

Uku can do it!

In the final part of this series, **Shaun Newman** adds the finishing touches to the tenor ukulele and shows you how to string up and tune it before you're finally ready to make some sweet music!

Welcome to the third and final part of my ukulele build. By now you should have a near-finished article and all that's left to do is to fit the frets, prepare and attach the fingerboard and to fit the tuners and bridge. Here, we'll also cover how to make the bone nut and saddle, how to apply a good finish and, finally, how to string up and tune your instrument.

Preparing & fitting the fingerboard

The fingerboard can be made from any suitable hardwood, such as rosewood or ebony. Many

players prefer darker woods as they make the frets more visible. I have used maple in the past but the frets seem to disappear from time to time, particularly in bright lighting. Fret distances from the nut are set out at the end of this article. The board must be absolutely flat on both sides and brought to a thickness of 6mm. It is as well to cut the fret slots while the sides of the fingerboard are still parallel. The slots themselves need to be cut with a fine dovetail saw (**Pic.1**). To judge the correct depth, make a simple depth gauge from a thin strip of metal with a strip of masking tape across it showing the depth of the fret tang. By placing this into the slot it is possible to see exactly how deep the cut is (**Pic.2**).

Once you've cut the fret slots, the fingerboard can be tapered from 37mm at the nut to 50mm at the end, which meets the top of the soundhole. I find a white 'Posterman' marker very useful in showing the cutting lines on very dark wood (**Pic.3**). The position of the fingerboard must be marked onto the neck ensuring it will be exactly central when attached (**Pic.4**).

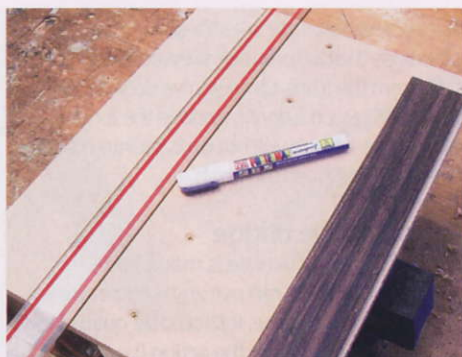
It is vital that the fingerboard does not move while it is being glued on, so drill 1.5mm holes: one through the centre of the first fret slot, and two through the slot at fret 15. Pass hardboard pins through the holes and dry pin the board into place (**Pic.5**) leaving a 5mm gap for the bone nut, and then glue, using the pins as locators (**Pic.6**). At this point the whole thing should be beginning to look like a musical instrument.



STEP 1. Cutting the fret slots



STEP 2. Checking fret slot depths



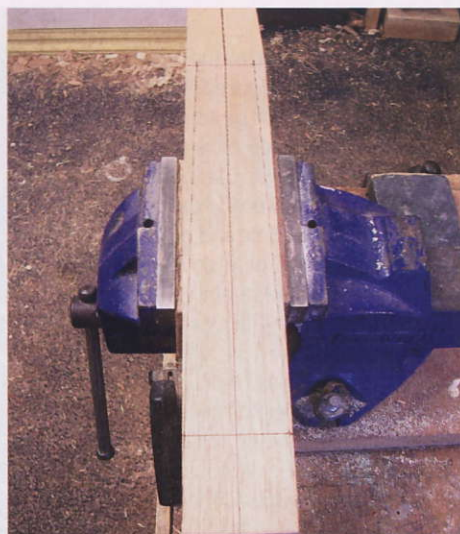
STEP 3. Marking the final shape of the fingerboard

