REPORT AND DRAWING NOTES ON THE

ORPHARION

FRANCIS PALMER, LONDON, 1617

Collection of
Musikmuseet, Musikhistorisk Museum & Carl Claudius' Samling,
Copenhagen, Denmark
Inv. No. CL 139

Photo : Ture Bergstrøm

Examined and measured (2004 and 2005), drawn (2007)
and this report written by
Darryl Martin, University of Edinburgh

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THE ORPHARION

There are three surviving orpharions, of which the 1617 Francis Palmer instrument is the only signed, and is the best known, example. The other two instruments (probably both of German origin) are in the Historisches Museum, Frankfurt am Main (8 courses), and in the Städtisches Museum, Brunswick (9 courses). There are also measurements of an instrument (of a very similar size to the Palmer instrument) in the Talbot manuscript (compiled in London, c. 1695) and a drawing (with a scale) in *Theatrum Instrumentum* by Michael Praetorius, published in 1620. Other less precise illustrations are also known to exist.

The orpharion can best be described as a flat-backed wire-strung instrument tuned in the same manner as a Renaissance lute and having between seven and nine courses of paired strings. It is characterised by an undulating body shape, fixed metal frets held in place by wedges, an angled bridge (to which the strings are attached) glued to the soundboard and nut, so that the bass strings are longer than the treble ones. It is related to the bandora, with which it shares a similar body shape, fixed fret and bridge arrangements and wire stringing, even though the bandora is not known to have ever had more than seven courses, and earlier examples (including the only surviving instrument, made by John Rose, London, 1580) had a parallel nut and bridge so that all strings were of the same length. Later bandoras also had an angled nut and bridge as found on the orpharion.

The earliest known reference to the orpharion occurs in a poem by Michael Drayton in 1590, and there are common references by 1596, the year William Barley published his *New Booke of Tabliture*. It is probable that the orpharion fell from popularity by 1630 - 1640 at a time when new French tunings were introduced to the lute (creating conversion difficulties with the fixed-fret orpharion). The instrument does not appear to have died completely - in addition to the measurements provided by Talbot (of what is presumably a renaissance lute-tuned instrument), he also mentions that some instruments were built with a second pegbox having the bass strings on separate nuts, with 12 courses in total, similar to his “English two-headed lute”, an instrument which did use French baroque tunings.

THE INSTRUMENT

The Palmer orpharion is on public exhibition in a sealed glass showcase. It is in structurally stable condition, but has been subjected to damage and alteration over the years since it was made. These changes can be summarised as :-

1) The present bridge is not original, with the (probable) exception of the bass terminal. This bass terminal is shown on the drawing in the bottom right hand corner in plan view, and in section view as Section N. The present bridge is in the same position as the original (as can be confirmed by a scribed line along its front edge, and by tearing of the fibres where a previous bridge has separated from the soundboard), but differs in both the height and the position of the bridge saddle. The present bridge is too high, giving an action in which the strings are too far from the fingerboard. The soundboard is now concave over its length and width (although it has been drawn as flat), and the action would have been higher than at present when original, making it even less satisfactory. The saddle is too far forward, so that the distance from fret 12 to the bridge is less than the distance from the nut to fret 12. This results in an instrument which cannot satisfactorily play in tune. In practice the distance from fret 12 to the bridge needs to be greater than the distance from the nut to fret 12 by several millimetres (experiments suggest that the distance should be about 2 mm in the treble to about 3 mm at the sixth course). Anyone reproducing the instrument should therefore use the plan view for position, but alter the height and saddle position accordingly. As it is not original, the position of the outer courses are the

only ones drawn, which have been done to provide evidence about the lateral string spacing on the present bridge. The hitchpins have not been drawn in plan view, but are indicated on the section views (Sections L and M) and, as the saddle is not notched, are directly in line with that of the strings from the nut to bridge.

