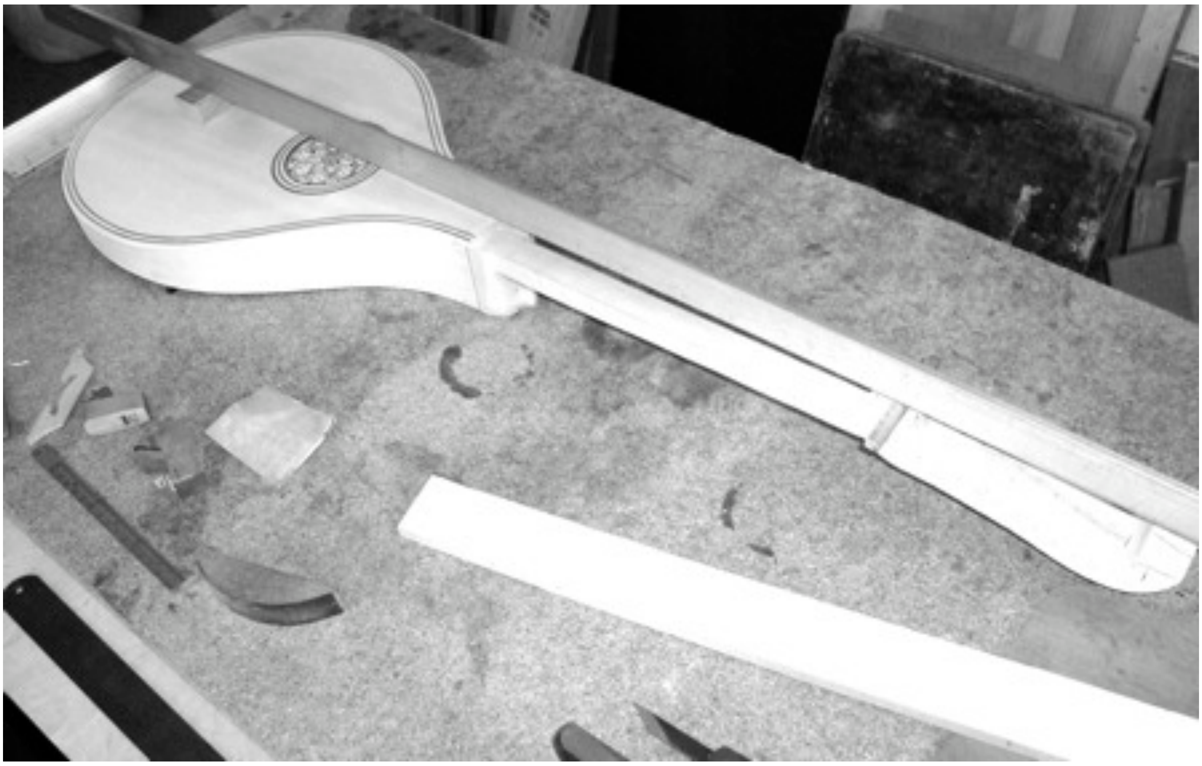
Fomrhi Comm. 2086. **Peter Forrester**

How I Build a Cittern, part 4 - the Fingerboard.

