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FoMRHI Quarterly

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Christopher Goodwin 2

COMMUNICATIONS

2090	How I build a cittern, part 5: odds and ending	Peter Forrester	3
2091	Making woodwind instruments: 10.3 The baroque oboe: some history	Jan Bouterse	9
2092	Supplement on baroque oboes	Jan Bouterse	25
2093	3D printed conical crook for a baroque bass racket	Ton Pel	43
2094	Castanets in mediaeval Sephardic manuscript illustrations	Laia Paleo & Chris Goodwin	50

The next issue, Quarterly 143, will appear in September. Please send in Comms and announcements to the address below, to arrive by 1st September

Fellowship of Makers and Researchers of Historical Instruments

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This is the second issue of the 2018 subscription year (numbers 141-144). You will find a subscription form herewith if you have not yet paid for 2018; a number of people have already paid in advance. Those who have not paid yet for this year will get this issue as PDF only, **to receive the printed copy, please renew now; if you do not renew shortly you will not receive anything more from us.**

Many thanks once again to contributors to this issue, which includes the latest instalments of Peter Forrester's series on cittern building (the conclusion in fact) and Jan Bouterse's series on making baroque woodwinds. We also welcome contributions from new contributors, Ton Pel and Laia Paleo.

In fact we already have enough contributions, wanting only light editing, for the next issue, on baroque winds, loaded lute strings and the nyckelharpa, so the next Q will certainly be out on time – but of course we would welcome further Comms too.

Welcome to new members

We welcome new members this quarter: Ton Pel (a new contributor!), and Jurn Buisman of the Geelvinck Museum Museum,

Bass racket – appeal for sharing of information

I am in the process of building a baroque bass racket. I would appreciate contact with members who own and/or play such instrument, or who know details about its construction. Of course I am willing to share the information I have.

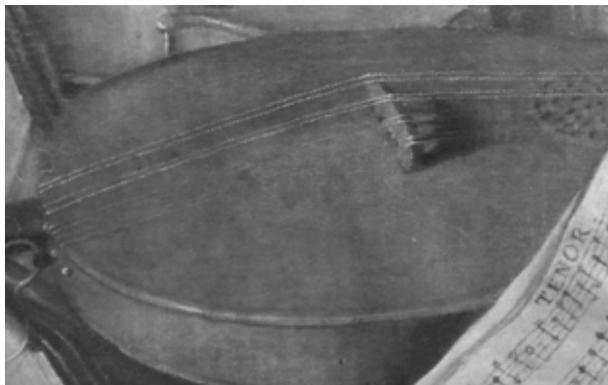
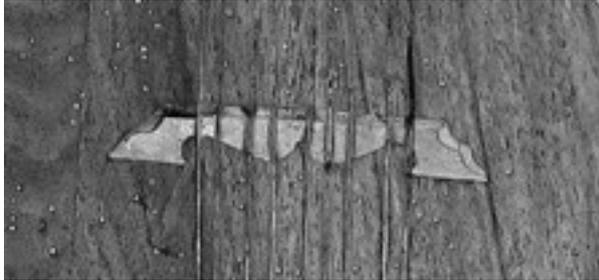
Ton Pel e. ton_pel@hotmail.com

Kenneth Mobbs

Readers will be saddened to hear of the passing of Kenneth Mobbs, a historic keyboard expert, and member of the fellowship of many years standing.

How I Build a Cittern, part 5 - Odds and Ending.

Some ideas for bridges.



1568 Eglantine table; 18th c. French?;

c. 1690 Edwart Collier; 20th c. Pakistan;

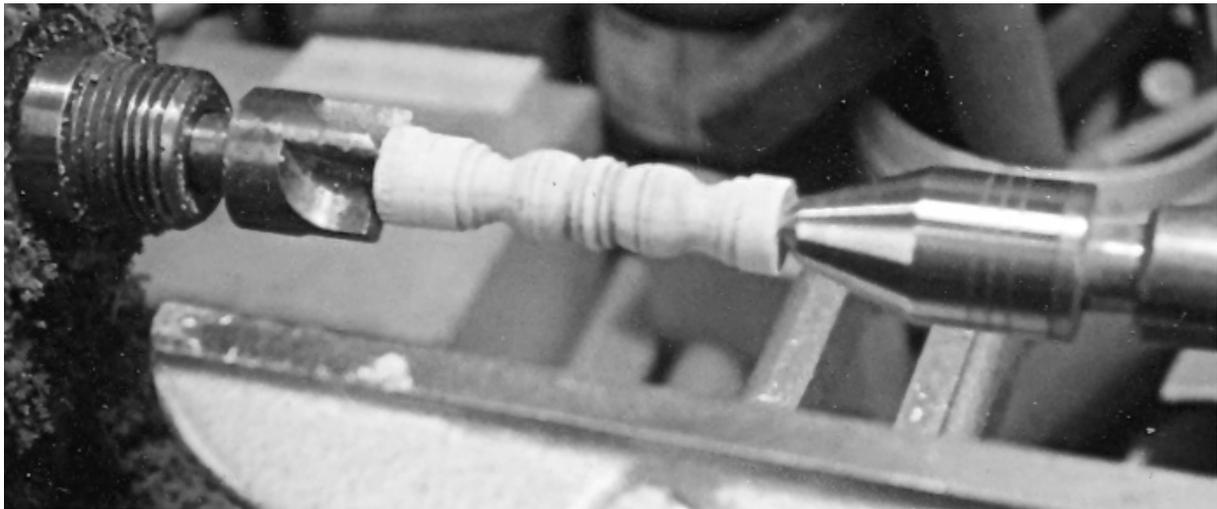
c. 1670 Frans Mieris

More, similar, examples of the two extremes can be found on The Renaissance Cittern Site, cittern.theaterofmusic.com/ and on Google. There seems not to be any historical development - the earliest and latest cittern bridges above being very alike. They are transmitters of sound, so should be as light as is possible, compatible with solidity and firmness.



The joint between the sides and the neck-block will need to be covered by a 'split-baluster' turning. These are made by glueing two layers of thin paper between pieces of wood, and turning an ornamental length which exactly matches the height required. This is then split apart - which is where two layers of paper prove better than one - and glued over the joint. Some fiddling will probably be necessary! Disks cut from a dowel, very slightly narrower than the baluster, will cover the joint at the

belly and back as necessary. Originals are frequently carved to simple floral shapes or concentric rings. Making more than are needed will allow better matching for the



belly and back pairs. Those on the belly will need trimming to fit against the finger-board.

Most unaltered citterns have carved heads, the exceptions being the large traditional Italian citterns which use elaborated scrolls. The quality varies considerably. The female heads on the RCM Campi, and the Tilman in Berlin are crude and appear to have been finished with a modelling material (gesso?) before being painted. Other ornament on both instruments is elaborate and well-finished. It is of course possible to use a specialist carver. Pepys' viol had a carver who was paid separately - one seventh of the total cost. Palmer's orpharion has a head very similar to another maker's viol, again suggesting a separate carver. Animal, especially imaginary, and ugly or amusing heads are considerably easier than beauty. Several of my own citterns still carry heads first modelled in Plasticene by my six-year old son. Fairgrounds and ship's figureheads are better sources than art galleries. Some originals, and especially those seen in Dutch paintings, have heads very vertical to the neck, which may cause problems when fitting a case. If a Kingham-type case is going to be needed, it is better that the head should lean further back. Refer to the drawing of the side view of the mould in Part 1. Relative to the 'datum line', the front of the head will need to be not much higher than the level of the top of the bridge.



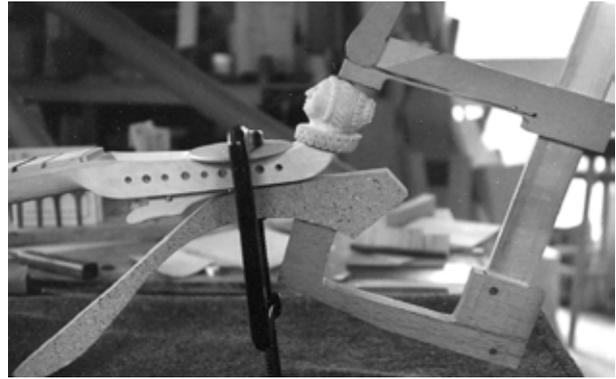
Asked to make a unicorn's head for a tenor cittern, I was lucky enough to find a photo of that from HMS Unicorn. The wood rectangle in the right-hand photo represents the boundaries for the outline of the finished head. The larger plasticene model was the first attempt where I learnt something of the shape of horses as seen in lumps of wood. This was slightly too large and not as compact as I wanted. The smaller was chosen and the unfinished carving is seen in the left-hand photo. One constriction was that the head had to dip forward a little so that the horn would eventually fit inside the instrument case. During carving a screw holds the head to a support in a vice, and the screw-hole will be used for a dowel between the head and the peg-box. A metal dowel is visible on an x-ray of one of the Virchi citterns in Paris. Alternatives to carving are beheading a doll, or a resin casting from the plasticene model. Many are painted, the best-known being Archduke Ferdinand's Virchi in Vienna.



Painted resin, and a photo of a suitable angle to fit inside a case.



Ingenuity, Heath Robinson and the dowel will aid clamping during gluing.



A ruff is a useful visual connection between the carving and the working parts of the cittern. In the case of the unicorn, it was necessary to fair the head into the peg-box so some of the carving was left until after gluing. Usually I've not found this necessary. The bone horn was glued in after the varnish was finished and polished. In the case of the jester above, the painted decoration on the head was done after the first clear coats of varnish, but before the colour coats, using a water-based paint which remains unaffected by the oil-based varnish. The heads shown are all of lime, which is very kind to cuts against the grain, and light-weight. Pear will accept more detail but is harder to cut.



Before varnishing I use two coats of glue size, the first very well rubbed down, the second less so. As there is always a risk of opening glue joints with hot size, I use it cold, as a jelly, applied with scrap foam plastic. Citterns are varnished all over, making them difficult to handle. A dowel through the peg-holes of a hanging instrument is one

possibility. Because the inside of my peg-boxes are painted, this, the top surface of the frets and the saddle - which will be scraped off later - are available for handling. I use my own oil-varnish, two pale coats, around six colour coats, two top coats. There are awkward corners so the varnish is applied one area at a time, quickly and unevenly with a brush, then evened-out with by dabbing with a cut (to get into corners) piece of foam. (Cennino Cennini describes this, although using a piece of sponge, on panel paintings.) Another, dry, piece of foam is used meanwhile to remove surplus varnish especially where two areas meet. An order of working is necessary, mine starts at the head as far as the nearest or next peg-hole, which is where I shall finish and is most likely to show the join. If the join is moved up and down a little with successive coats it should disappear into any flame in the wood. Now holding the instrument by the neck, this is followed by the fingerboard from the 11th or 12th fret to the end, the adjacent top and around the rose to cover the belly - this may be in two parts depending on how quickly the varnish is solidifying, the block and sides, where a joint with the neck may be necessary, the back, the remainder of the fingerboard and neck up to the first peg-hole, then, with fingers inside the pegbox, the pegbox. With the fingers of the other hand against the saddle, the cittern can rest on its fret surface under UV or sunshine, being reversed when the back is hard. Variations are possible, though limited!