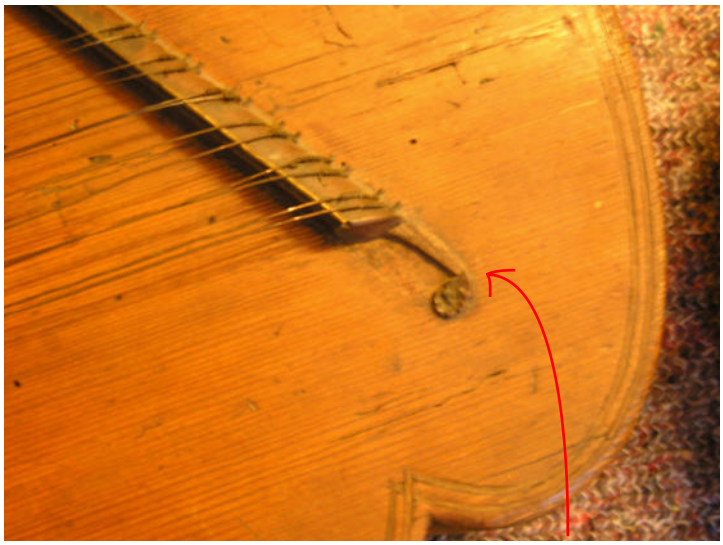


Photo : Darryl Martin

Edge of original section of bridge

2) The instrument has suffered considerable worm damage, particularly to the upper part of the head. This has resulted in the head breaking from the rest of the pegbox at some time. Although the instrument has always had nine courses, there were originally two pegs nearer the head than at present, which were at a part which has been very badly damaged by worm. This can be seen in the photograph below, where the peghole nearest the head has been filled, and the next hole left open.

Photo : Darryl Martin

As a result of the worm damage these holes were no longer serviceable, and two new pegholes were drilled at the other end of the pegbox near to the nut. The drawing reproduces the pegs in their original positions and makes no reference to the altered position.

3) There is some separation between the sides and the back near the bottom of the instrument on the treble side. This is probably due to back shrinkage. This separation can be seen in the photograph below.

Photo : Darryl Martin

There are also filled holes between in the central (maple) back stave, which were probably the result of plugs used (presumably not original) between the back and the endblock. Neither the separation of the sides nor the plugged holes have been indicated on the drawing. The line of the back on the drawing indicates its present position, and does not in any way attempt to correct any shrinkage distortion.

4) The instrument's soundboard has suffered some distortion, presumably as a result of string tension over a period of many years, so that it is concave over both its length and width. The drawing reproduces the instrument as thought the soundboard is flat.

MEASUREMENT METHODS

With the exception of the internal details, all of the measurements and other details on the drawing were taken during two visits to the instrument, the first in 2004, and the second in 2005.

Wherever possible details from the instrument were taken by direct rubbings, combined with straight-line measurement and triangulation measurements. The scale is 1:1 and can be checked by the border which is in 1 cm and 5 cm sections as appropriate.

The soundboard and back details were taken by rubbings of the instrument. As the edges of both are rounded over, straight-line measurements were also taken so the rubbings could be corrected to illustrate the instrument as if it wasn't rounded at the edges. In order to ensure there were no unexplained divergences, a profile gauge was used to obtain the shape of the sides halfway between the back and the soundboard. This has not been indicated on the drawing for reasons that shall be explained below (in the **body** section). The shape of the back over its length and width (in four places, Sections B - E) were taken with a profile gauge. Previously carried out tests shows that the profile gauge is consistent to generally a quarter of a millimetre. The neck and fingerboard details were taken by direct measurement, triangulation and a profile gauge. The profile gauge was used to obtain the curve of the heel, back of the neck, and shape

