own working sketch with some dimensions



3 A Christian Martin guitar plan available from Stewmac



4 The half body template transferred onto ply

which is bowed rather than plucked and has six strings in guitar tuning. The instrument is half guitar and half cello, and even attracted the attention of Schubert, who wrote a sonata for it.

In Staufer's workshop, so it is believed, worked an apprentice named Christian Frederick Martin. He took his skills and knowledge from Vienna to America where he founded the famous 'Martin' brand, which is still in production today.

Making a start

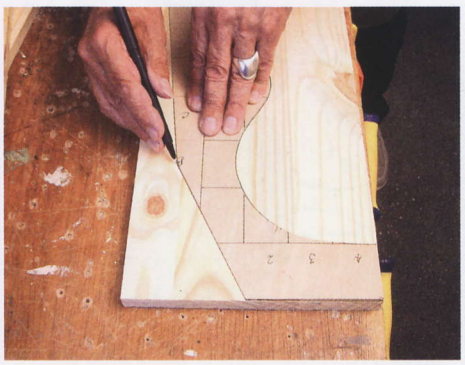
The first task in this commission was to find a drawing of the guitar, which as it turned out, proved to be quite difficult. I contacted some of the leading makers of Staufer copies (Bernd Kresse, Miodrag Zerdoner, and Gary Southwell, for example) but none had a working drawing. Luckily, the customer for this guitar, after conducting some online research, told me of some drawings made by Michael Schreiner in 2014, and published as a free PDF in 2015 (**photo 1**). They are of a model produced at about the right time, so I made my own plan from these sketches and created a full-sized outline by scaling the A4 drawing up to the correct dimensions (**photo 2**). The customer also found more drawings and details of a Staufer guitar from the website of Thomas Ochs in Germany where a free PDF can be found with measurements and pictures. I was grateful for the head start this offered me but discovered later that a full-sized plan with virtually identical measurements is also available from Stewart-MacDonald (see list of suppliers). The plan is of a C.F. Martin guitar, so is a little later than Staufer, and has a slightly different bracing structure (**photo 3**).

The next task was to find some suitable timber for the component parts, which included maple for the back and sides, spruce for the soundboard and mahogany for the neck and head. I decided on sipo mahogany for the latter and ordered the maple and spruce from Alpenholz Pahler, a supplier of the very timbers Staufer would have used from the Markneukirchen area of Saxony in Germany. Luckily the German firm Rubner, famous for their well-engineered guitar tuners, still manufacture the Staufer-Mechanik. I ordered a set and gulped as I paid the invoice!

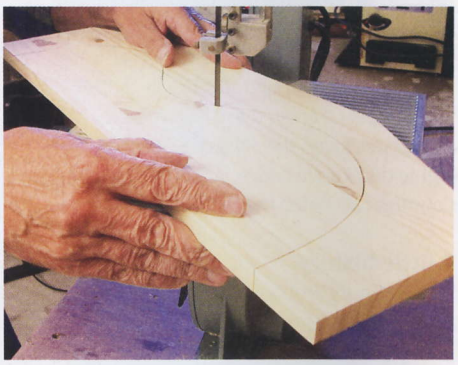
The construction mould

While awaiting the arrival of the timber and tuners, I set about making the mould. There are two principal ways of constructing a classical guitar, the first being to use a workboard with cams that hold the instrument in place while working, and the other is to use a mould. I favour the mould method as it holds everything very