Dutch paintings of citterns generally show more expensive instruments than the one above. Almost invariably the sides are striped and we do not know how they were made. Those that I have made were almost certainly made 'wrongly'. My first one was taken as far as the 'ready for block, bars, side supports stage' with the sides finished shaping to receive the belly. The shape of the sides was copied onto a card template. This was laid out flat and divided into three equal stripes. (These are quite complex curves.) A copy was made and saved. The upper stripe was cut away, and another template copied from the lower two which were then also separated. The templates were then used to transfer the tripartite division to the wood which was then unglued from the back. The woods used in this case were sycamore and ebony,



so required lines of white sycamore and black-stained sycamore to be inserted. The central segment was to be replaced with ebony, so was waste. The lowest was cut from the whole and re-glued to the back. It was found impossible to bend lines to fit, so they were glued to this upper surface in sections of ordinary veneer. (Black dye from sycamore veneer can stain adjacent surfaces so needs sizing with very weak glue beforehand.) A central stripe of ebony was made from the templates, bent, and glued in place. Checked, and reduced against the template of the two lower stripes. Second layer of lines added. Top stripe glued in place and matched to the original template of the sides. This stripe was now too narrow by the width of the lines, but this was unnoticeable when the belly thickness was added. There was some trimming necessary and the whole process seemed unnecessarily long. However the templates were used successfully again for another 5 or 6 similar instruments using ebony or plum for the darker wood. Their repeated use became much quicker. The cittern in Brussels, on which my copies are based, also has striped edging to the belly. It is desirable that there should be a similar number of diamonds on treble and bass sides and essential that they should match at the neck-block and saddle. A couple of extra slots in the mitre block help.

A number of drawings have been published by museums. None are ideal models although all have useful information. Obtainability varies, so is best found on-line.

Ashmolean Museum.

Gasparo da Salo. Originally probably five course. Useful for showing barring. The fingerboard and frets are completely replaced. one piece back

Anon. (Virchi?) Italian. 6 course. Too large for the English repertoire. Fretting altered to ET.

Anon. Probably Michael Bochum, Cologne c. 1720. 4 course, 3-piece back. Late.

Vermillion NMM.

Petrus Rautta? English or German, perhaps 1679. Treble-sized, 4 double courses. Ugly and obviously replaced comb. Otherwise a good model for Playford's gittern. With an extra peg for an octaved 3rd course, it could be used for the more difficult music in Robinson and Holborne, but would be at the wrong pitch for most Consort Lesson ensembles today. (Though not all...)

V&A, London.

Urbino cittern. 1582. A large carved-out instrument, so not really relevant here. The drawing describes it as four course, but it is actually for six.

Royal College of Music, London.

Campi c. 1600. A smaller carved-out instrument, so again not really relevant.

Sebastián Núñez has made drawings both of the remains of two excavated Dutch citterns, and of his reconstruction. Good but needs barring as described in these articles.

Leipzig Grassi museum.

Drawings of four citterns (1594) played by angels in the Freiburger Dom. Rustic and incomplete.

Making woodwind instruments

10.3 The baroque oboe: some history

Section 10.1 (in Comm. 2077) was an introduction to the chapter of double reed instruments. I wrote that I had some luck with my first copy of a baroque oboe, which I made in the early 1980s. Since then, I have made perhaps no more than 10 oboes, experimenting with techniques and with the aim of trying to understand its secrets. I am by no means an experienced maker of this type of woodwind instrument and I can play it only in a very restricted way. But I had the privilege of investigating many historical oboes and discussing the results with professional makers and players. It is in that light that you must see the information in these chapters: some history, some theory (about the acoustics of the oboe) but also a bit of basic practical information, which I hope will be useful for beginner instrument makers. Perhaps my strongest advice for them is: do your own research and carry out experiments. Also important: widen your view, try to become a good player yourself; be in touch with other instrument makers and players.

For this chapter I have compiled a supplement with drawings, tables with measurements and colour photos of eight interesting baroque oboes. Seven of them are historical instruments by Robbert Wijne, Hendrik Richters (2), Richard Haka, Coenraad Rijkkel, Jan Steenbergen and Jacob Denner. The other one is a baroque oboe as it was made for fifty years, designed in the Moeck factory by Otto Steinkopf. This 20-page supplement is printed as the following Comm, but can also be requested as a hi-res file by email to the secretary of Fomrhi.

Several people gave me kindly their support when I asked them for their advice. My thanks go to Piet Dhont (Utrecht), Lucas van Helsdingen (Amsterdam), Jem Berry (England), Mary Kirkpatrick (USA) and finally, but sadly, posthumously: Bruce Haynes who wrote such fine books (such as *The Eloquent Oboe, A History of the Hautboy from 1640 to 1760*) and gave me his advice when I was working on my dissertation and the catalogues for the Gemeentemuseum in The Hague.

The oboe is for me perhaps the greatest invention within the new group of woodwinds (nowadays called 'baroque instruments') which were developed in France in the course of the 17th century. The oboe became an orchestral instrument, the sound perfectly blending with string instruments. But the oboe could also be used as solo instrument or in wind ensembles. The oboe became popular outside France and often kept its French name (hautbois, hautboy with several variations) in the languages of other countries.

I became interested in these instruments when I started my research into Dutch woodwinds. Over 90 oboes, made by at least 15 Dutch *fluytenmakers* (as they called themselves) between c.1670 and 1770 are preserved in collections all over the world. The challenge for me was to find the connections between these oboes: the resemblances and differences between them. And then the difficult question about the acoustical consequences of those differences.

That research implied: measuring the oboes and assessing the data. But also: playing them, where ever that was permitted and possible (depending on the condition of the instrument). The problem of such playing tests however is that the outcome always has very much a subjective element, and that is even stronger on oboes because of the great influence of such a highly personal item as the reed (with the staple) on the results.

It is possible to reduce that subjective character in two ways: one instrument can be evaluated by a group of players, or one player compares the properties of several instruments. And that is what we did with the oboes in the Gemeentemuseum, with interesting results. There were differences between the instruments in pitch, attack and sound. There were also all sorts of variations in bore profile, placing and shape of the tone holes and other aspects (luxuriously made oboes versus cheaper ones).

How to explain those differences and variations? Thinking about this, I realised that the answers are leading us to the heart of instrument making, and making music.

These are my considerations:

- The makers had their own ideas how an oboe should sound.

But how good were those makers as players themselves? Most *fluytenmakers* produced all types of instruments: recorders, traversos, oboes and even bassoons. It is hard to believe that they were individually expert players on all those instruments.

- The makers adapted their instruments to the wishes of the players.

Here is a problem: we do not know much about those wishes, we can often only deduce from the music which was composed for the instruments (and from some contemporary reports) how good the players were. But were they just as critical about their instruments and did they have the same detailed wish-lists for their makers as many professional players have today?

- We must not forget that although many (but what percentage?) woodwind makers learned the trade as pupil in the workshops of other makers, they had to (re)discover the secrets of the oboe when they started for themselves, designing and making reamers and so on.

That also applies to us. We all have to go through an important learning process which you can't get round: advice for every instrument maker, also in our modern times.

10.4 The choice: which oboe to copy?

Before you start building an oboe, you have to make a choice: which instruments are best for you to copy, what are their characteristics, qualities and faults. Where to find information? There are not so many publications (and I am afraid that they are hard to find) with measurements of historical oboes. One of them is from 1988, by Mary Kirkpatrick about the oboe collection of Michel Piguet, published as an appendix to an article 'Neun Oboen aus der Sammlung Michel Piguet', in the *Basler Jahrbuch für historische Musikpraxis* 12 (1988), p. 81-107. The other one is the *Niederländische Doppelrohrblattinstrumente des 17. und 18. Jahrhunderts - Dutch double reed instruments of the 17th and 18th centuries* by Rob van Acht, Jan Bouterse and Piet Dhont (Laaber Verlag, 1997). But furthermore you must find drawings in the webshops of some museums or perhaps via the websites of some instrument makers.

What you also must know:

It is not easy to assess the pitch of historical oboes: no original reeds and staples have survived from before c.1770; the oboe is in addition a flexible instrument: the same oboe can be played up to 50 Cents (or even more) lower or higher with another reed. Unlike recorders and traversos you can't estimate the pitch of a baroque oboe so easily from the concept of 'sounding length': not only because of the uncertainty at the upper end (the length of missing reed and staple), but also because at the bell the pitch of fundamental (c1) depends more on the size of the tuning holes than of the physical length of the bell. Even more so: the c1 is not the most reliable tone as starting point for tuning the oboe, as it sounds often a bit sharp, on some early baroque oboes so sharp that you can even manage to play the tone c#.

Piet Dhont told me that for an oboe in a-415 Hz, the distance from the top of the instrument to the third fingerhole should be *c.*203 mm, or to the distance the hole of the great key should be about 410 mm. I myself think that it is easier to play a shorter oboe with a longer staple and reed in a lower pitch than forcing a longer oboe into a higher pitch.

What you also must realise is that the baroque oboe is nowadays played in way that is different from the past, concerning for instance the finishing of the reeds, and some fingerings. I will discuss this later on, but it is good the read the article 'Oboe Fingering Charts, 1695-1816' by Bruce Haynes. It is published in the *The Galpin Society Journal*, Vol. 31 (May, 1978), pp. 68-93, but you can find it on internet (<https://www.jstor.org/stable/841191>).