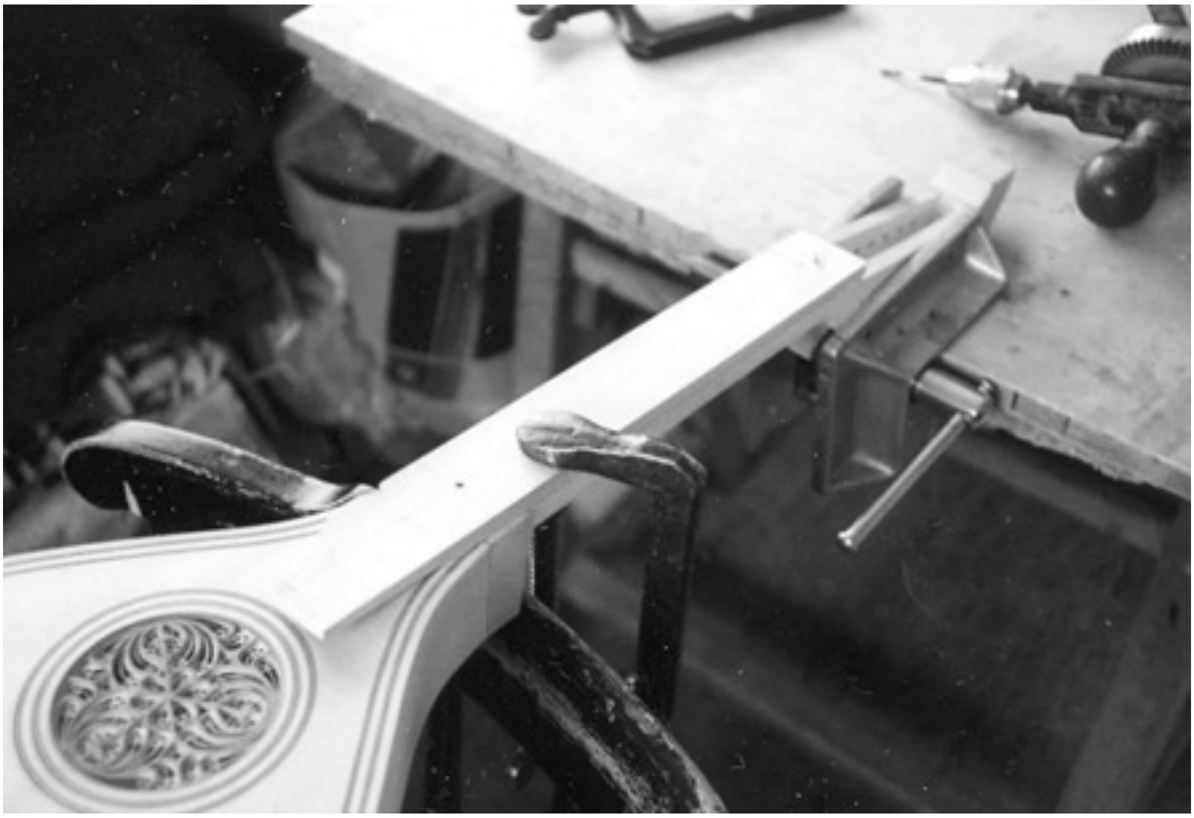


The fingerboard is the most important component of a cittern. As well as controlling the tuning and temperament, it comprises rather more than half of the eventual neck structure. It needs to be thoroughly seasoned, cut as exactly as possible on the slab or quarter, and parallel to the centre line of the trunk of the tree in order to avoid any warping that might occur when the slots for the frets are cut. The favourite wood used originally seems to be maple, some are of sycamore or beech, both of which I have mostly used myself.

Blocks of wood cut to the correct height for the bridge and nut are placed on the instrument with a straight-edge between. Generally I aim at 18 - 20 mm for the bridge and 9 - 10 mm at the nut. The straight-edge now represents the strings, and allowing up to 1.5 mm, or slightly less, for the action at the 12th fret position, will give a suitable side elevation for the fingerboard. Its upper surface will be the eventual fret height. When ready, it should be of even depth, or taper slightly towards the nut. Brescian (constructed) citterns have the end of the fingerboard partly cantilevered over the belly. Traditional carved Italian citterns, North European citterns and the equivocal cittern in Vermillion are flush.

In plan, the fingerboard will also taper, perhaps 2 mm, from the 12th fret to the nut. As a precaution, I leave this tapering until after gluing. Most citterns have the bass side of the fingerboard cut away in a more or less fancy outline. It will be easier if the approximate position of the frets and wedges in this area are known.

With a centre line marked and the positions of the 12th fret and nut known, I cramp the fingerboard in place using the rather Heath Robinson arrangement shown here: and drill holes for two dowels to preserve alignment when gluing. One fits neatly into the area which will be occupied by the nut, the other perhaps under the 12th fret's wedge, although it proves most important that neither hole should partially overlap