5 Hardening the template edges with CA adhesive



6 The body shape is transferred onto boards to make the mould



7 The mould boards are then roughly cut out on the bandsaw

8 The hardened edge of the template attached to the mould board for final finishing

9 The inside edge of the mould should be flat and smooth

10 The completed mould – note the removable block to allow the neck through

11 A rebate is cut on the underside of the mould body

12 The mould 'well' prevents damage to the soundboard

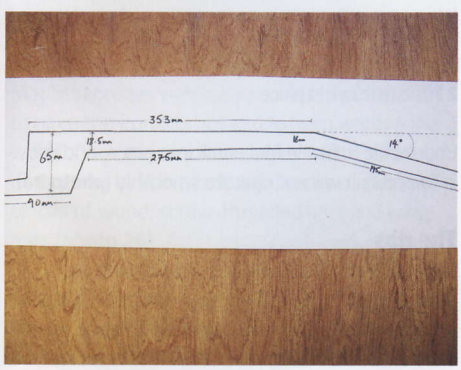
firmly during the many operations that need to take place. First, a template is created, which is half the shape of the body (**photo 4**). This is made from 6mm plywood and has to be cut and finished with care as a bearing-guided flush cutting router bit is used to create the final finish to the sides of the mould, and any uneven areas of the template will be transferred to the sides themselves. To harden the inside edge of the template a coating of CA adhesive is applied; this hardens the edges and prevents small dents being made into the template as the cutter bearing is pressed against it (**photo 5**).

The sides of the mould are made from softwood boards 535mm long and 205mm wide. The outline is transferred from the template onto the boards (**photo 6**), which are then cut roughly to shape on the bandsaw (**photo 7**). Each half side is then finished by attaching the template with small, countersunk screws and using the router with a flush cutting bit to give a smooth finish (**photo 8**). Three boards are required for each side and are glued together to form a sandwich. Both mould sides are then brought together, and the inside edges smoothed (**photo 9**). The structure is then attached to a base of 22mm Stirling board with coach bolts. The baseboard is 760mm long and 405mm at its widest point. A space must be made at the neck end of the mould to allow the neck to pass through during construction. The piece that is removed is glued together at the centreline and held back in place with dowels (**photo 10**).

Two further tasks are required before the mould can be used. First, a rebate measuring 6 × 6mm must be cut into the underside edge of the mould sides (**photo 11**). This permits the braced soundboard to be placed under the ribs later in the construction process. The next task is to make a well for the baseboard so that when the soundboard is fitted the curvature that is applied does not get damaged (**photo 12**). Once the mould is complete, it is treated with several coats of polyurethane varnish to help prevent any part of the instrument becoming attached to the mould during the build.

The neck & headstock

Many of the 'Legnani' model guitars had a detachable neck that was held in place by a through-bolt and a clock key mechanism. The customer for this guitar decided against the mechanism as there are instances where the idea, though it may be a good one, causes more trouble than it is worth. I therefore chose to make the neck, heel and headstock using the traditional Spanish 'slipper heel' method. First a template is made in the shape of the neck and

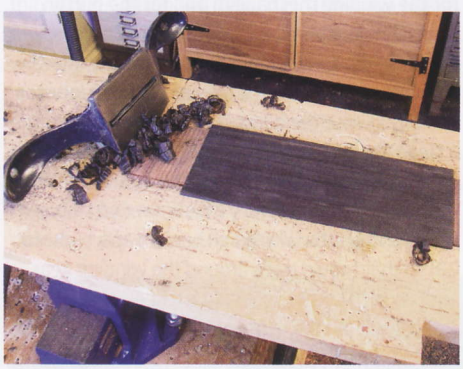


13 The neck and heel template

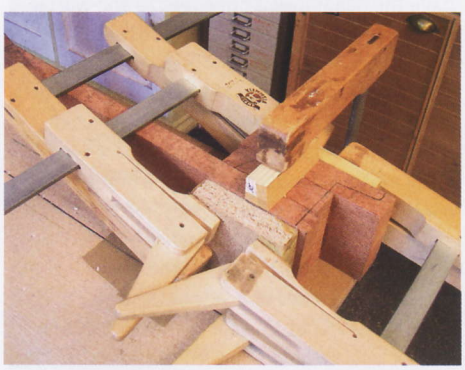
14 A scarf joint is cut into the sipo mahogany to form the headstock joint