Fretting

Even though the fingerboard will have been planed absolutely true prior to being fixed into place, there can often be slight movement so it will need to be sanded flat. The best method I have found for this is to use a piece of plate glass around 9mm-thick, 75mm-wide and a little shorter than the fingerboard itself. Attach double-sided abrasive to both sides: one grit being 120 and the second 240. Draw three pencil lines down the length of the fingerboard – one near each edge and one in the centre – which will show up when the board is flat as the lines disappear (Pic.7). As soon as the board is flat, it is necessary to check the fret slot depths once more as they may have been slightly compromised during the sanding process. If any of the slots below fret 14 (which sits at the shoulder of the instrument) need to be cut deeper, then the ukulele front must be protected. I normally use a sheet of thick acetate held in place with masking tape. When you are happy that everything is in order, put in the position dots. These are made from mother-of-pearl and measure 6mm in diameter and around 1.5mm-thick. Their purpose is to help the player to know which fret is which and one is normally placed between frets 2 and 3, 4 and 5, 8 and 9 and two between 11 and 12 where the octave sits. The dots must be placed exactly along a centreline, or in the case of the two dots between 11 and 12, equally spaced from the centre. They must also be precisely placed between the frets. It is best to mark the positions onto masking tape, then apply this to the

fingerboard (Pic.8) using a sharp tipped scribing tool. These small holes will then act as a precise guide to the centre of each position dot. Next, carefully drill the holes to the correct depth (Pic.9), then use CA adhesive to hold the mother-of-pearl in place. The frets can now be put in.

Fret wire comes either in rolls or as straight pieces. I would recommend cutting them from straight pieces as the fingerboard is not curved as is the case on many acoustic guitars. Clip each fret to around 10mm over length and tap into place with a hammer with a nylon head. It is best to use a 'dead blow' hammer if possible, as the shot filled head means the frets do not tend to bounce out of the slot as they are tapped in. Never use a metal-headed hammer as this will seriously dent the frets and it will be a tedious job to level them all. Once in place, clip off the ends of each fret so they are flush with the sides of the fingerboard. Opinion is rather divided on the subject of gluing frets in. A fine trace of epoxy in the fret slot will hold the fret firmly for years, but if new ones have to be fitted over time, they are difficult to remove without causing splits in the board itself. On balance, I fit frets dry and make sure they sit absolutely flat. Their flatness can be checked with a straightedge, and if some sit high they will need to be levelled with a flat honing stone. To ensure flatness, you need to remove the minimum amount of metal, as they will need to be 'crowned' when they are level. This is best done with a triangular file with the sharp edges dressed off on a whetstone. Gently round the



STEP 4. Marking the location of the fingerboard onto the neck



STEP 5. The fingerboard pinned dry onto the neck

tops of the frets using the file in a back and forward motion, gradually rolling towards the top of the fret (Pic.10).

Next, file the fret ends flush with the fingerboard sides, then bevel the outside ends to around 60°. I find the best way of doing this is to use a safe edge file with no handle that has been attached to a block of hardwood planed to 60° on one face (Pic.11). The edge of the file overhangs the side of the block by just 4mm and is run along each fingerboard edge to file the required angle. Finish the fret ends with 1,000 grit wet and dry paper to ensure they are absolutely smooth (Pic.12).



STEP 6. Clamping the fingerboard into place



STEP 7. Levelling the fingerboard

Fitting the tuners

Before the tuners are fitted the headstock needs to be reduced to the required thickness. This is normally 12mm and can be achieved by careful sawing with a fine blade with no spine (**Pic.13**).

It is really important to use a good set of tuners on any stringed instrument. Poor quality tuners will wear badly over time and will not hold the instrument in tune. 'Grover' do really good tuners, with a lifetime guarantee, at a very reasonable price. I used their 'Sta-Tite' geared range for a solid peg head. These have nickel plates and black buttons and at around £25 for a set represent good value. You need to drill two holes for each tuner: one for the collar, which fits into the face of the headstock, and one for the shaft, which fits in from the back. The face hole is 9.5mm in diameter and 7mm deep while the holes for the shaft are 6.5mm in diameter. It is important to make sure the holes are in the right place as there can be a tendency for the two inner strings to foul on the shaft of the two outer ones. Aesthetically it is as well to ensure that the back