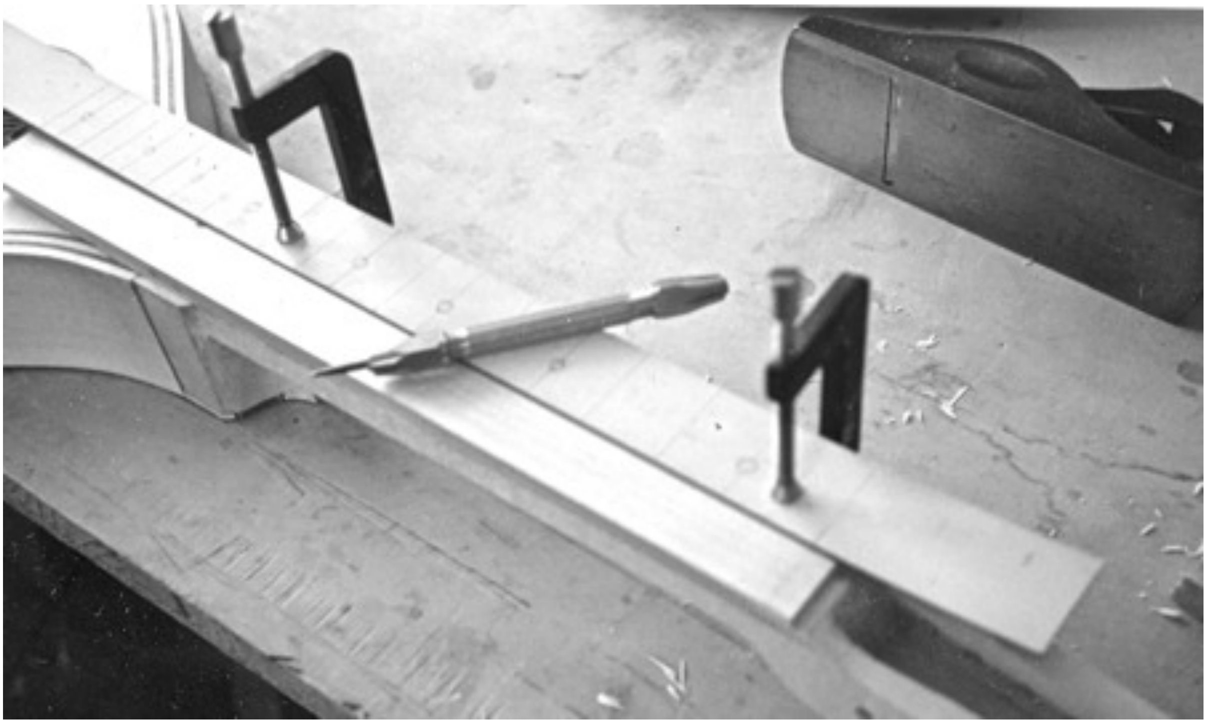


those previously used for attaching the neck to the base of the mould.

The fingerboard is glued in place using a tried and tested wood block as shown. It is better to think of gluing the rest of the instrument to the fingerboard, rather than the reverse. When the glue is dry, using the bendable straightedge, check that the centreline of the fingerboard still coincides with that of the belly. It is now possible to make the taper of the outline and reduce the width of the peg-box to its finished size.

Playing the cittern will be helped by a low action and this can be aided by hollowing the surface of the fingerboard, technically to a very shallow parabola - in practice simply by scraping to a slight but even curve, about 0.5 mm deep on a 43/45 mm string length. This can be judged by a light behind a straightedge.

It will be checked again later after the wedges are fitted. *See:* Ephraim Segerman, ‘Fingerboard shapes and Graded Frets’, Fomrhi comm. 1168, April 1993.



The fret positions are now marked along the centreline. I have various lengths of formica marked for different string-lengths and degrees of mean-tone. Marking the frets themselves at right-angles to the centre-line will either require an adjustable square, or that the fingerboard has not yet been trimmed to its finished taper. I prefer the former. Though be warned that there will now be an imperceptible bend at the 12th position. The width of the wedges, perhaps 2.5 mm, is also marked.

Fret positions and temperament.