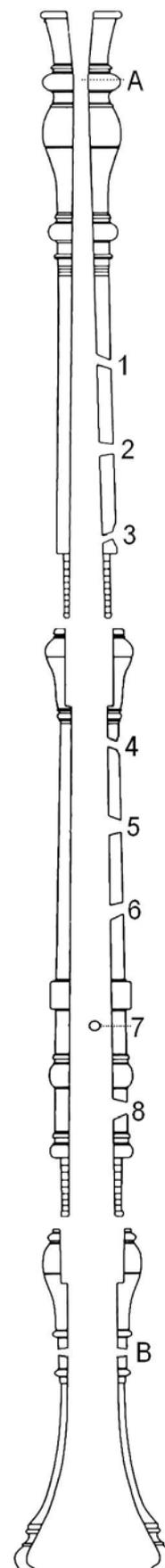
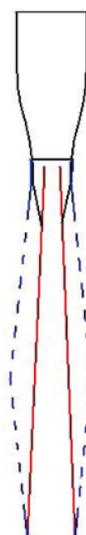
10.5 The baroque oboe: parts and construction

The baroque oboe is made in three sections: head, middle joint, and bell. These parts are connected by tenon-and-socket joints. The oboe is played with a so-called double reed which is fixed to a brass staple, see the picture below. That staple with the reed is inserted in the counter bore at the top of the head. The bore of the head has it smallest diameter, on most descants (the common oboe in c), of about Ø 6 mm in the 'passage' just after the counter bore (at 'A' in the drawing). From there the bore widens gradually to about 11 mm at the lower end of the head. In the middle joint the bore widens further to about 16 or 17 mm at its lower end. On most oboes there is a clear and visible leap in the bore profile between middle joint and bell: the bore of the bell begins wider (between 18 and 20 mm): from the socket to the tuning or resonance holes (B in the drawing) or a



Holes 3 and 4 on an oboe by Steenbergen.

little after them, the bore widens only slightly conically, thereafter broadly following the profile of the surface of the bell flare until the widest point, the top of the inner convexity behind the bell lip where on Dutch oboes the widest diameter of the bore is often *c.*45 mm or more. There are three fingerholes on the head, two of them single (1 and 2) and no. 3 with two small holes. On the middle joint there are three more fingerholes (4, 5 and 6), of which hole 4 is on many oboes double with two small holes. These holes are used to avoid fork fingerings for notes such as f# and g#. To enable players to feel the double tone-holes and close them properly, makers cut tone-hole covers. The construction of most baroque oboes is such that they can be played with either the left or right hand below. This not only means that the tone-holes are aligned in a straight line, but also that there are paired





small or e-flat keys (7) and that the great or c-key (8) is symmetrical, with a touch on the left and the right.

Left: the two small keys are closing both holes 7 when they are not used. The great key is made in two parts and leaves hole 8 open when it is not used.

Two more holes are drilled in the flank of the bell; they are generally called 'resonance holes'. But 'tuning holes' is also correct as they are used to tune the fundamental, the c1 (C4 in modern or American notation) on the 'descant oboe' (which term is hardly used by players, you will find it in encyclopedias and museum catalogues). A fifth lower and much rarer than the baroque oboe in C is the tenor oboe in F; be aware that modern oboes in F are called *altos*, which is rather confusing. A special type of the tenor is the *oboe da caccia*, with curved joints and often a widely flare lower part of the bell, made of brass.

Between the descant in C and the tenor in F is the *oboe d'amore* in A. This instrument has a short bell, without resonance holes but with a lip which only leaves a small opening. Special chisels (such as the 'swan neck hollowing tool' in the catalogue of Robert Sorby) must be used to turn the bore behind this bell opening.



To the photo: this bell in the Bate Collection in Oxford is the only surviving part of an oboe d'amore by Johannes van de Knikker, a woodwind and clock maker from Tilburg (second half of the 18th century).

10.6 Making a baroque oboe: drilling, reaming, turning, the keys

Making the parts of a baroque oboe is not too difficult for people who have some experience in making recorders or traversos. The basic rules are the same:

- 1- use pieces of wood with some overlength and a bit thicker than the maximum diameter
- 2- drill pilot holes through the wood
- 3- drill, ream or turn the bore profiles and the sockets
- 4- turn the exterior of each part
- 5- drill (but a bit too small) the fingerholes and key holes
- 6- make the keys, cut the key channels and drill the axle holes for the keys
- 7- tuning the instrument (therefore you must have a good reed and an appropriate staple, which will be discussed later)

There is of course some other work to do: oiling the wood, finishing the exterior, attaching thread or cork to the tenons.

There are two points which need special attention: the bore of the head and the question of how to turn the bore of the bell. As the bore of the head is very narrow at the passage (between 5.5 and 6.5 mm, on later oboes even narrower, you have to make a narrow pilot hole.

But drilling such holes in a long (c. 250 mm) piece of wood is not easy. Often a thin drill of such a length does not go straight enough, making a curved hole, and that destroys the wood. I prefer making a pilot hole in sections: with diameter 10, 8 and 6 (or 5) mm. I have made some d-bit drills (see chapter 7.2 in FoMRHI Comm. 2060), which work fine as long as you are not forcing them too hard into the wood. Gun drills are of course the best solution for making long and narrow holes in wood. But you need then some special equipment, as you have to use compressed air.

Making reamers for the head is another point to which you have to give great care. Because the bore profile is so narrow, small deviations of the reamer may cause severe problems. In the bore of a bell there is no problem if you are 0.2 mm or so inaccurate. But in the head you have to be much more precise as reaming 0.2 mm too wide results in deviations up to 3%.



The retired oboe player Piet Dhont made his own instruments. For the head joints of one of his oboes he used a set of 5 reamers, all made of long flat bit drills (photo above). He ground these drills in a conical shape. These reamers are self-centering in a pilot hole, I don't think that the drill points were used for making that hole. The advantage of such a set of reamers is that you can make some bore corrections, for instance when you want to have one section in the bore a little wider. Such bore corrections, or even complete bore profiles, can also be made with adjustable metal reamers, which I have from 6.0 mm upwards (see under 8.6 in FoMRHI Comm. 2060 how to use them).

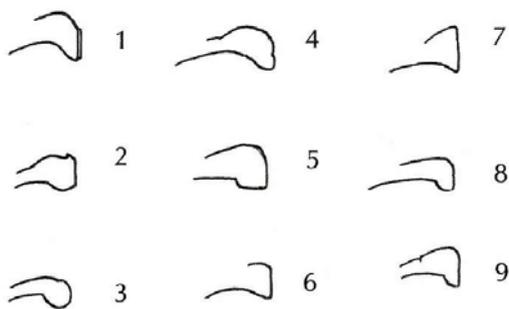
I have made for my oboe heads a few reamers in one part, turned from a steel rod (see 8.4 in the same FoMRHI Comm.) or from a flat piece of steel (see 8.5). It is wise to check the bore that is made with a reamer on another piece of wood before you do it on your oboe joint.

The middle part of a baroque oboe can be made with the same types of reamers (and sometimes even with the same reamers) as for alto recorders or traversos. But be always be sure that you make the socket at the upper end at first: the bottom ledge of that socket is the point which is also the end position of the reamers which is put in from the lower end.

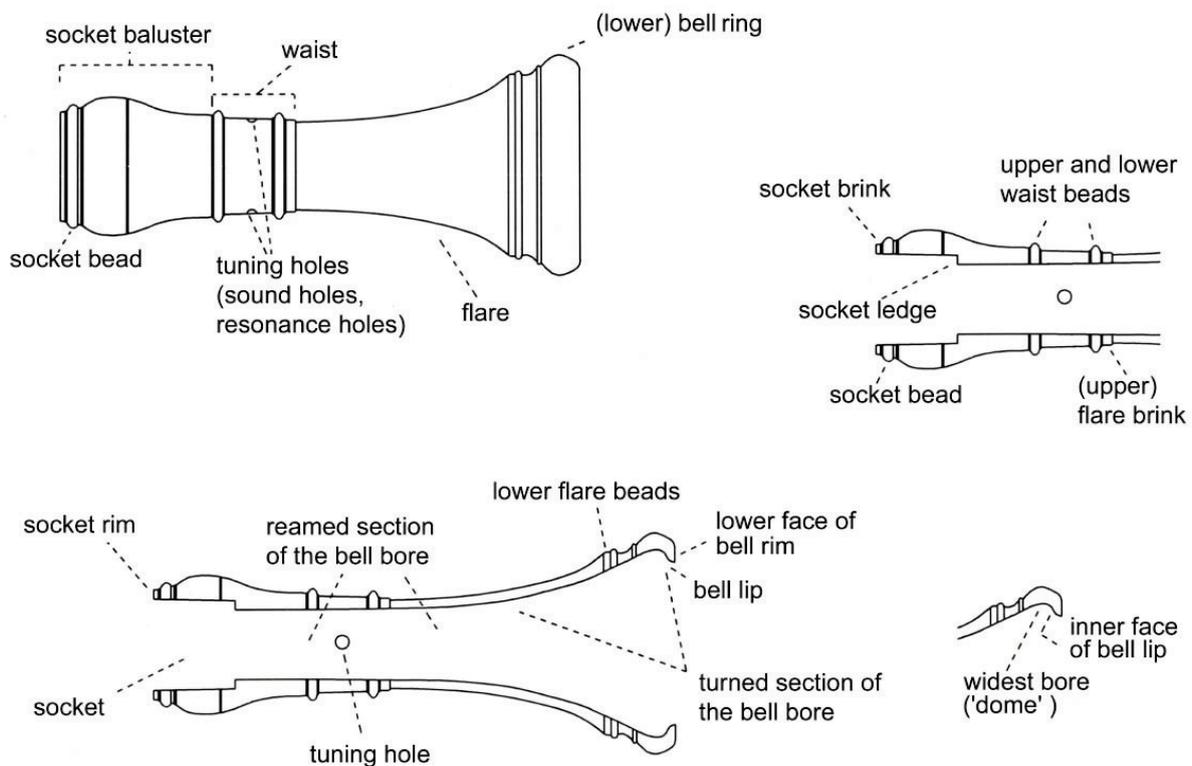
There is an identical situation at the bell end: the socket must be made from the upper end, the rest of the bore from the lower end. When you are doing the job on a lathe (using a

lunette, see the pictures in section 6a in FoMRHI Comm. 2056), it means that you have to change the position (left and right) of the wood. A point for attention: centering the wood must be done with great care. And that might sometimes be difficult. At first you must turn the wood perfectly round with the pilote hole exactly in the centre. The following step is fitting the round piece in a lunette with a minimum of play. But the wheels or contact points of the lunette (and the chuck at the other end) may cut traces in the wood - and that can have a disturbing effect. And after changing the position of the wood, you have to do it all again.

The bore of the bell is executed with two techniques: reaming out the upper part, where the bore is only slightly conical, and reaming the flaring lower part. There are special chisels to turn behind the bell lip, but I have simply ground a piece of steel in the desired shape. The inner side of the bell lips can have all types of profiles (see sketches below). They are acoustically perhaps not very important, but why not try to copy the original profile?