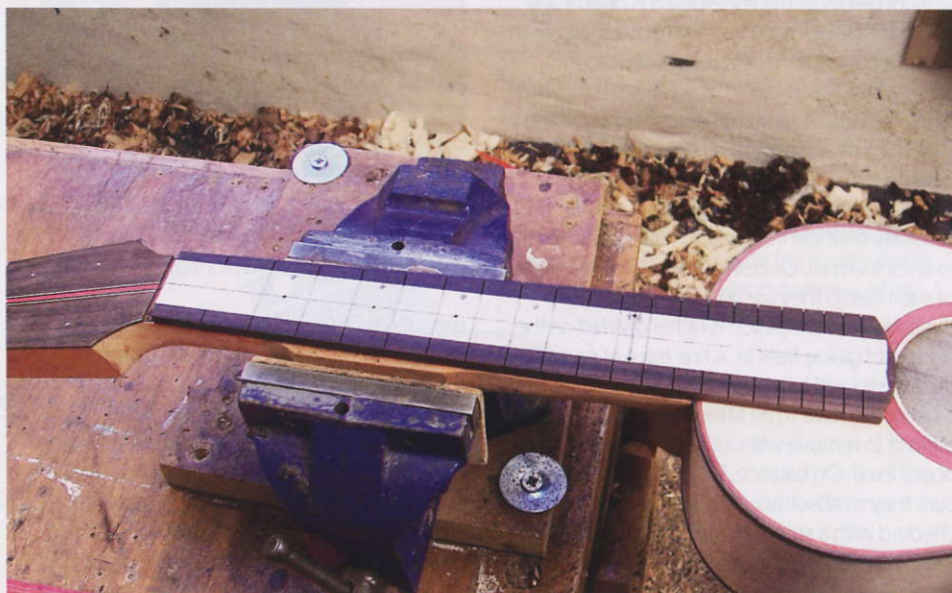
plate screw holes are in a straight line as otherwise the buttons look skewed when seen from the front. Once you've drilled the holes and tested a dry fit, remove the tuners and collars – these will not go back into place until you've applied the finish.

Preparing the bridge

The bridge on my ukulele is made from rosewood, but you can use any well-seasoned hardwood you choose. It should be quartersawn as if it twists over time, the action (i.e. the height of the strings above the frets), will alter and the ukulele may even become unplayable.

First, plane the rosewood billet flat on both sides to a thickness of 8mm and a width of 26mm. It should measure 110mm long. Mark out the billet to show the positions of the wings, the saddle slot and the tie block for the strings (**Pic.14**). The next task is to reduce the wings of the bridge to a thickness of 4mm. The wings are each 25mm long, leaving a high spot in the centre some 60mm long (**Pic.15**); this will be

turned into the saddle bone housing and tie block for the strings. The saddle slot runs the length of the high part of the bridge and is 2mm wide and 4mm deep. It is 4mm from what will be the front edge of the bridge. The decorative bone and veneer cover for the tie block is 8.5mm wide and 2mm-thick. The bone edges are needed to prevent the strings from cutting grooves into the rosewood edges. You need to cut a ledge across the high spot of the bridge to let the bone and veneer cover in (**Pic.16**) and then glue in place using epoxy resin to ensure a very strong join (**Pic.17**). Carve a ramp between the inner edge of the tie block and the saddle housing so that when the string holes are drilled through the lower edge of the bridge, underneath the tie block cover, the strings can pass up over the saddle itself (**Pic.18**). The underside of the tie block has two holes for each string 4mm apart and 3.5mm from the underside of the bridge. The string passes up through the hole on the left side, around the tie block and then up through the hole on the right. You can then tuck the tail end of the



STEP 8. Marking the location of the position dots



STEP 9. Drilling the position dot housings



STEP 10. Crowning the frets



STEP 11. Bevelling the fret ends

string under the first winding and hold it tight as the string is brought to tension.