A necessary interruption, and some fairly recent history. It was not until the 1970s, that there was a realisation that equal temperament did not really suit the sound of the lute. Some lutenists experimented by moving their frets, and practical advice was published, particularly by Eugene Dombois in JLSA, and Eph Segerman in Fomrhi. Citterns of course, having fixed frets, were indisputable evidence that some form of meantone was in use. For some time it was believed that all citterns, regardless of size were tuned with a top string at an "e". Most extant tuning instructions also suggest an e' top string, and it needed a realisation that extant cittern string lengths occurred in clumps of specific sizes that allotted them to different pitches. There are in fact some references to other pitches - Cerone, Mersenne, Praetorius. Here we are concerned with an e' cittern of 43 - 45 cm string length. The other sizes which were used were at a', d'(or perhaps a low pitch e'), b, and a. There was also a citara tiorbata at e', Robinson's 14 course cittern also at e', and a large ceterone, included by Monteverdi and with one still extant in Florence, for which there are questionable tuning instructions in both Praetorius and Mersenne. Apart from one fret on some Italian traditional diatonic citterns, all citterns have a similar pattern of large and small spaces between frets despite different string lengths and pitches. Mostly the printed music seems written to fit the frets so that enharmonics are avoided. The 11th fret seems usually 'averaged' on chromatic citterns, and on the more sophisticated diatonic citterns from Northern Europe.
My first citterns used equal temperament, but measuring originals, and advice from Eph Segerman convinced me to try meantone. Peter Trent, then of the Extempore String Ensemble, played on both for me, convincing us that meantone worked much better than equal temperament. This first cittern's frets were calculated by deviation from equal temperament using Segerman's original article. Later it was more convenient to use fret factors taken from Dombois and Martin Shepherd. Of course, as shown by Chris Coakley in an earlier comm., the original makers did not start from lists of numbers. Mostly they would have used geometry and judgement. Mersenne's Proposition III in his Second Book of String Instruments from the Harmonie Universelle shows what must have been typical, and which results in a good working meantone pattern. (He does elsewhere, however, also include the only specifically cittern fretting instructions I know of. They do not work!). Original instruments vary, but for today, 1/6th comma meantone is a good compromise for playing with other instruments and alone.

Based on Martin Shepherd's article, *see below;* the fret factors to be used are:

Fret	1	.0605	7	.3320
	2	.1075	8	.3724
	3	.1614	9	.4037
	4	.2034	10	.4398
	5	.2515	11	.4708
	6	.2968	12	.5000

The string length multiplied by the fret factor gives its position. Past the 12th fret, multiply half the string length by the next factor and add the result to half the string length. The 18th fret can be omitted.

Relevant reading includes:

Peter Forrester. Italian Citterns in the Museum of the Paris Conservatoire, The Lute, 1991.

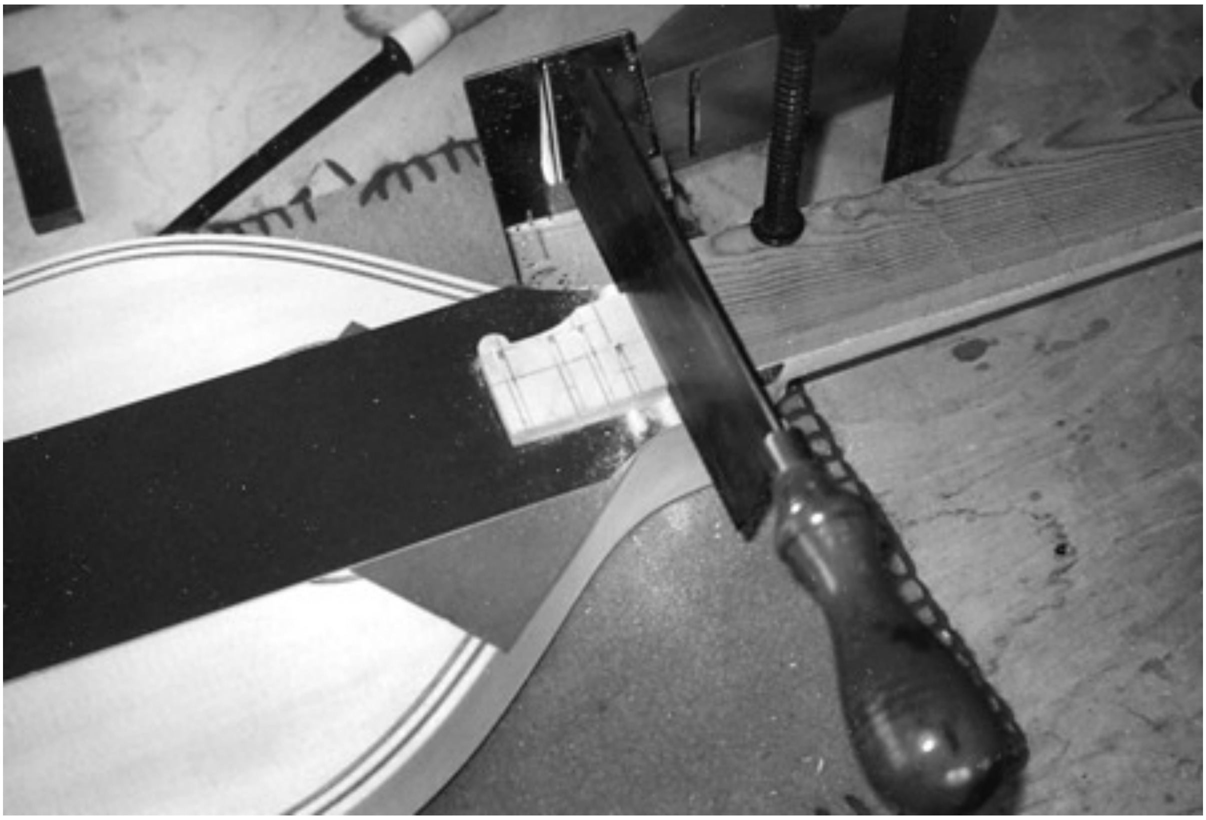
Eugen M. Dombois. Varieties of Meantone Fretting realized on the Lute, Journal of the Lute Society of America, 1974.