of the bass side of the neck (where it joins the fingerboard). Straight-line measurements (with a ruler or caliper) were taken to ensure that there was no distortion from the profile gauge, and templates were also made to ensure the neck and heel shapes were correct. The fingerboard was measured using rulers, a metal tape measure and calipers, according to the length of the part being measured. The fret positions were measured at each end of the frets, from the edge of the nut to the centre of the fret using a caliper, and were measured to the nearest 0.05 of a millimetre. As the caliper could only take measurements up to 155 mm in length it was necessary to take higher fret measurements from other (already measured) frets. In all cases multiple measurements were taken to ensure the new "starting points" were accurately determined in relation to the nut. The position of the neck / fingerboard in relation from the body was calculated by triangulation.
The pegbox and head were detailed using rubbings, profile gauge curves, direct measurements and photographs. In particular the head was drawn by tracing photographs (in both cases digitally) which had been sized according to direct measurements taken from the instrument using calipers.
It was not possible to take any direct measurements of the interior of the instrument. Instead, these details come from an analysis of X-ray pictures (in the possession of the museum), and by a limited visual examination through the holes in the rose and the gap between the sides and back (discussed above). It is not possible to accurately determine the type of joint between the body and heel, not the end or depth of any soundbars.

All direct measurements of distances less than 155 mm were generally taken with a vernier caliper to the nearest one-tenth of a millimetre. Measurements up to 300 mm were taken with a metal ruler, generally to the nearest half-millimetre. Longer measurements were taken with a metal expanding tape measure, generally to the nearest half-millimetre. Measurements were taken in the examination room of the museum, the instrument being removed from its stable museum environment the morning of the examination.

The drawing was produced directly using a computer drawing program AutoCAD, using both the 2006 and 2007 versions. Rubbings taken from, and photographs of, the instrument were scanned and imported as picture files into the program and traced.

INSTRUMENT DETAILS

The **body** is, apart from the separation and concavity of the soundboard (both already mentioned) structurally sound, marred only by some repaired worm damage on the back. The soundboard is of a close quarter-sawn coniferwood, probably spruce, the sides are of walnut, and the back is of alternate staves of walnut and figured maple.
There is a fairly large difference between the soundboard and back profiles. To ensure that both profiles were correct profiles were taken at the midpoint of the sides which, as expected, essentially average out the soundboard and back. The difference between the soundboard and back can be seen in the side view of the drawing where the line between the bottom and bass side pieces is not vertical. This suggests that the sides were bent and assembled freehand (similar to the method employed in traditional Spanish classical guitar construction), rather than using a form of some type around which the sides are held in place.
Rather than provide a third "averaged" profile which would either make the drawing larger in overall size or more cluttered without having any particular benefit in practice (since it is unlikely that the profile at the middle of the sides is the one specifically intended by the original maker), only the top and back views have been illustrated.
As the body is intact it is impossible to get any accurate thickness measurements of the soundboard or back. The soundboard and back were measured at the sides and these have been included on the drawing, along with information about where those measurements were taken

from. The separation between the back and sides near the bottom has allowed measurements to be taken of the thickness of the sides, but the separation is not enough the allow calipers to get a clean measurement. The sides were measured in several places along the separated area with different results, so the quoted figures resrsent the extremes that were measured.
It was clear from the separation that the linings between the soundboard and the sides, and the back and the sides, were small individual triangular blocks. These have been indicated on the drawing. Although their size, and the space between them is typical of the instrument, their exact positions were not determined, and the illustrated lining are not indicative of the exact positions, but rather their typical arrangement and size.
The soundbars and upper block positions have been taken from the X-ray image. The image makes it difficult to determine the depth of any interior parts with any degree of accuracy so the soundbars are drawn in Section A without a bottom edge. The shape of the upper block is also open to some question. The X-ray images show no evidence of bars across the back of the instrument.