15 The headstock joint in cramps

16 The headstock ready for facing

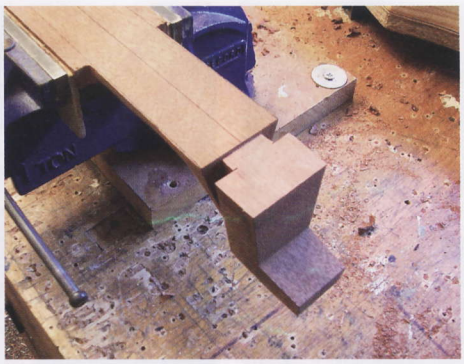


17 The ebony headstock face



18 The heel block before carving

19 The cone-shaped heel nearing completion



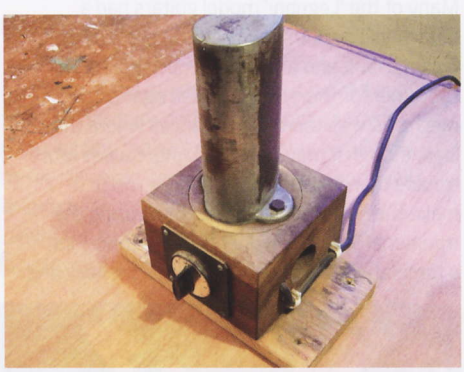
20 The ledge at the top of the heel to accept the soundboard

21 The Staufer-Mechanik housing under preparation

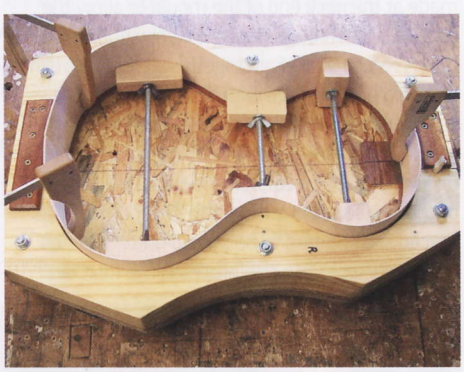
22 The housing now complete

23 The disassembled Staufer-Mechanik

24 The headstock showing the Mechanik in place



25 A commercially available heated bending iron



26 The ribs held inside the mould

27 The tailblock in place

heel (**photo 13**). A billet of sipo mahogany around a metre long, 25mm thick and 75mm wide is required, which is then planed smooth all round. Approximately 200mm is cut from one end to create a scarf joint to produce the headstock angle, which is 14˚ (**photo 14**). Next, blocks are cut from the other end of the billet to form the heel. The shape of the headstock is distinctive and will eventually accommodate the backplate and tuning mechanism. At this stage the headstock is cut oversize and will be adjusted later during the fitting of the Staufer-Mechanik. After cramping into place (**photos 15 & 16**) the head is planed flat and then faced with a thin sheet of ebony that has been reduced to just 2mm in thickness (**photo 17**).

Out of the crude block at the end of the neck (**photo 18**) a cone-shaped heel is formed using a sharp chisel and a Japanese marking knife. This heel shape is typical of early 19th century guitars and was often made of a pine block rather than the same timber as the rest of the neck. In the sides of this block two tapered slots are cut. These will later receive the ribs of the guitar, which will be held in place with cedar wedges. This method of construction offers strength due to the opposing grain directions (**photo 19**).

To allow the soundboard of the guitar to sit flush with the upper edge of the neck, a 2mm ledge must be cut into the top of the heel. This can be done with a chisel or a rebate cutter and router (**photo 20**).

The Staufer-Mechanik presents a challenge in that it must be inset into the back of the headstock. This involves cutting out channels for the winding mechanism and for the button rods. This must be done with extreme accuracy as the screws which hold the backplate in place come very close to the edges of the slots (**photos 21 & 22**). Once the backplate is positioned, a clean line may be drawn around its edge and the headstock can be neatly trimmed back.