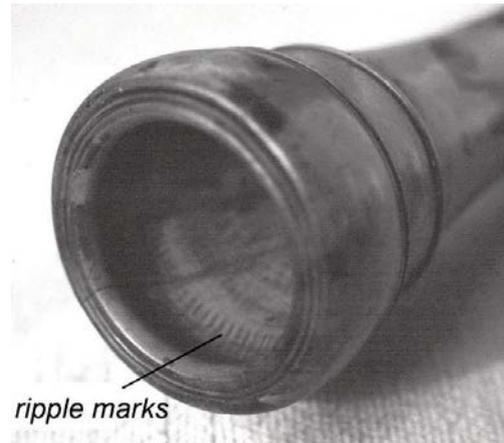


It is clear that for all the work on the bell you must have a good lathe, where you can mount a chuck and a lunette. I have been thinking about making a bell without the help of a lunette (for instance with a separately turned lower bell ring to avoid reaming behind the bell lip). But I am afraid that such a strategy does not really make the work easier.



I made these drawings for my dissertation. A problem: I had to invent some technical terms in my native language (Dutch) and translate them into English. I am not sure whether these terms are used by other (native English-speaking) instrument makers.

There is always some distance between the tool rest and the place where the chisel (or whatever you are using) is cutting the wood. Together with the mounting of the wood in the lunette some instability can occur, resulting in vibration chatter or ripple marks, as I have seen on one of the finest instruments, a particular interesting oboe by Robbert Wijne (see photo).



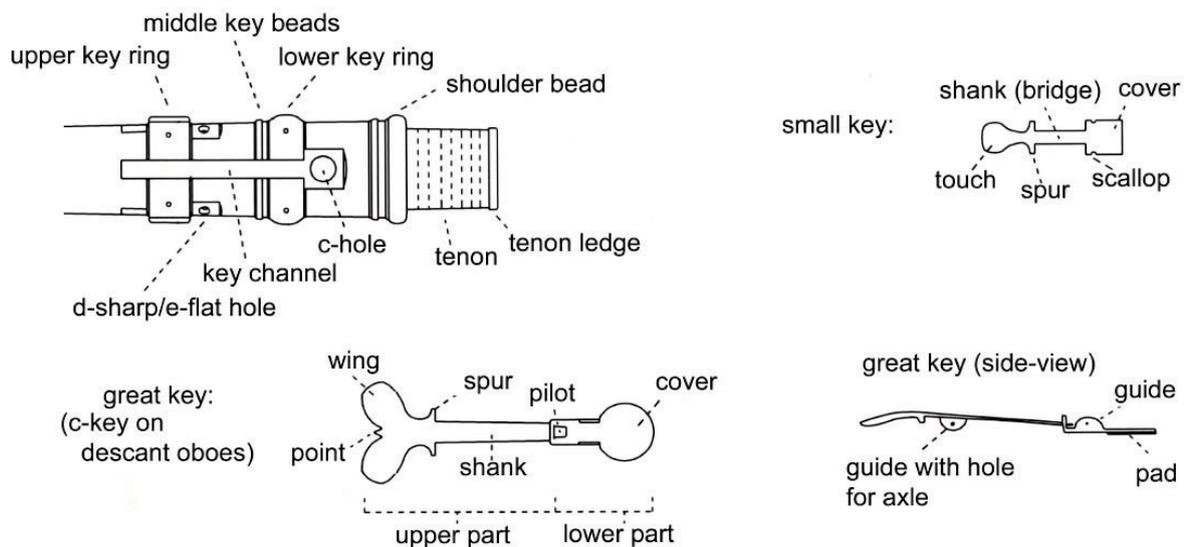
On another instrument, it was apparent that the maker in question (Jan Steenberg) had to solve problems because the bell had not been centered correctly: the bore profile in the lower part was slanted, causing an irregular thickness of the wall of the flare. Steenberg solved the problem by gouging out some wood by hand (Museum of Musical Instruments, Brussels, Inv. No. 2611).

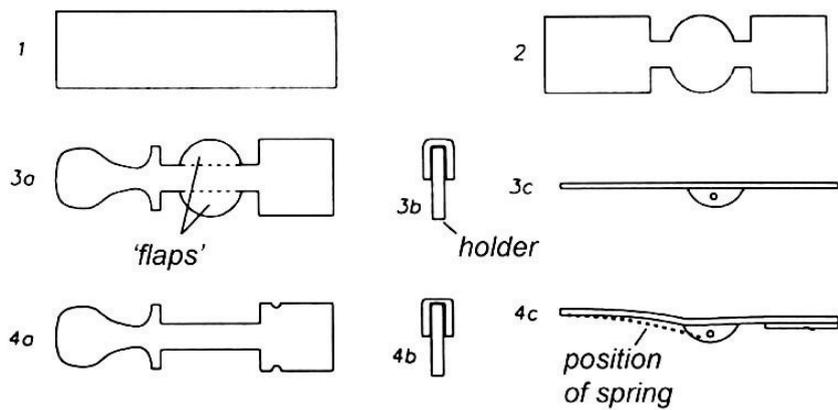
After finishing the interior of the bell, you must make two plugs: one for the socket, and one which fits nicely in the lower bore. Make sure that you can remove those plugs easily! Turning the exterior of the bell is rarely a problem, but you must be accurate so that the wall of the wood in the flare is not becoming too thin. I have seen an old oboe (I can't remember by which maker) where the wall of the flare was so thin that you could see light shining through.

10.7 Making a baroque oboe: the keys

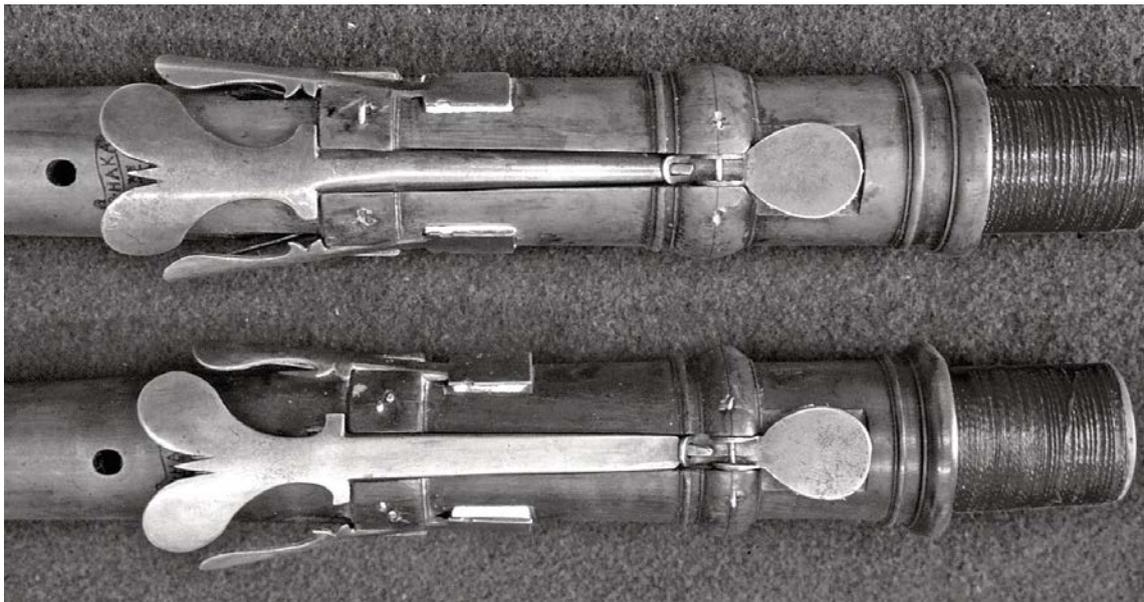
The small key on the oboe works in the same way as the key on a baroque traverso: see the information in section 9.15 in FoMRHI Comm. 2074.

The great key is made in two parts, the connection between the parts is quite simple: the pilot of the upper part goes through a hole in the upper part: see drawing below. Other constructions are possible, but are not often seen on original baroque oboes.





I make my keys mainly from brass, between 1.0 and 1.5 mm thick. Using a fine saw, hammer and files. The guides or flaps must be bent over a metal holder and then hammered and filed in the desired shape. See instructions on the drawing.



It is interesting to see the difference in the construction of the shanks of the great keys of the two tenor oboes by Haka (photo above) in the collection of the Verein der Musikfreunde in Wien (Vienna, where it is not allowed to measure the instruments any more). On the lower one, the shank is hammered straight (in cross section), on the upper one the shank has a curved cross section. There are some more differences between the instruments. Both are made in boxwood but one of them has a widely flaring bell in fruit wood, where the other one has a much less flaring boxwood bell.



This photo is from the oboe by Engelbert Terton in the Smithsonian Institution, Washington DC - USA. It shows the very deep key channels (it takes some courage to cut them out so far) and how the springs are inserted in the channels. Positioning them so far in reduces the risk of breaking: they bend less sharply when the key is pressed.



Hendrik Richters, famous for his luxuriously made instruments, often drilled blind axle holes. That means that you can't push the axle back from the other side. That causes problems, as can be seen on the photo above (one of the Richters oboes in the Gemeentemuseum in Den Haag, inv. no. Ea 284-1933), where also the axles have become so short that in attempts to remove them, the wood is damaged around the opening of the axle holes.

This photo is from a boxwood oboe by Hendrik Richters in the Bate collection in Oxford (Inventory number: 2040). The upper part of the C-key is probably not original, likewise the key axles with their untypical long hooks. I think that these axles were also a bit too thick and forced into the blind-drilled holes; that is likely the reason that at the lower key ring a piece of wood is broken out.



10.8 The preparations for voicing and tuning: the staple

Voicing means: optimising the sound and playing qualities. Tuning: bringing all tones to their desired pitch. Voicing and tuning are very much correlated on an oboe: making a hole (which you have initially drilled a bit too small) bigger or wider by undercutting changes not only the pitch but also the sound of a note.

But the first task is making or finding a good reed and an appropriate staple. There are three methods for combining reed and staple: 1- Attaching the reed to the staple (as in the picture in section 10.5); 2- Using a multipiece staple; that consists of an upper section made from a cut-off modern oboe d'amore or modern alto oboe staple (on which the reed is tied) combined with one or more conical brass tubes which fit into the oboe. Bruce Haynes writes: this telescoping staple is especially useful for experimenting with different types of staple, or for trying out a new instrument when one is unsure of the type of staple it needs. The reed, of course, effectively remains the same for various 'different' staples (in the article 'Baroque oboe reedmaking', see www.idrs.org/publications/controlled/DR/DR2.1/baroque.html (the quality of the pictures is rather low)); 3- the bassoon method: making a reed that is tied on its own wood and can be put on one or more several (long) staples (see picture next page).