To locate the bridge, drill two 2mm holes down through the saddle slot housing around 5mm from each end of the slot through which cocktail sticks need to be passed to hold the bridge in place while it is being glued. When the glue has dried, snap the sticks off and the bone saddle then hides the ends. The bridge needs to be held in place with homemade wooden clamps while the glue dries (Pic.19). Once the bridge is in place, reduce the neck to its correct thickness and round to make playing comfortable (Pic.20). The combined thickness of the neck and fingerboard should be 18mm at fret 1, 22mm at fret 7 and 24.5mm at fret 9.

The bone nut & saddle

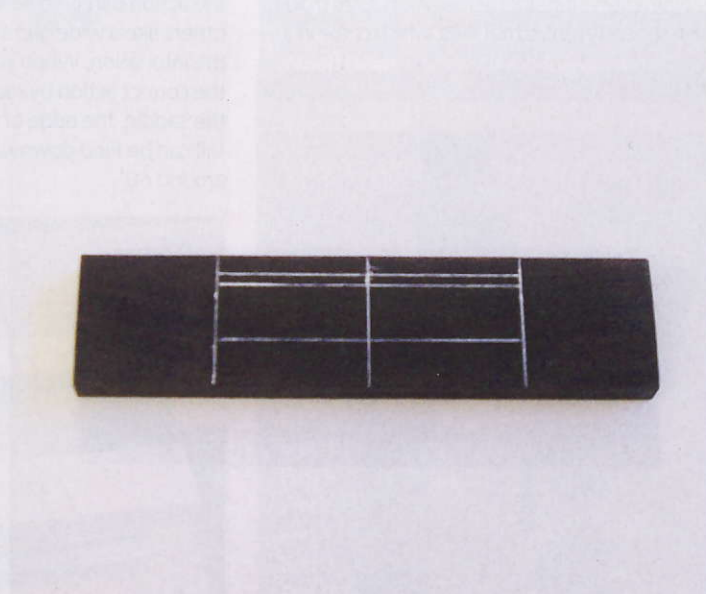
It is quite possible to make your own bone nut and saddle, particularly if you want to deprive the dog of its lunchtime snack! However, it is a long and tedious operation: first the cattle bone must be boiled for hours and then soaked in ley



> STEP 12. The finished fingerboard



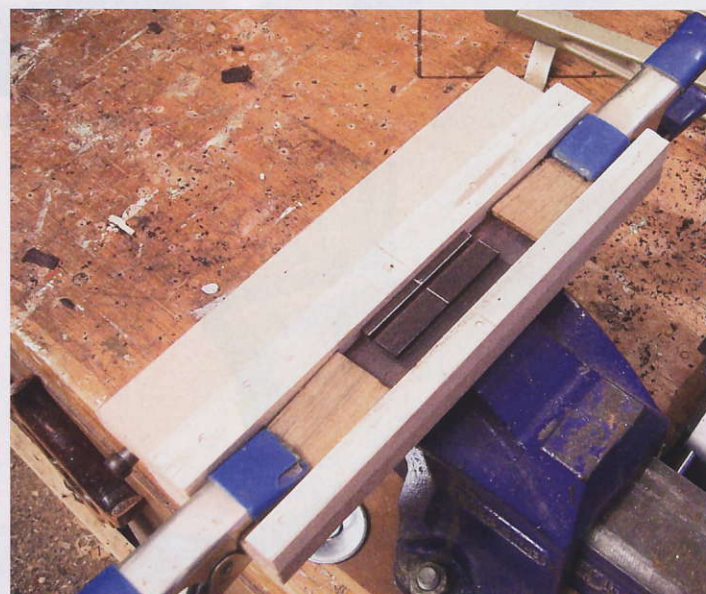
STEP 13. Cutting the headstock to the correct thickness



STEP 14. The rosewood bridge marked out



STEP 15. Reducing the thickness of the bridge wings



STEP 16. Cutting the saddle bone slot

to remove all traces of fat, then the bones must be cut to size and made to fit their respective slots, before finally being made to work. It is far easier to order them from a supplier.