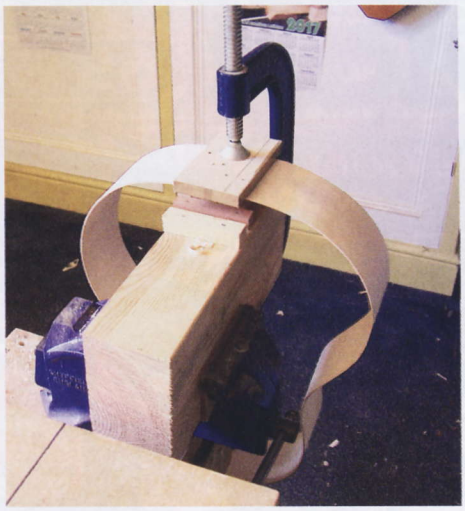
To achieve the accuracy that is needed I found it useful to take the whole mechanism apart (**photo 23**) so that I could trace around the winding gear and along the button rods with a fine marker pen. It also gave me the opportunity to pinpoint exactly where the barrels, through which the strings pass, should align along the head. If these holes are even a fraction of a millimetre out of line, it is almost impossible to fit the Mechanik into place, and if it is forced in, it will not operate smoothly (**photo 24**).

The ribs

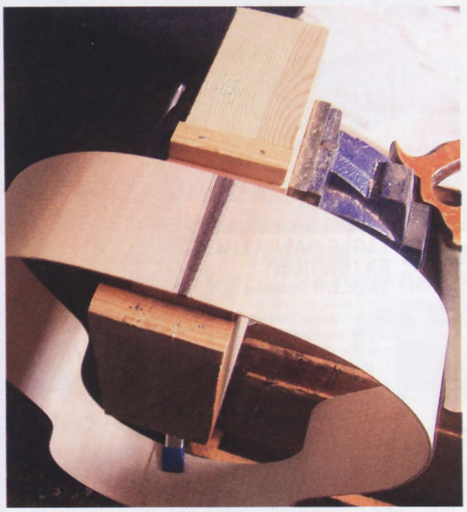
Each of the two guitar sides, also known as 'ribs', are planed to just under 2mm thick, sanded smooth with 320 abrasive and cut to the correct shape. The heel end of the rib is 65mm wide, the tail end 82mm, and the overall length is first cut to 680mm and later adjusted when the two are fitted into the mould. The ribs must be bent exactly to the form of the inside of the mould and this is done on a hot bending iron (**photo 25**). Such irons are quite expensive, and the investment is really only worthwhile if the intention is to make several instruments that require shaped sides. Alternatives can be found, not least a home-made bending iron made from a piece of cast-iron pipe with a gas blowtorch to provide the heat from the inside. Examples can be found in books and articles on guitar making as well as on YouTube.

Before bending it is as well to wet the timber as this creates a steam cushion that helps prevent splitting as pressure is applied during the process.

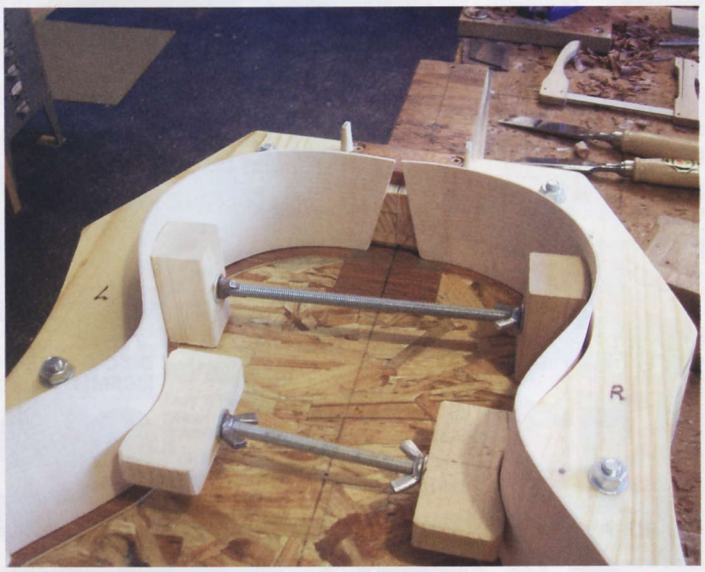
28 The tailblock inlay slot is cut out with a sharp chisel