1: reed tied on a long staple; total length 78, length of staple 58 mm;

2: multipiece staple with a reed tied on a short upper staple which is put on the lower staple; total length of combination 74.5 mm;

3: reed (for a bassoon or larger size of oboe) tied on its own wood.

It is obvious that for the combinations 1- and 2- you must have a staple before you can make a reed. Bruce Haynes gives useful information in the same article. He writes: *'Staple making from brass stock is time consuming, especially if one is experimenting with designs and cannot re-use old staples, but the possibilities which it opens for control of intonation, response, and tone will repay the effort. Because the modern staple is more or less standardized (as is the modern oboe compared to earlier ones), the art of staple design has nearly been lost to us. Rediscovering it is perhaps the longest and most complicated aspect of baroque reed making, and certainly one where much experimentation is still needed'*.

Haynes wrote these lines in 1976. Nowadays you can order for only a few euros complete staples in several lengths for baroque oboes (Chiarugi is one of the providers).

See for instance on www.oboe-shop.de (also in English) under 'staples'. Example: one of the staples I bought has a length of 60 mm, widest diameter (inside) 5.5 mm, at the (flattened) top 2 x 3.5 mm, the brass is 0.5 mm thick. Some other staples are a bit shorter.

Making a staple yourself means that some calculations have to be carried out first; then cut out accurately the shape on a flat piece of thin (0.4 or 0.5 mm thick) brass. Then you must fold the brass (after annealing) around a mandrel. Bruce Haynes describes the process in detail in his article 'Baroque oboe reedmaking'. He doesn't mention soldering the seam, and you can do it without that.

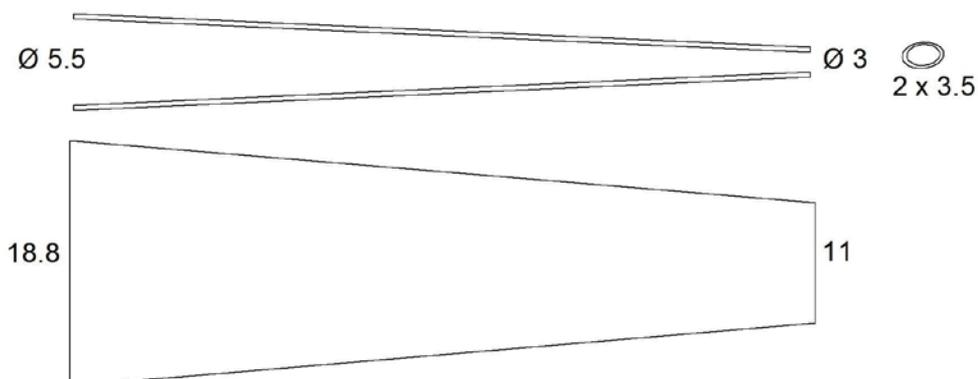


Diagram of a staple with internal diameters from 5.5 to 3 (flattened to 2 x 3.5) and a piece of brass, 0.5 mm thick. Calculations: $5.5 + 0.5 = 6$ and 6×3.14 (pi) = 18.8. In the same way: $3 + 0.5 = 3.5$ and $3.5 \times 3.14 = 11$ mm.



Some tools for making reeds, with a knife and a self-made mandrel.

About the mandrels: these tools can also be bought (together with the staples). My problem is that on the websites no dimensions are given (only length, not diameters). I have made a few mandrels myself, on a metal lathe. But that is because of the small diameters not an easy job. The advantage is that you can make mandrels with a different conus.

From the article by Bruce Haynes:

1. Cut out a piece of brass with metal cutters (scissors) to the calculated dimensions. Cutting should be accurate to within .1 mm tolerance. A file can be used after cutting to help touch up the dimensions.

2. Anneal (soften) the piece of brass by making it red-hot and then cooling it immediately in water. This can be done by holding the brass with pliers over a flame, such as that of a kitchen stove. When the brass is annealed but still flat, scribe horizontal lines in it from side to side with an old knife, which will later help to keep the thread and cane in place.

3. Make an initial bend down the middle (lengthwise) of the annealed piece of brass by pressing it into a groove with a mandrel. Then bend it roughly around the mandrel with your fingers. (The brass should be soft enough so this is quite easy.)

4. Avoid any rough hammering of the staple, so that the bore will be as smooth as possible when finished. Tap it along the seam so that it forms a butt-joint but does not overlap. Use a wooden or plastic hammer, on a wooden surface. Even this small amount of hammering will "work-harden" the brass sufficiently. The bottom of the staple must be perfectly round when finished, in order to fit exactly into the oboe bore.

5. File both ends of the staple straight (i.e. at right angles to the axis of the staple). File the bottom rim of the staple at about 45 degr., so that there are no sharp corners to damage the oboe bore when the staple is inserted.

6. Tightly wrap the staple with beeswaxed linen or cotton thread of about .15 mm. thickness, beginning near the top but leaving room to tie on the reed, and progressing nearly to the bottom. Be sure the seam closes completely over its entire length. Before wrapping, the staple should be inserted into the oboe to determine if it extends far enough into the bore, if it does not, check (1) if it is absolutely round, (2) if it closes completely at the seam, and (3) if the dimensions are still accurate.

7. Continue to wrap the staple with thread so that it forms an airtight seal when inserted into the oboe. This is critical. Regularly check, while wrapping, to be sure that the staple remains projecting the proper length out of the oboe.

8. Flatten the upper end of the staple with pliers as desired. In the interests of avoiding leaks, put the seam on one of the flat sides so that the cane will seal it when it is tied to the staple.

Bruce Haynes gives in his article also ample information about the effects of the length and the conicity of the staple, and how far the staple must be put into the bore of the oboe. He writes: *to avoid leaking, the bottom of the staple should come as close as possible to the oboe bore walls. (Leaking is a major problem on the baroque oboe, and is the main cause of squeaking. If the staple is too short, it creates turbulence in the bore just below the reed, the direct result of which is squeaking on the middle d2', e-flat2, and e2.)*

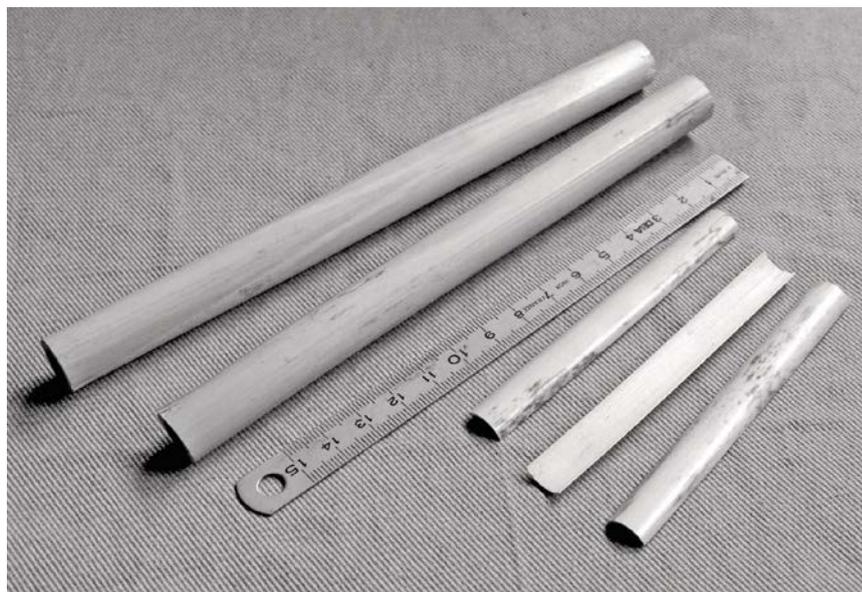
The top diameter of the staple affects the response of the extremes of high and low registers: generally, for low notes the bigger the better; for high notes vice-versa. For an average baroque oboe, the range lies between about 2.4 and 3.2 mm. Since the top end of the staple is usually somewhat flattened, it should be kept in mind that the flatter the final opening, the wider the original round diameter can be, as the area of the opening becomes smaller as it flattens (to the extreme of completely flat and no area), and it is this area which is significant to us. The last active variable, exposed length, determines the basic pitch of the reed. To control this variable, one must of course maintain a constant basic shape, approximate cane thickness, and scrape. The further the staple is exposed, the lower the pitch; 30-40 mm is average. Generally a mm or two more or less in the length of the staple has little effect, although this same difference in the length of the cane itself is quite noticeable. See the original article for more important information!

10.9 The preparations for voicing and tuning: the reed

Reeds for baroque oboes which are ready to use can be bought nowadays from several providers via the internet. It is better to go yourself with your oboe to the maker of the reeds, or visit a music festival where instrument makers exhibit their products.

But many players make their own reeds. I refer again to the publication of Bruce Haynes (<https://www.idrs.org/publications/controlled/DR/DR2.1/baroque.html>): it obtains more or less all information you need.

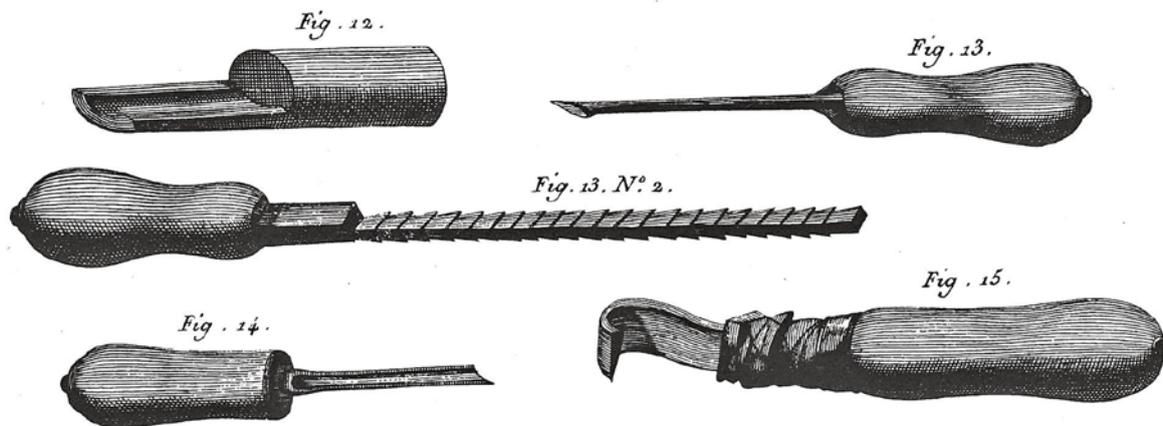
The cane used on modern woodwinds comes from the plant *Arundo donax*, which grows in countries around the Mediterranean and Asia. Haynes says that it is difficult to imagine using any other reed material on an instrument as sensitive in its reed as the oboe has always been. But I am told that in Central America maize leaf is used for reeds of folk instruments. And perhaps other plants might be suitable as well for our oboe reeds.