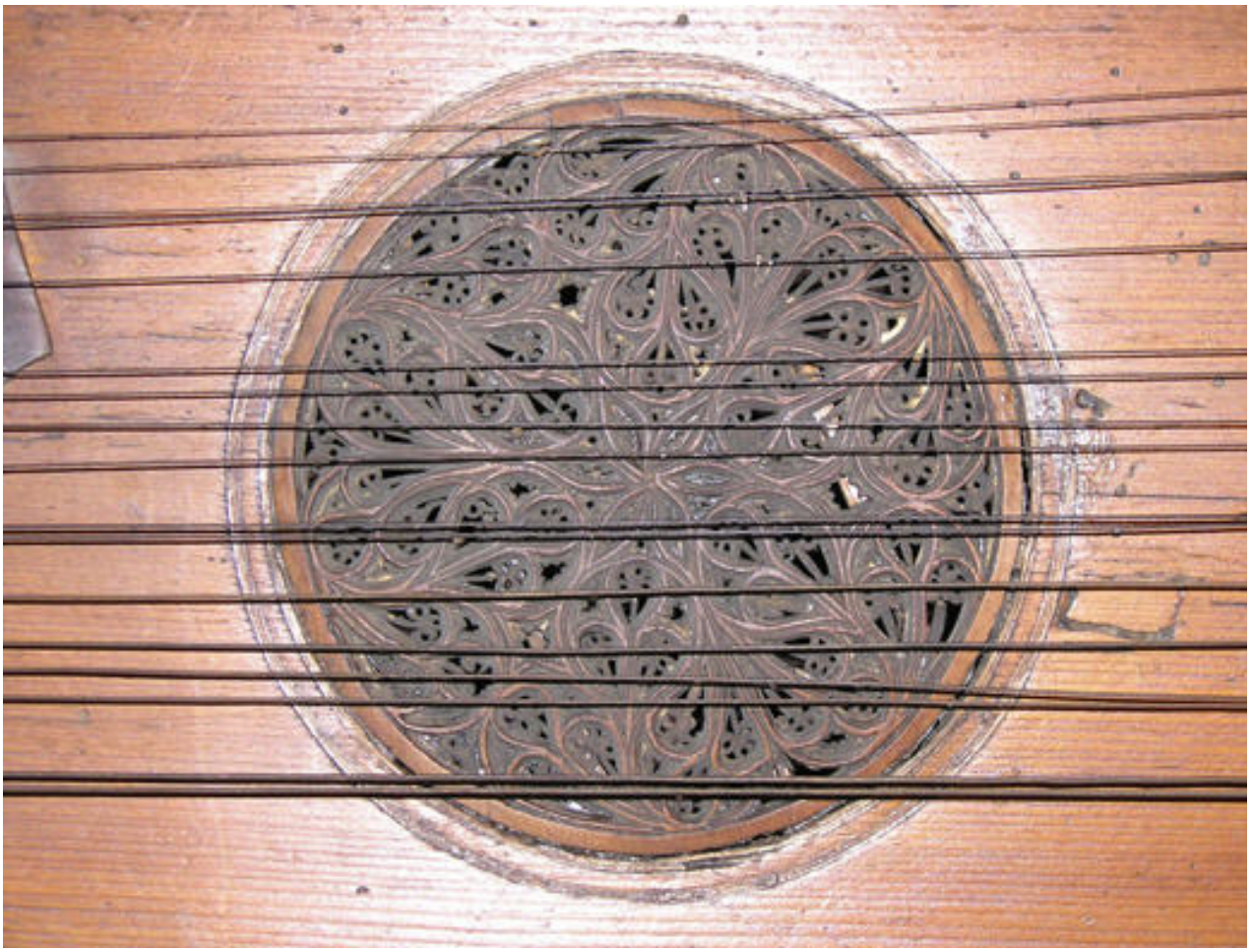
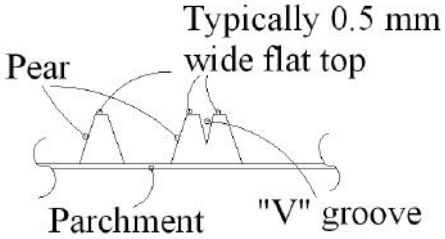


Photo : Darryl Martin

The above photograph has been reproduced at a 1:1 (full size) scale. The rose is made up of two layers - a thin parchment layer at the bottom, and a thicker (2 mm) layer of wood (pear) above. The layer of pear is cut in an inverted “V” or “W” shape, clearly visible in the above photograph. A section view of the parts is shown below.