Next, the saddle needs to be made 60mm long and 2mm-thick. To begin with it can be left at the 8mm or so wide that will have been supplied. The first task is to make sure it fits into the bridge slot smoothly and does not rock backwards and forwards. Once you've achieved a snug fit, it is best to move on to the nut at the top end of the fingerboard. This needs to be cut to the same length as the top width of the fingerboard (i.e. 37mm). Next, file it to a width of 5mm to fit the slot exactly. With the nut in position, scribe a line along the face where the nut meets the fingerboard; this acts as a guide to how deep the string slots must be made. Mark the string slots across the top of the nut, allowing around 5mm for the two outer strings from the edge of the fingerboard with the remaining two inner strings spaced equally in between. This should mean the strings are around 9mm apart.

Normally string slots across the nut are made with specially ground nut files, which come in a

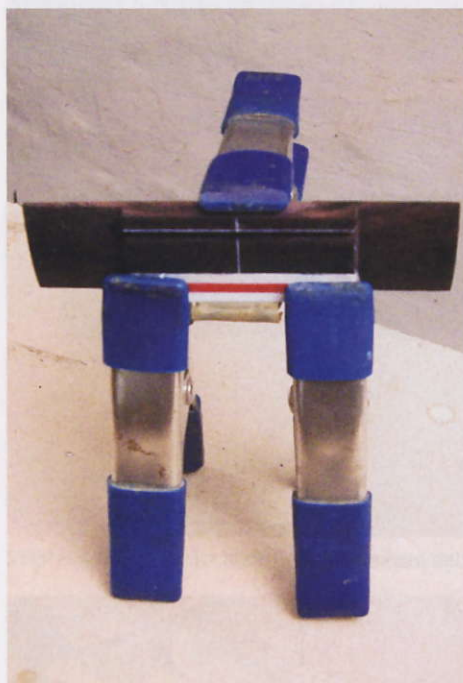
variety of thicknesses. These are not cheap and a good job can be done with fine-edged needle files, especially the oval section ones. The slots must be filed down to around 1.5mm above the scribed line and each slot should match the string diameter where possible. If a slot is made too wide for the string it can buzz, and if it is made too narrow it can jam. Finally, round over the back edge of the nut to allow the strings an easier pathway to the shafts of the tuners. You also need to slightly round the top corners, which will make playing more comfortable.

To ensure the correct action is set on the ukulele, fit the two outer strings and test the height at the 12th fret. The precise point of measurement is from the top of the fret to the underside of the string. That measurement should be around 2.5mm to begin with on the bass side and 2mm on the treble. It is only with trial and error, and quite a bit of playing, that the most suitable action height can be determined. String action is very much a personal choice with some players needing the action barely to be above the frets while others like a wide gap so that they can vary the intonation. When you've decided upon the correct action by reducing the height of the saddle, the edge of the bone nearest the tail can be filed downwards at an angle of around 60°.