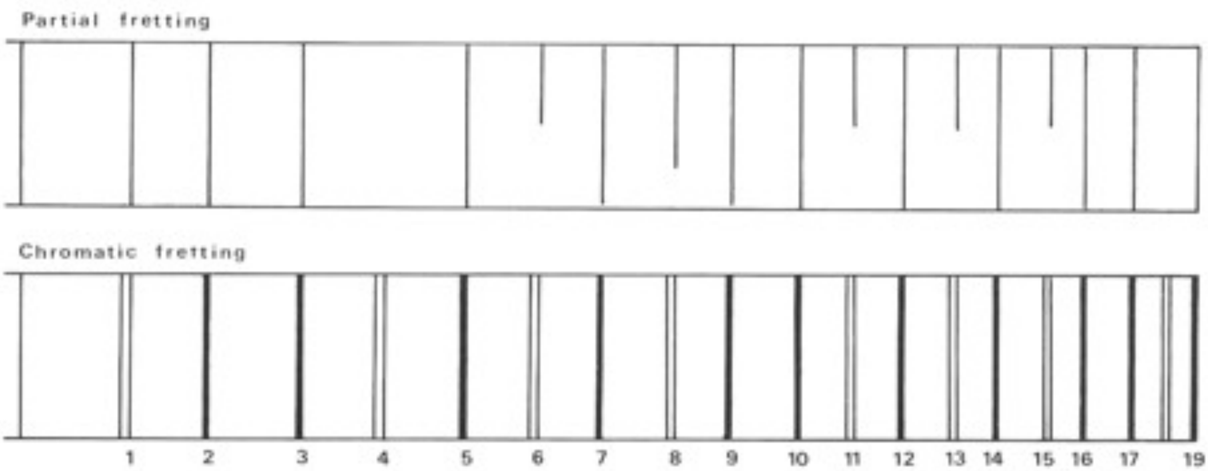
Abbott and Segerman. A reasonable and practical approach to mean-tone fretting, Fomrhi comms. 88/89, October 1977.

Mark Lindley. Lutes, Viols and Temperaments, CUP 1984.

Martin Shepherd. The Well-Tempered Lute, Lute News 41, March 1997, and shortly on his website.

Chris Coakley. Orpharion and cittern fret analysis and other ancient tunings....., Fomrhi comm. 1987, February 2013.