The **purfling bands** on the soundboard, sides, back and fingerboard have not been drawn in full anywhere on the drawing so as to avoid cluttering it unnecessarily. With the exception of the lower part of the outside walnut staves all of the purfling bands appear in pairs (see the photograph of the back separation on page four for their typical appearance in pairs and the exception). Each purfling band is made of three equal-thickness strips. In each case the outer strips are of a contrasting wood to the piece into which it is inlaid, so the soundboard bands are walnut/maple/walnut, whereas the purfling bands on the sides, back and fingerboard are maple/walnut/maple. The depth of the bands cannot be determined. To avoid clutter on the drawing only the outside edges of the bands are drawn in all instances. The width of all of the bands is typically 1.7 mm, each strip being slightly less that 0.6 mm.
As already discussed, the only part of the **bridge** that is original in the bass terminal. Its decoration can best be seen in the photograph on page three.

The **sides** of the instrument are of walnut, decorated only by pairs of purfling bands near the soundboard and back. Three pieces have been used - the bass, bottom and treble respectively. They were, as discussed above, probably assembled freehand. The depth of the sides (not including the soundboard or the back) has been included (where measured) on the back profile view of the drawing.

The **back** is of alternate staves of figured maple and walnut, arched slightly over both its length and width. The length arching is seen in the side view of the drawing, and the width arching is illustrated in Sections B to E of the drawing (at the top left corner). Please note that the rounding of the edges has not been included on the drawing, and that the width arching profiles are shorter than the full width of the back. There are seven staves in total, the central stave of maple. Only the walnut staves have decorative purfling bands. At some time plugs were added from the back into the endblock. These are visible in the photograph on page four, but not included in the drawing. The staves have been strengthened inside by strips of linen over the joints. These can be seen in Section A of the drawing.

The **neck** and **heel** are a single piece of maple. It cannot be determined how they are joined to the upper block. The neck has been reduced in width on the bass side so that there is only the fingerboard below the lowest two or three courses. The reduction in width at each end has been illustrated in the photographs below.

Photos : Darryl Martin

The **fingerboard** is of walnut, and is glued to the top of the neck and soundboard. It is tapered along its length. The slots for the frets and wedges were cut after the purfling bands were inlaid (although their positions were clearly calculated before as the bands stop at fret 12 (bass) and fret 15 (treble)). The slots for the frets and wedges stop short of the bass edge of the wrestplank, and there is an added capping piece of walnut glued to the treble side of the fingerboard. This ensures that neither end of the frets and wedges is exposed. As a result of this it is not possible

to determine the depth of either the fret or wedge materials, nor to accurately determine their shape below the fingerboard. The **frets** protrude by only approximately 0.3 mm above the top of the fingerboard, and the **wedges** are flush with the fingerboard top surface. The frets have not been drawn on the side view of the drawing, but a section view has been drawn (at 4x full size). The stopped ends, added capping on the treble side and colour-coded wedges can be seen below.

Photo : Ture Bergstrøm

The frets have been colour-coded according to whether they are "naturals" or "accidentals". Ebony has been used for the naturals, maple for the accidentals. These are listed on the drawing near the bottom left corner. The drawing also includes accurate measurements of the fret positions (measured to the centre of the frets), and these measurements should be used for reference rather than relying on the drawing which may be reproduced inconsistently.