Left: two pieces of cane, and three of those ready-gauged pieces which I bought in a music shop.

There are two ways to begin: buying canes with a diameter of 14 to 15 mm, which must be split lengthwise in four with a knife. The pieces are much too thick and must - after being soaked in water - be gouged (at the inner side) to the desired dimensions. That gouging

is a science about which I can't tell you much. The other way is buying ready-gouged unshaped English horn (= modern alto oboe in F) cane, which has just the right dimensions for a descant baroque oboe.

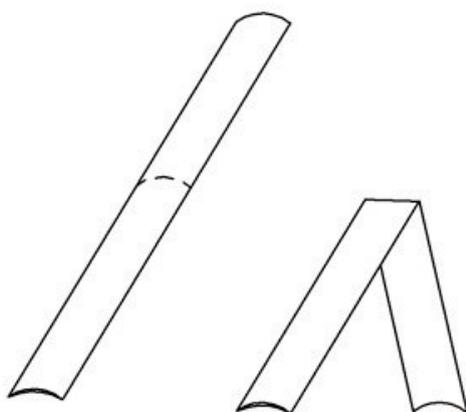


From the Encyclopédie by Diderot & D'Alembert, plate X. Fig. 12 is the wooden bed with the blind end for supporting the reed when it is gouged with some of the other tools.

Professional players use sophisticated machines and tools for gouging the canes. Again Bruce Haynes: *Reeds were probably gouged by hand in the baroque period, as many oboists in Holland and other countries continued to do until recently. This involves using either a tool similar to those shown in Diderot's and Garnier's plates, or a hand-carving gouge (a kind of round-bladed chisel) with the ground (sharpened) side on the bottom, and a diameter approximately equal to that of the cane used. Gouges for hand-carving work better than the similar but more heavily built ones used with a hammer.)*

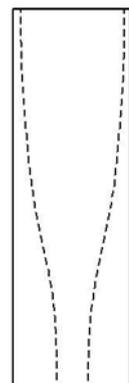
During the gouging process, the cane is supported by a wooden bed of somewhat larger diameter than the cane, about 110 mm. long, with a blind end toward which one gouges. In order to keep both hands free, the bed can be clamped to a table. In gouging, try to make a continuous cut from one end of the cane to the other, in order to keep a consistent thickness. The gouging tool should be kept quite sharp. Leave more wood in the middle than on the sides, so that the cane has a slight crescent shape when seen from the end. So far from the article by Bruce Haynes.

Back to some more basic information:



The next step is shown here (work with damp reeds only!): cut a small groove and bend it carefully (diagram left).

Cut the reed - which is now double - in the right shape (diagram right).



Now it is time to attach it, airtight, to the staple. Then follows the hard work: scraping, at both sides (front and back) of the reed and symmetrical (left and right). How the scaping is done can be seen on some videos: www.youtube.com/watch?v=83CAPfjwaOU shows how to make a reed for a modern oboe, but the information (no spoken text) is also very useful for baroque reeds. On www.youtube.com/watch?v=JfLBDmT3THc&list=RDJfLBDmT3THc&t=13 you can see how Giuseppe Nalin shows the long process of making a baroque oboe reed, but without any explanations.

Harry Vas Dias wrote an article 'Making reeds for the baroque oboe' for *Tibia*; it is in English on internet (www.idrs.org/publications/controlled/Journal/JNL9/making.html) with useful information, but the photos are of a terrible quality.

From that article: *There are, however, many different ways of scraping a reed, many of them good. A knowledgeable teacher can be of great help, but do not be afraid to experiment on your own. The experience gained can help be very rewarding. The way any one person's reeds are finished is greatly influenced by their "embouchure" and manner of blowing on the oboe, and varies to a certain extent, Blowing on baroque oboe should be much less forceful than on modern oboe. Good reed making, and especially the finishing stages, can best be learned by experiencing the changes in response that occur as one gradually scrapes the reed to its final dimensions.*

One of the difficulties in scraping reeds is that you can't measure exactly how thin a good reed must be. It also depends on the quality of the cane: softer cane must be left a bit thicker. Shining a light through the reed gives useful information about the shape of the scraped areas.

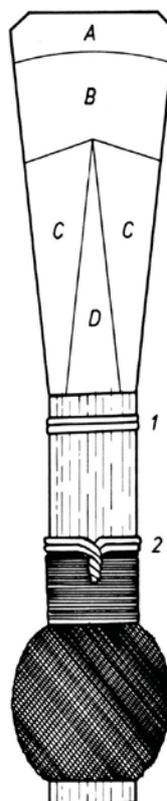
A = response and staccato. Scraping produces an easier response; cutting off the tip produces a harder response.

B = response in the middle register. Scraping makes response easier.

C = response in the low register. Scraping makes response easier.

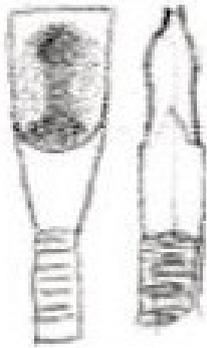
D = response in the low register and source of elasticity in the entire reed. Scrape here only if the reed does not "speak".

There are many possible ways of scraping and of adjusting the clamps, and one must experiment with care. Except in zone A, one can remove a considerable amount of wood without damaging the reed. Always scrape left and right and on both parts of the reed. In every instance, be sure to examine the reed for irregularities and humps. Before scraping in the middle, ascertain that both sides are already thin enough.



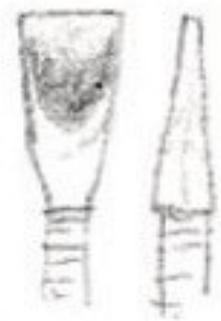
I found this drawing in my archives, but could not find where it comes from; maybe from a publication by Moeck (Germany). It seems to me that it is not especially describing the reed for a baroque oboe. But the remarks about the zones make sense and might be helpful to understand how a reed works.

The properties of the finished reed very much determine the sound and other acoustical qualities of the baroque oboe. But which type of sound do we prefer? There has been (and still is) some discussion about the way that reeds were scraped in the past, and how it is done in recent times. Piet Dhont wrote a letter (in English) about this discussion, which is published on internet: see www.barokensembledeswaen.nl/html/rieten.html (I do not know for how long this website will be active, so don't wait too long before downloading this important article).



What is going on? Piet Dhont writes: *Holding a modern oboe reed in front of a lamp, you will see a figure like this (left) and right the profile. This figure varies from player to player, but all reeds have in common a very thin tip (as thin as possible) followed by a thicker section (called the 'heart'). This seems to be essential to all modern oboe reeds. The method of scraping however is relatively new (from about the 1950's).*

In older days the scrape was made in a more straightforward way, without a heart and with a slightly thicker tip (figures right).



Piet Dhont then says that baroque oboe players nowadays mostly use the modern American way of scraping. This because the modern tone ideal is a dark, velvet, focused sound. The old schools of scraping produce a much brighter, thinner tone. Piet ends: on old recorders like Furtwängler, Toscanini and Mengelberg you can hear this bright, (vibrato less) style of oboe playing.

Lucas van Helsdingen (player and maker of baroque oboes) told me that he makes his reeds now in the old way. These reeds has the advantage that they last longer, even up to a year.

For some final remarks I return to Bruce Haynes, who compares the baroque oboe with the modern instruments. *The differences in reeds are naturally a reflection of differences in instruments. The baroque oboe is considerably larger in overall dimensions than the modern oboe; the bore is much wider, usually 1.5 to 2 mm. and the pitch is lower, usually one half tone or more. To accommodate this bore, the staple and reed must be proportionally wider. A wide reed tends to play low notes more easily, helps the response of the cross fingered notes like the b-flat, g# and f#, causes less squeaking, and has a generally rounder and sweeter tone. Beyond a width of 10 mm, however, the high notes stop responding.*

The size and shape of the tone holes is also quite different. On the baroque oboe, these are much smaller and proportionally longer. This causes a greater resistance in the general response of the instrument, so that reeds must be scraped softer and freer. The resistance that the modern oboist often consciously creates in his reed, for the sake of tone quality, is automatically built into the early oboe. Softer reeds allow more of the dynamic nuance and tonal range demanded by baroque music.

For a number of reasons, frustratingly little was written by contemporaries about early reeds. In no case is there any information on scraping or finishing, and what little is said about dimensions is not to be trusted unquestioningly. Pictures are our best early source, although oboe reeds hardly form important parts of compositions, and are consequently rarely depicted in detail. Our best key to reconstructing early reeds, though sometimes misleading, remains the practical and empirical experiments each player makes with his reed in one hand and his knife in the other.

Supplement on baroque oboes - March 2018

This supplement contains plans with drawings, tables with measurements, drawings, descriptions and photos which I have made of a selection of historical baroque descant oboes. This supplement is compiled as an addition to my series of articles about making double reed instruments and will be available, also as a digital file, distributed exclusively to members of FoMRHI.

The measurements and other data presented here are surely far from complete; I collected them not so much for making copies of the instruments, but for scientific reasons: for comparing the main characteristics. Also: I can't give guarantees that all information is 100% accurate, errors may have occurred.

The instruments presented in this supplement:

- Robbert Wijne, boxwood oboe (private collection)
- Hendrik Richters, boxwood oboe (private collection)
- Hendrik Richters, boxwood oboe (Drents Museum, Assen)
- J. Denner, boxwood oboe (private collection)
- Jan Steenbergen, ebony oboe (private collection)
- Richard Haka, boxwood oboe (private collection)
- Coenraad Rijkel, short oboe in fruit wood (Boers Collection, Rijksmuseum Amsterdam)
- Moeck-Steinkopf: oboe a-440 Hz in fruit wood (collection Jan Bouterse)

See for other drawings with measurements (by Mary Kirkpatrick) of baroque oboes the article with supplement 'Neun Oboen aus der Sammlung Michel Piguet' (*Nine oboes from the collection of Michel Piguet*), in the *Basler Jahrbuch für historischer Musikpraxis* 12 (1988), p. 81-107.

See also the catalogue *Niederländische Doppelrohrblattinstrumente des 17. und 18. Jahrhunderts - Dutch double reed instruments of the 17th and 18th centuries* by Rob van Acht, Jan Bouterse and Piet Dhont (Laaber Verlag, 1997).

The oboe by Robbert Wijne

Robbert (or Robert) Wijne was one of the few Dutch woodwind makers who didn't live and work in Amsterdam. Robbert was born in 1698 in Nijmegen, a town close to the border with Germany and died there in 1774. We don't know where he learned instrument making, his father Hendrik Wijne (or Wyne) was probably a locksmith.