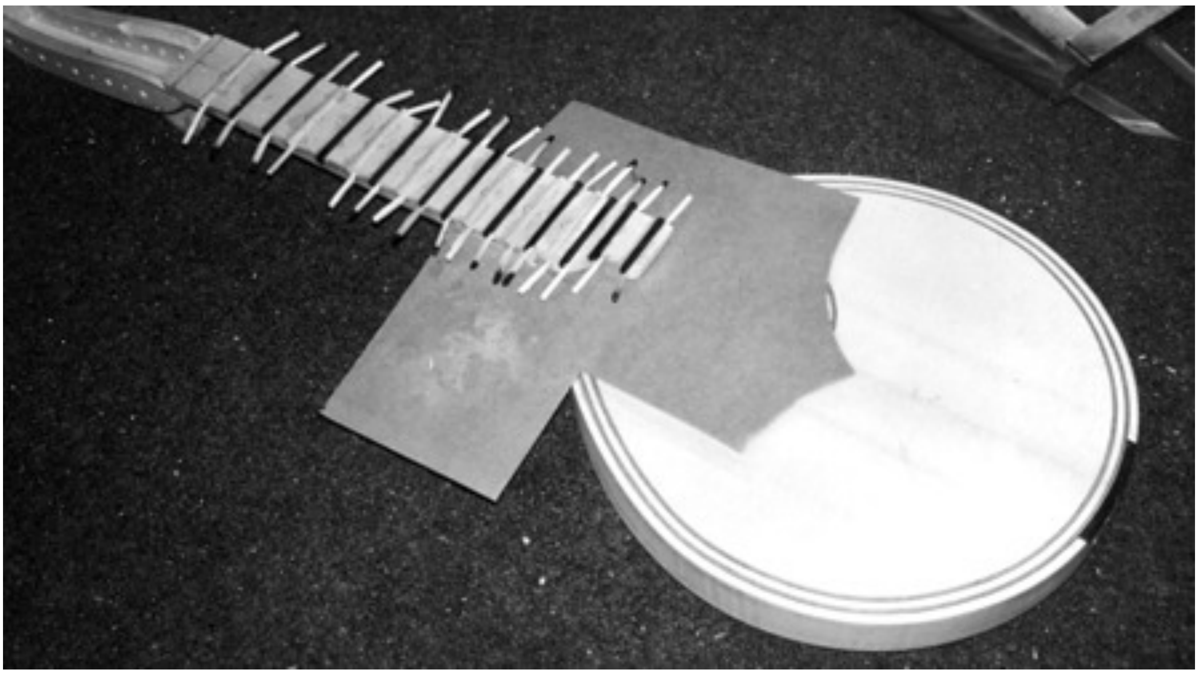




The slots for the wedges could be cut with a modified saw to give a constant depth. I make them freehand, aided by a small mirror behind the fingerboard as in the photograph. The side of the slot which will be occupied by the fret itself is cut at an angle, the other side at right-angles to the surface. Partial frets can be started with a saw, and finished with a knife.

Original frets and wedges vary in size, and our choice will probably depend mostly on the material available for the frets. I have used scrap brass 28 thou thick for most of my instruments, with a thicker gauge for the '0' fret at the nut. The slots are around 6 mm deep. Recently I have found strip material available from model railway suppliers. It works for citterns, although I would have preferred it slightly deeper for larger instruments. It will be worth looking for sources. Some original citterns from Brescia use folded strips of brass. Experimentally, they do not act as springs to hold themselves in place, but the fold gives a rounded top to the fret, slightly work-hardened.

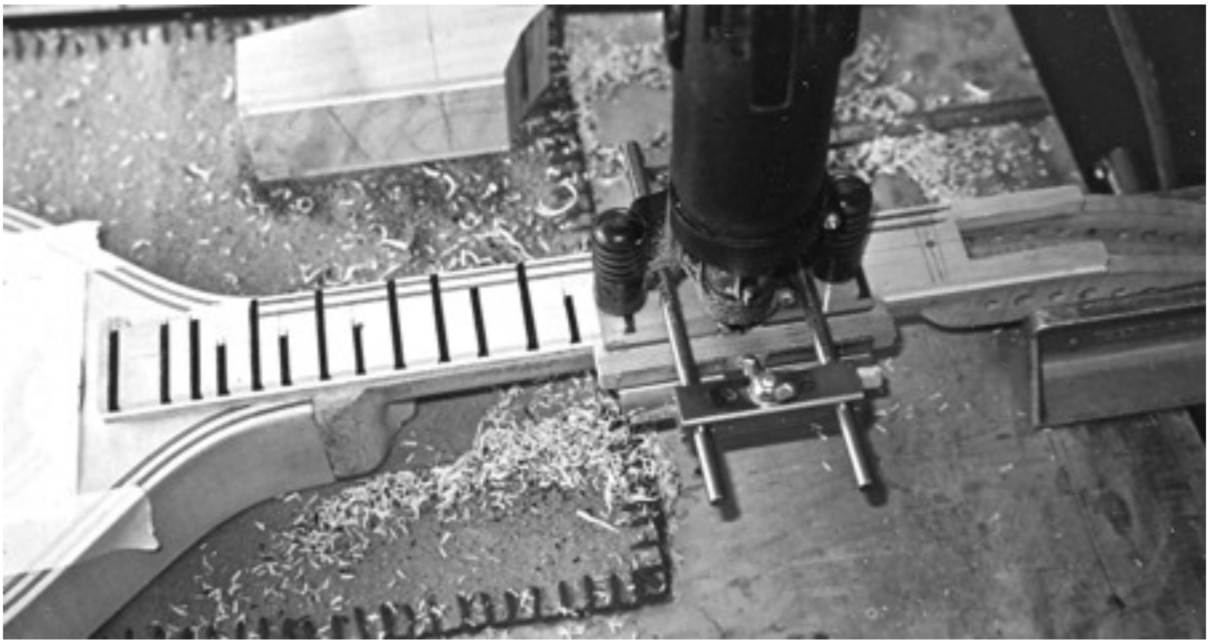
When the slots are cut, their wedges can be glued in place - they can be loose when fitted because the actual fret slot has still to be cut. The shape of the slot will enable them to be wedged in place when gluing. Save matches! For a chromatic cittern, they will be colour-coded to match the complete and partial frets on the diatonic instrument. (The cittern tablature added to the end of Morlaye's 4th book for guitar is for a cittern with the first fret also missing.) Colour-coding continues up to at least Tielke's cithrinchen of 1676. As the wedges will absorb some of the finger-pressure on the frets they are of a hard wood with the grain across the direction of the strings. Ebony and box-wood are suitable. Although we call them 'wedges', there is no record