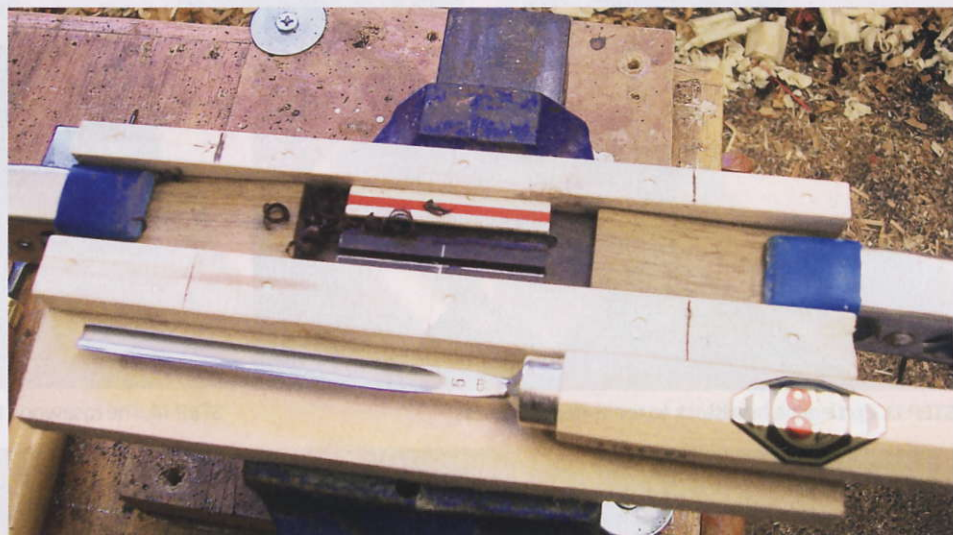
Applying the finish

There are many ways in which a ukulele can be finished, some of the more popular being nitrocellulose lacquer and products such as Rustins' Plastic Coating. Nowadays many players like the feel of an oil finished instrument and I would recommend Liberon finishing oil. However, the best finish I have ever used is made by General Finishes in East Troy, Wisconsin (available from www.stewmac.com). It comes under the name 'High Performance Water Based Topcoat'. As the name indicates it is water-based, which makes clean up very easy. It is environmentally friendly with low VOCs, very durable and easy to apply with either a foam brush or fine quality varnish brush, such as the Liberon fine hair ones. Just three coats are needed with a light rub down with 600 grit abrasive between coats and the final one can be buffed with '0000' steel wool.

Before applying the finish the entire instrument must be sanded clean, first with 240 grit, then 320 and finally 400. Ensure to remove all traces of glue otherwise they will show up as ugly patches after the finish has been applied. If patches do show after the first coat, it is best to strip those areas back to the wood and start again. Apply the finish over the whole of the ukulele except the fingerboard, which may receive a coat of oil after the overall finish is dry.



STEP 17. Clamping the tie block cover into place



STEP 18. Cutting out the ramp in the bridge



STEP 19. Clamping the bridge into place



STEP 20. The final shaping of the neck

Stringing & tuning up

The moment of truth arrives at this point! I hold my breath every time as I start the process. You can never tell exactly what the instrument will sound like until the strings are on and it has been played in for a while. If you have picked good tonewoods and made the braces light, the front delicate and the back and sides thin enough, you should get a really good sound.

At this stage it is also necessary to decide which tuning convention you want to go with. A tenor ukulele can be tuned in a variety of ways but the most popular two ways are known as 'high G' and 'low G'. Players going with one or the other swear by their choice and it seems the two camps are frequently in dispute with each other as to which is the better way. I decided to go with

the 'high G' as I simply like the sound it makes. 'High G' will be explained below.

It is best to begin with the first string, which will be tuned to A (i.e. A above middle C). As this string is quite thin, it is worth tying a knot in the end that will be tucked under the winding at the tie block to stop it pulling through. Next, move to the fourth string. This is tuned to 'high G', and is the G above middle C. This string is also thin so requires a knot. Next comes the second string, which is tuned to E above middle C. An easy point of reference for this one is that it matches the first string on a guitar that has standard tuning. Finally comes the third string, which is tuned to middle C.

You are now in business with a 'high G' tenor ukulele. 'Pomaika'i' as they say in Hawaii, or 'good luck'! **GW**



The completed tenor ukulele



The back of the instrument

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STRINGING UP YOUR UKULELE

Fret distances measured from the front edge of the nut to the centre of the slot in millimetres:

Fret 1	24
Fret 2	47
Fret 3	68.5
Fret 4	89
Fret 5	108
Fret 6	126.5
Fret 7	143.5
Fret 8	160
Fret 9	175
Fret 10	189.5
Fret 11	203
Fret 12	216
Fret 13	228
Fret 14	239.5
Fret 15	250
Fret 16	260.5
Fret 17	270
Fret 18	279
Fret 19	287.5
Fret 20	295.5
Fret 21	330

NB: The overall string length from the inside edge of the bone nut to the inside edge of the saddle is twice the distance of the centre of fret 12 (i.e. the octave) to the nut plus 1.5mm to compensate for the increased tension when the strings are depressed. Therefore the overall string length is 433.5mm