I became interested in Wijne because in the first years of my activities as woodwind maker I found some instruments (traversos) on which his name was stamped. Also in that time I received information about an oboe, found at an excavation site (probably in Amsersfoort) and heavily restored by violin maker Joost van der Grinten. He turned off substantial pieces of the head and middle joint and replaced these with new boxwood 'skins' (the shaded parts on the drawing): a very risky operation! It is a pity that I have not seen pictures of the instrument before its restoration: the workshop of Van der Grinten had been flooded, resulting in the loss of his archive. The oboe is now in a private collection, the owner plays it regularly, despite the restoration (also with several glued cracks in the bell).

The Wijne oboe is made of boxwood which is stained brown in tortoiseshell imitation (nicely reproduced by Van der Grinten), with brass keys. The turned profiles are quite different from the oboes by the Amsterdam makers. I believe that it is a rather late instrument by Wijne, the fourth hole which is single is also an indication. The oboe is perfect playable at a-415 Hz.

Another oboe by Robbert Wijne was recently discovered and is now in a private collection in England. This instrument has a different appearance made (with more traditionally turned profiles and a double 4th fingerhole). A tenor oboe by Wijne is in the collection of the Gemeentemuseum in Den Haag.

About the measurements: I have a set of bore diameters made by Piet Dhont and some additional bore measurements by me. As they are not very detailed, I also give some bore measurements of my copy. All measurements in millimeters, L = Length, SL = sounding length (is length without the tenon); W = width, Øext = diameter exterior.

head (upper joint, I): L 234.5; SL 212.7; tenon: L 21.8

fingerholes (L from lower shoulder to centre of hole; ØWxL; Øext-max):

hole 1-	75.5	2.8	19.0
hole 2-	43.9	3.3	19.8
hole 3l/r-	10.6	2.2	20.9

bore (Ø, Lmax, from lower end - after measurements by Piet Dhont):

11.0- 0; 10.5- 31; 10.0- 47; 9.5- 62; 9.0- 86; 8.5- 100; 8.0- 117; 7.5- 139; 7.0- 156;
6.75- 162; 6.5- 167; 6.25- 171; 6.0- 175; 5.75- -> (through)

counter bore from upper end:

8.2- 0; 8.0- 8; 7.5- 13; 7.0- 17.5; 6.5- 20; 6.0- 23; 5.75- ->

bore (Ø, Lmax, from lower end - after measurements by Jan Bouterse):

11.0- 0; 10.5- 39; 9.5- 58; 9.0- 75; 8.4- 87; 6.9- 169;

counter bore, from upper end:

6.2- 22; 6.0- 24; 5.9- exactly through

middle joint (II): L 237.55; SL 212.5; tenon to bell: L 25.0; socket to head: ca. 22, Ø ca 17.5

fingerholes (L from upper end to centre hole; ØWxL; Øext-max):

hole 4-	52.5	5.5	21.8
hole 5-	83.5	4.8	22.2
hole 6-	113	4.8	22.8
d#-hole(r)-	158.5	4.8	23.8
c-hole-	193	6.8	24.6

bore of middle joint (Ø, Lmax, from lower end):

15.5- 0; 15.2- 37; 15.0- 48; 14.6- 70; 14.0- 97; 13.7- 113; 13.3- 129; 13.0- 131;
12.7- 134; 12.6- 170; 12.4- 180; 12.0- 198; 11.8- 207; 11.7- ->

bell (III): L 149; socket: L 25.5, Ømax 24

two tuning holes at L 54; Ø ca. 4.5, Øext- 28

bore (Ø, Lmax, from lower end):

37.8/38.5 - 0; 44- 8.5; 35- 24; 30- 33; 26- 41; 22- 58; 20- 80; 19.0- 110; 18.5- ->

All fingerholes are drilled straight and are only little undercut.

Bore measurements on copy:

Head (I, from lower end, Ø-L): 5.95- just through; 6.0-196; 6.2-185; 6.4-180; 6.5-170;

6.8-164; 7.0-159; 7.2-153; 7.5-145; 7.8-140; 8.0-139; 8.2-127; 8.5-108; 8.8-101; 9.0-95; 9.2-91;
9.5-80; 9.8-66; 10.0-58; 10.2-53; 10.5-44; 10.8-18; 11.0-8; 11.5-4; 11.8-0

From upper end (counter bore): Ø 6.0-33; 6.2-28; 6.5-25

Middle joint (II, from lower end, Ø-L): 11-7- just through; 12.0-206; 12.4-195; 12.7- 172;

13.0-155; 13.3-140; 13.7-130; 14.0-120; 14.2-123; 14.5-95; 14.8-72; 15.0-70; 15.2-45; 15.5-35;
15.8-22; 16.0-12; 16.2-0

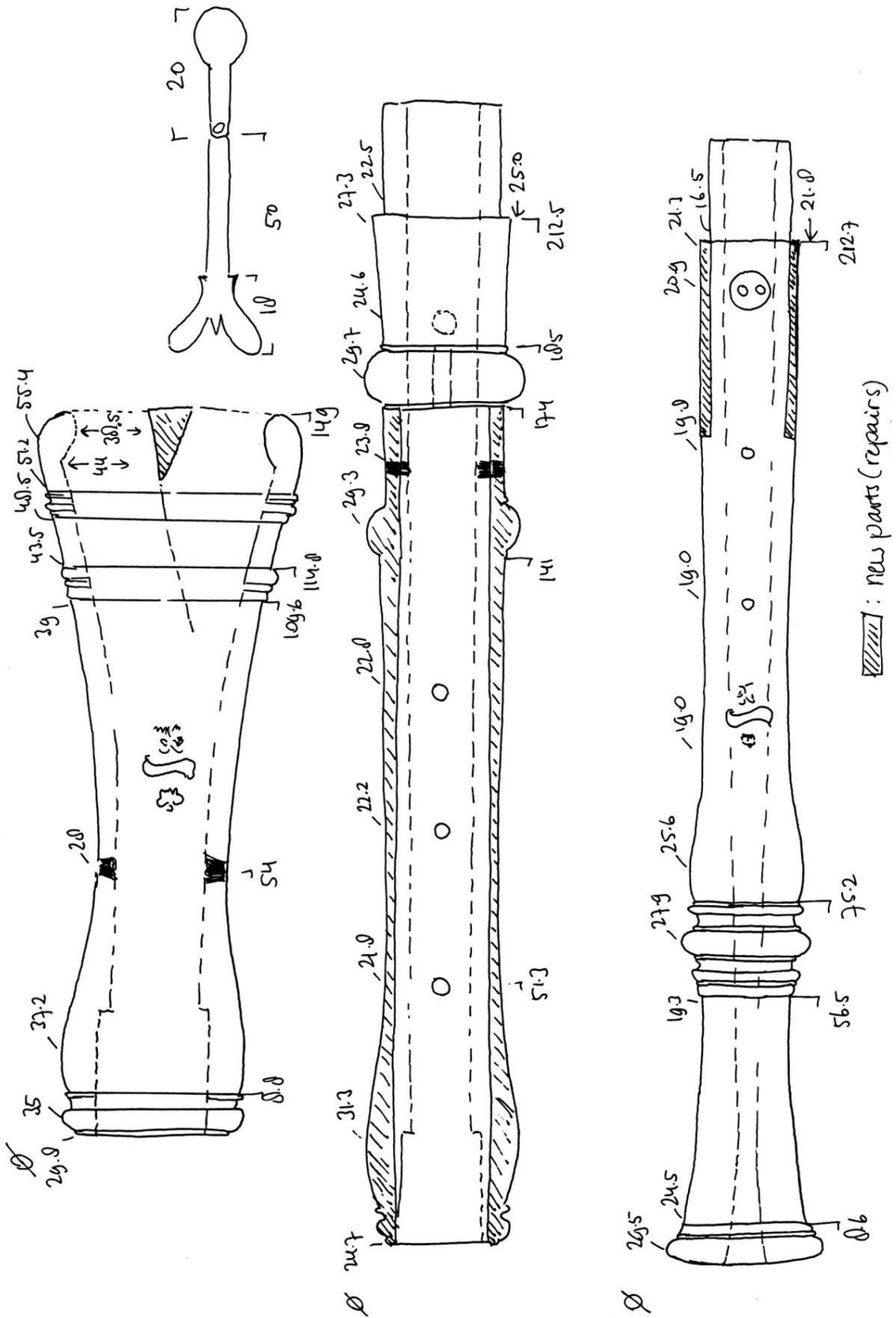
Bell: 18.4-through, 38.5 - opening at lower end.

The bore of the head and middle joint of the copy are in several places a bit wider than on the original oboe. I don't know why or how that happened (the copy is 30 years old), but the deviations are not too much and the instrument plays well. What I deliberately changed: making the 4th hole double (4a and 4b), two holes each 3.5 to 3.6 mm wide. Doing so, it gives the possibility to play f1# with two fingerings: 1 2 3 4 + 7 (small key) or 1 2 3 4a + 6 and 7.



The keys of the Wijnne oboe
Below: the baluster of the middle joint is a part of the new shell; it seems a bit too heavy.





Oboe by Robbert Wijne, private collection; measurements Piet Dhont and Jan Bouterse

A boxwood oboe by Hendrik Richters

This oboe was 1996 given on loan to the Gemeentemuseum in Den Haag, but came too late to be presented in the catalogue of Dutch double reed instruments. The present location is unknown (many instruments which were given on loan recently returned to the original owners).

The instrument is one of the few oboes by Richters which is not made in ebony. But what species of wood Richters has used here, is not certain. It is maybe boxwood, but the growth rings are rather wide and the colour is too brownish. The enigma: in an earlier colour photo the wood seems much paler, and maybe the brown colour is caused by an oil treatment (which was not done in the museum). It is clear that this oboe originally had some silver rings and bands, of which only one survived. That band fits around the bell rim, but so loosely that that might be an indication that the wood had shrunk rather much at that place.

A similar oboe, in boxwood with brass fittings, is preserved in the Drents Museum (Assen, Netherlands). Both instruments can easily be played at a-415 Hz.