of what they were originally called. Their end-view of a half-dovetail (a full dovetail on one Italian instrument) is wedge-like, but experimental actual 'wedging' caused the fingerboard and neck to bend backwards... Occasional wedge shapes on original instruments are probably due to repair. It would be possible to retain a parallel appearance and form a wedge by tapering the depth. This has perhaps been done on one cittern, but again there is a likelihood of a bent-back neck. When ready, the wedges are planed, filed and scraped level with the sides and top surface of the finger-board. It is again checked for a slight curve with a straightedge and light.

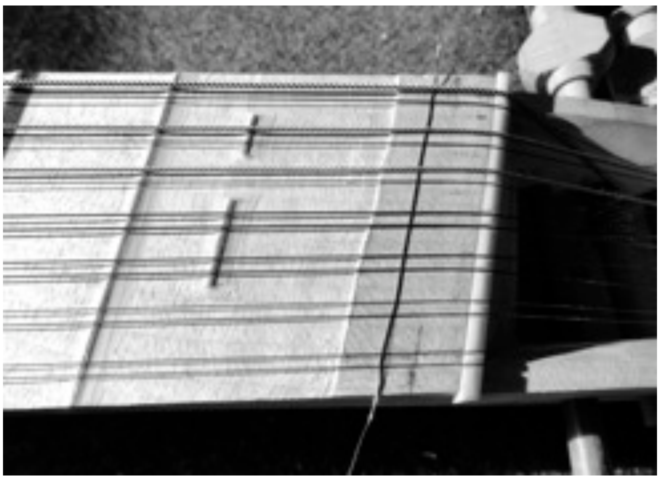
The slots for the frets are recut. It will be necessary to have a saw which is the correct size for the frets. Instructions on saw-sharpening easily found online will include adjusting the width of the cut. Now is an opportunity to check and if necessary, adjust the accuracy of the previous marking and cutting.

Some citterns have covered fret ends, often on one edge only. If wanted, a rebate should be cut before the frets are inserted.



Whatever material is used, the frets need to be roughened with a coarse file and degreased (carbon tetrachloride?). If scrap brass is used, it will need eventually to be filed flat with the surface of the fingerboard. Manufactured strip could perhaps not need filing. Some adhesive or cement will be necessary. Options include animal glue, mastic, epoxy resin.We do not know what was originally used. I have used all three successfully but am happiest with an epoxy, Araldite. Usually it is rightly avoided in instrument making because it is considered irreversible. However I have found that a small soldering iron applied to the fret, and some brute force with a scriber, will remove a fret if necessary. In practice, the resin is inserted into the slot with a sharpened piece of scrap wood and the slot pressed into place, squeezing out surplus. A little heating with the iron will help to ensure any gaps or air-holes are filled. Epoxy does require that the full setting time of three days - as it says on the packet! - is observed if scrap brass is going to need filing down to the fingerboard surface. The action of filing can cause the fret to loosen and rise out of its slot during the process, especially on the longer frets on larger citterns, orpharions and bandoras. When an even surface along the fingerboard is achieved, check again that the slight curve is still there, and continuous. It is also possible, using a bridge-high block in position, and a straight-edge, to check each fret. There should be sufficient light showing at the next fret that buzzing will not occur. This gap will be considerably less than with a lute or guitar.