The neck has been spliced to the **pegbox**. The pegbox is made of pear and is surmounted by a finely carved human head figure. The carving has been identified (by Michael Fleming) as the work of the carver responsible for several heads on viols by Henry Jaye (a London maker contemporary with Francis Palmer). It appears likely that the head was carved prior to the pegbox being glued to the neck. The spliced joint can be seen below:

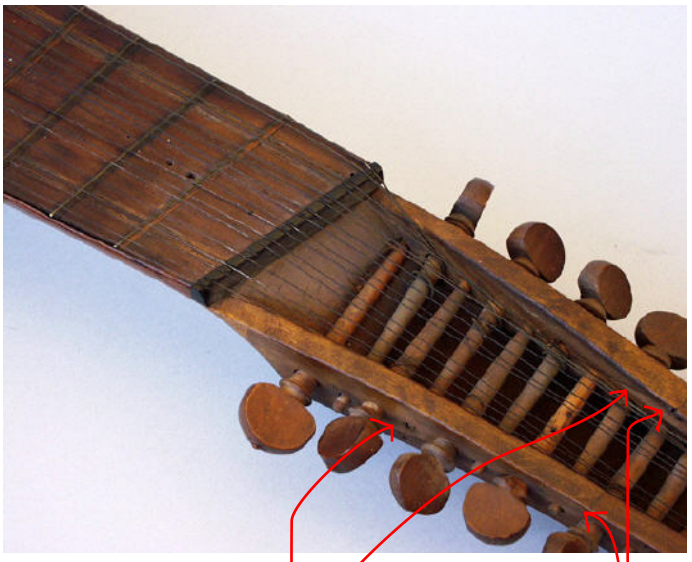


Photo : Ture Bergstrøm

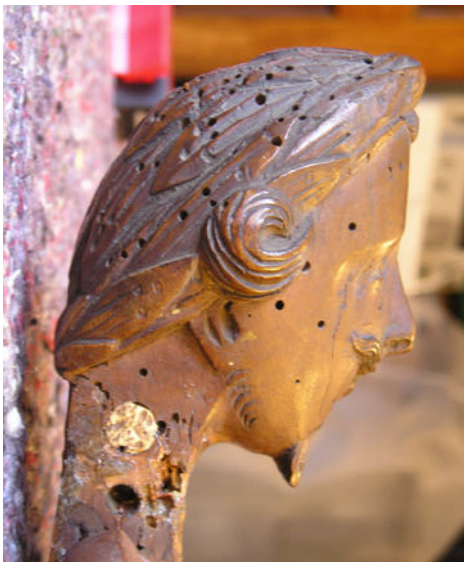
Joint seen at side of the pegbox

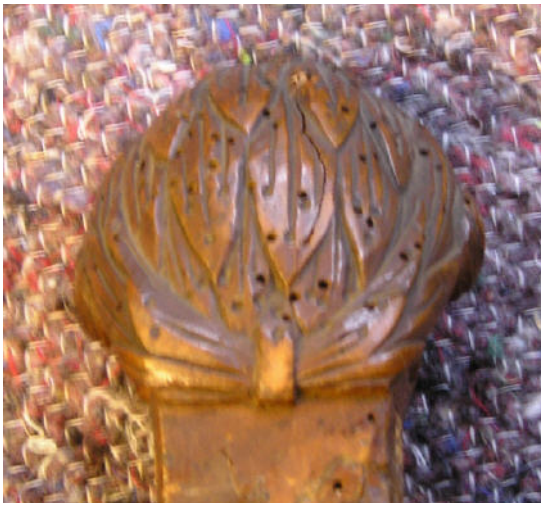
Top edge joint between neck and pegbox

The pegbox was probably hollowed out after it was spliced to the neck and after the **pegbox back inlay** position was cut (though almost certainly before the inlay was glued in position. The hollowing of the pegbox underneath the pegs is generally rough (although the sides are smooth, even if not of a consistent thickness), suggesting the head carving limited the access the the pegbox.
The pegbox back inlay thickness is 2.3 mm, determined as the upper surface is exposed at the fingerboard end of the pegbox. The rear of the pegbox, showing the pegbox back inlay (towards the head) is illustrated below.

Photo : Darryl Martin

The **head** carving is illustrated below from several different angles.





Photos : Darryl Martin