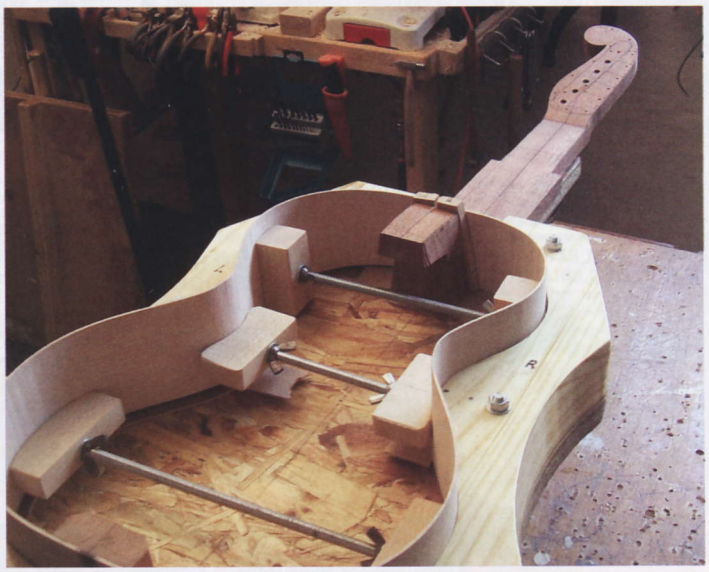
29 The inlay is cramped into place



30 Once in place the tailblock inlay is looking good



31 The rib ends at the heel cut to an angle



32 A dry fit of the heel-to-rib wedges

Maple scorches very easily so it is important not to have the iron too hot and to keep wetting the wood. Once the required shape is achieved, the ribs can be held in place with braces made from blocks of wood, screw-threaded bars and wing nuts (**photo 26**).

The tailblock

The tailblock is made from a small billet of mahogany and used to strengthen the lower end of the guitar and to help counterbalance the weight of the headstock and tuners. The block is 82mm high, 65mm wide and 17mm deep. The side facing the inside of the end of the guitar is curved to fit the profile of the lower part of the instrument and the inside edges of the opposite side are chamfered. Once the block has been glued into place (**photo 27**) the guitar ribs can be removed from the mould to allow a decorative inlay to be placed along the join where the two rib ends meet. This inlay is made from a small piece of rosewood 2mm thick and tapers from 7mm to 15mm. It is edged with sycamore and black tulipwood purfling. The purfling is optional. The inlay is held inside the channel with cam clamps and the ends trimmed flush once the glue has dried (**photos 28, 29** & **30**).

Attaching the ribs to the heel

Before the ribs, with their new tailblock and inlay, are returned to the mould the heel ends should be cut off at an angle to conform to the angle of the slots that will house them with the aid of the tapered wedges mentioned earlier (**photo 31**). It is best to fit the wedges into the slots with the ribs in place dry, as once the wedges are tapped in with adhesive the Titebond will grab quickly, making them extremely difficult to remove (**photo 32**). Any gaps that appear where the rib locates with the heel slot can be rectified by tapping in a thin veneer, which will help to push the join flush. Any scraps that protrude can be trimmed flush with a sharp chisel once the glue has cured.

It should be remembered during this part of the build that before the ribs are finally put into place, they should be held clear of the mould 'well' by small pieces of hardboard or similar just 2mm thick. This will allow for the front of the guitar to sit at the same plane as the neck as it is being fitted.

NEXT MONTH

In the September issue, Shaun makes the soundboard and rosette before preparing the soundboard for fitting

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- **Stewart-MacDonald** – timber, tools and accessories (including drawings). USA based, therefore 20% tax needs to be added to most purchases – **www.stewmac.com**
- **David Dyke** – timber, tools and accessories. UK based – **www.luthierssupplies.co.uk**
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- **The Early Music Shop** – a source of authentic strings for 19th century guitars – **www.earlymusicshop.com**