The scallops between frets are variously shaped on original citterns. They could be, and probably sometimes were, made entirely by eye, but for accuracy really need some form of router. This could be as simple as a piece of sanding-plate glued to a flat surface, a hand router - probably an ‘old woman’s tooth’ plane, or a small router as shown - a Dremel drill, with its router base remade, smaller and in transparent perspex. (If needed, there are designs in at least two guitar repair manuals.) I use a flat plane parallel to the original surface, and set the depth to 0.5 or 0.6 mm. The depth obtained does need constant checking - there is some play in these drills. The actual rebate extends from the ‘wedge’ of one fret up to 2mm before the next fret. The ‘wedges’ and remainders are shaped by eye with a small gouge and files. The exception is the rebate in front of the ‘0’ fret.



Cittern nuts can be, and sometimes are, similar to those on lutes and guitars. Most, however, have a brass ‘0’ fret, perhaps slightly higher than the other frets, placed in front of a ‘nut’ which serves mostly only to arrange the strings into their courses. Because of the depth of the frets, acerbated by its slight extra height, the ‘0’ fret needs to be moved slightly towards the bridge. So this rebate needs to be temporarily left shorter. The photo detail of a bandora shows a pencil mark where the theoretical ‘0’ fret would be. The length of wire is at the point where the tuning will be correct. For a cittern I use a spare piece of 0.20 mm brass. Obviously a tuning meter will be necessary. But before the ‘0’ fret is finalised some strings must be in place.

Probably no original bridges exist. In paintings of players most right hands hide the bridge. Of those that do show the bridge, some are unconvincing, others seem of two sorts. The first is the type that I follow in the first photograph at the head of this article. The other has the feet closer together, and smaller, so that they appear to be more directly below the strings. Basically they will be working like violin bridges, so need similar dimensions.

The rough-turned pegs can be taken towards completion. The photograph shows my method of ensuring that they can be replaced exactly in the lathe. They are being held by pressure and for longer or narrower pegs it would be better to use a three-jaw chuck in the headstock.

I don’t finish the knobs of the pegs, nor fully fit them, until after varnishing in case they need to be returned to the lathe, or there are varnish splashes in the peg-holes which need to be reamed away. Talcum powder (not chalk, which is abrasive) and dry soap are used for fitting. If it is intended to make several citterns, a spare set of pegs could be an alternative.

A saddle similar to that of a violin is needed and straightforward to make and fit. Largish hitch-pins which should reduce string breakage, and the nut are made from bone which must be fat-free. Camel bone is available now and seems very good. The end-pin will take a cord or a light strap.

When fitting strings, especially as here where previously used strings are being reused, an ordinary wooden clothes peg truncated to a square end makes a useful third hand. Also in the photo are scraps of hacksaw blade reshaped to make scrapers for the slope up to the frets. The ‘0’ fret wire is at its theoretical ‘nut’ position.

After the instrument has been strung and its tuning has settled, the bridge position is found. This will be a little more than twice the nut to 12th fret distance because of the sharpening of the string when it is depressed to the fret. The bridge notches should be minimal eventually, but the present aim is for an action of 1.5 mm at the 12th fret combined with a note at the 12th fret exactly an octave above the open string. Use of a plectrum will give a clearer note than fingers. When the bridge position is established, the final position for the ‘0’ fret can be found. This is governed mostly by the depth of the frets. For one sixth comma meantone the following cent values are expected:

Fret 1	108.0	7	698.4
2	196.8	8	806.4
3	304.8	9	895.2
4	393.6	10	1003.2
5	501.6	11	1102.0
6	609.6	12	1200

The ‘0’ wire will need moving slightly, probably a little less than the bridge, and in the same direction. Theoretically the bridge might need moving again fractionally. In practice I’ve never found it necessary. The musician’s finger pressure can alter a note considerably. The maker’s job is to make the musician’s job easier with no surprises.

The most important notes to listen to firstly are those at the 5th and 7th frets, slightly sharp and flat by equal amounts. They were probably found by ear by the original makers. When you think they are satisfactory, check the first fret. When this also sounds correct, you have probably finished, although it is sensible and hopefully satisfying to check all the frets on all the courses. It is worth realising that any movement of the frets away from an equal temperament position towards meantone will sound better, and exact cent values are not absolutely necessary.

An ’0’ fret can now be fitted. It needs to be left higher than the other frets by the thickness of the wire used to establish its position. Possibly, as with the bandora above, it will be advantageous to move the nut also, closer to the bridge. The first fret space can be finished, and how well the nut works, checked. The ‘0’ fret definitely, and possibly the others, will benefit from using a specialist fret file, taking care to only round edges, not to reduce height.