The measurements

upper joint (I): Lmax 234; SL 211; tenon: L 23; Øext-max of lower shoulder: 21.2;

finger-holes (L from lower shoulder to centre of hole; ØWxL; Øext-max):

hole 1- 73.9; 3.0 x 3.1; 17.9

hole 2- 39.8; 3.4 x 3.6; 19.2

hole 3l- 6.8; 2.7 x 2.7; 20.5

hole 3r- 6.7; 2.7 x 2.9; 20.5

bore (Ø, Lmax, from lower end):

11.0/11.1- 0	10.8- 11	10.6- 17	10.4- 43	10.2- 51	10.0- 59
9.8- 67	9.6- 72	9.4- 80	9.2- 91	9.0- 96	8.8- 104
8.6- 110	8.4- 114	8.2- 120	8.0- 127	7.8- 129	7.6- 138
7.4- 143	7.2- 144	7.0- 150	6.8- 157	6.6- 166	6.4- 186/ ->

counter bore, from upper end:

8.3/8.4- 0	8.2- 12	7.7- 17	7.3- 23	6.7- 36	6.5- 45
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middle joint (II): Lmax 237; SL 210.5; socket: L 24.2, Ømax. 17.7; tenon: L 26.5

finger-holes (L from upper end to centre of hole; ØWxL; Øextmax):

hole 4l- 47.0; 3.5 x 3.8; 20.8

hole 4r- 47.1; 3.5 x 3.5; 20.8

hole 5- 82.7; 5.0 x 5.3; 21.9

hole 6- 115.2; 4.7 x 4.8; 23.3

L from shoulder:

d#-r- 51.9; ca. 4.5; 24.7

c-hole- 20.7; ca. 6.6 x 7.0; 25.6

bore (Ø, Lmax, from lower end):

16.1/16.2- 0	16.0- 9	15.8- 26	15.6- 76	15.4- 82	15.2- 86	15.0- 92
14.8- 101	14.6- 110	14.4- 115	14.2- 122	14.0- 127	13.8- 134	13.6- 139
13.4- 146	13.2- 150	13.0- 157	12.8- 163	12.6- 169	12.4- 175	12.2- 179
12.0- 186	11.8- 190	11.6- 199	11.4- 211	11.3- ->		

bell (III): Lmax 141.8; socket: L 27.3, Ømax 23.5; tuning holes at: L 53.4 and 53.6 from upper end, Ø 4.3 x 4.4 and 4.2 x 4.4, Øext 26.6;

bore (Ø, Lmax, from lower end):

39.6 x 40.5 - 0	ca 46 - 12				
40- 24	36- 31	32- 40	28- 51	26- 57	
24- 65	22- 72	21.0- 79	20.5- 84	20.0- 95	
19.6- 103	19.2- 108	19.1- just through			

Playing the Richters oboe

Piet Dhont has played the oboe by Hendrik Richters
Tuner at a=415 Hz, equal temperament, deviations in cents)

c1 -	1 2 3 4 5 6 8	+20 (but -5/0 possible)
c2 -	. 2 . 4 5	-5
c3 -	. 2 3 4 5	0/+5
c3 -	0/+5
c#2 -	. 2 3 4 5 6 8	-10/-15
c#3 -	1h 2 3 4 . . 8	0/+10
d1 -	1 2 3 4 5 6	-5/-10
d2 -	. 2 3 4 5 6	-5/0
d3 -	1h 2 3 . . .	c +10
d#1 -	1 2 3 4 5 6 7	-25/-30 (very flat)
d#2 -	1h 2 3 4 5 6 7	-20/-25 (also very flat)
e1 -	1 2 3 4 5 6	0/+5 (stable)
e2 -	1 2 3 4 5 6	+5/+10 (also stable)
f1 -	1 2 3 4 . 6	-5/0
f2 -	1 2 3 4 . 6	0/+5
f#1 -	1 2 3 4 . . 7	-15/-20
f#1 -	1 2 3 4h5 . 7	0/+5
f#2 -	1 2 3 4 . . 7	-20
f#2 -	1 2 3 . 5 6	-5/0
g1 -	1 2 3	-5/0
g2 -	1 2 3	-5/+5
g#1 -	1 2 3h	0/+5
g#2 -	1 2 3h	+30
g#2 -	1 2 . 4	+40
a1 -	1 2	-5/0
a2 -	1 2	0/+10
a#1 -	1 . 3	-5/-10 (good interval to b1)
a#2 -	1 . 3 4 5 6	0
a#2 -	1 2 . 4 5 6 7	-10/-15
b1 -	1	-15/-20
b2 -	1 . 3 4 5	0
b2 -	1	-5/+5



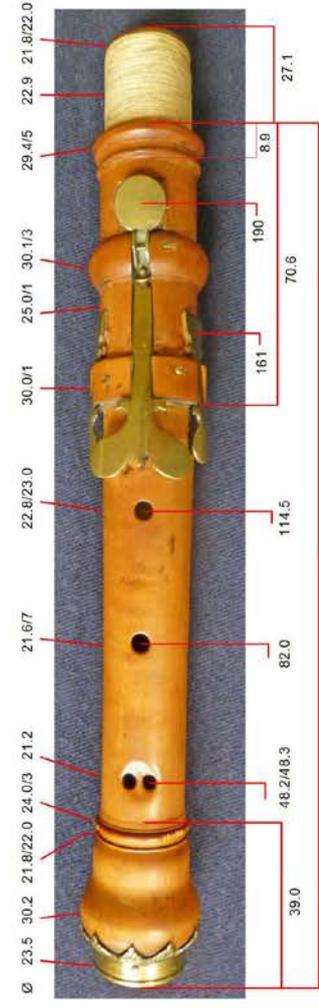
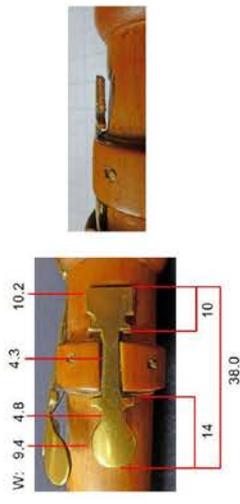
General conclusion: this oboe can be played at a=415 Hz, but both d#/e-flat and f# (f-sharp, with 1 2 3 4) are flat, just as on several other Dutch oboes. The c1 is without corrections rather sharp, what also is common on many baroque oboes. The general pitch of this instrument is a bit sharper than of most other Richters-oboes, maybe caused by the fact that the instrument was recently intensively oiled.



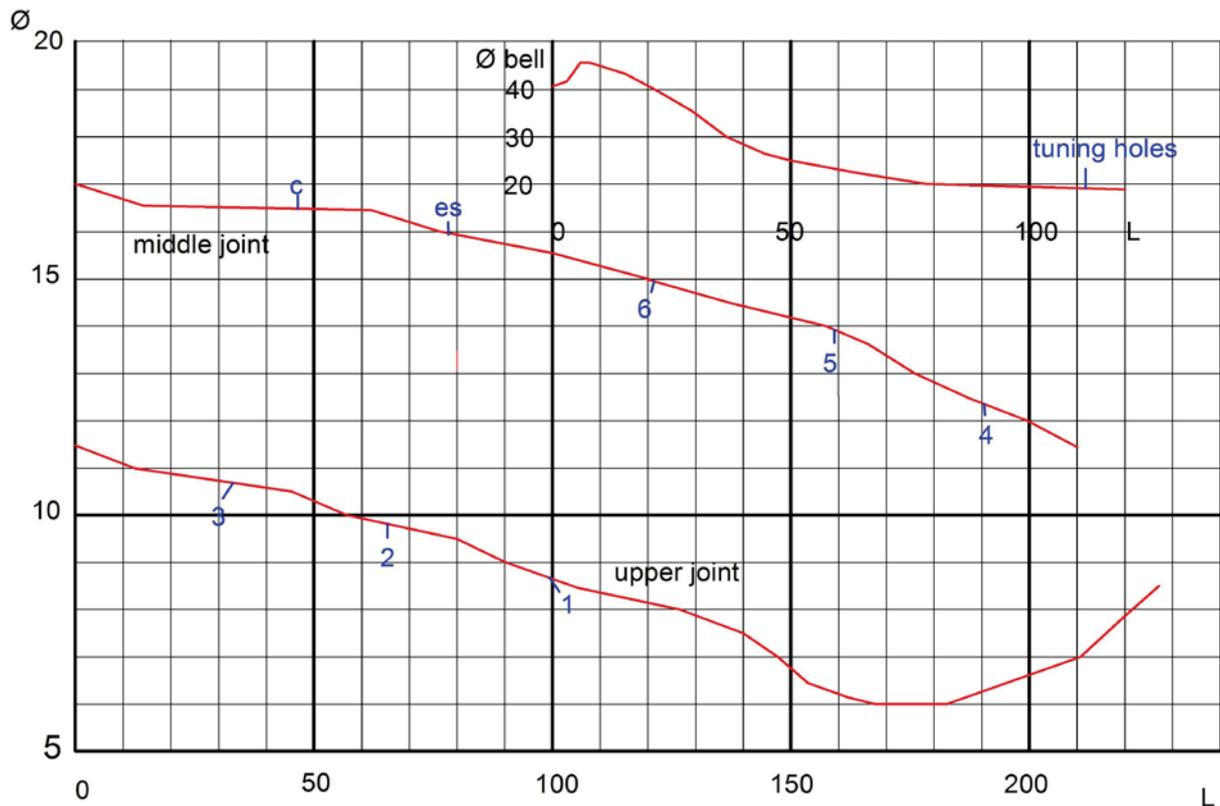
Next page: photos with measurements of the exterior of the boxwood oboe by Hendrik Richters in the Drents Museum in Assen (the instrument was - or still is - on loan to the Museum Vosbergen in Eelde, Netherlands).



stamp on bell



Hobo H. Richters
Drents Museum Assen
inv. nr. H1991-2a



H.Richters (Assen - Eelde-Vosbergen)

Graphs of the bore of the oboe by Hendrik Richters (Drents Museum - Museum Vosbergen)
 About the tone holes: 'c' = hole 8 (great key), 'es' = hole 7 (small key).

Fingerhole dimensions:

- | | |
|-----------|--|
| 1 | Ø 3.2; c. drilled c. 2 mm upwards |
| 2 | Ø 3.4; only slightly undercut |
| 3ab | Ø 2.8/3.0; drilled 1.7 mm downwards |
| 4ab | Ø 3.3x3.5 and 3.4x3.5; almost straight |
| 5 | Ø 4.5; slightly undercut |
| 6 | Ø 4.5; a bit downwards undercutting |
| d#/e-flat | Ø ca. 4.5 |
| C | Ø ca. 6.5 |

resonance holes: Ø 4.0, no undercutting

There are other boxwood oboes by Hendrik Richters in Oxford (Bate Collection) and London (Horniman Museum - this Richters oboe has a bell with the stamp of P. Borkens).

See my dissertation: *Dutch woodwind instruments and their makers, 1660-1760* (Utrecht, 2005) for more information (with concise measurements) about these instruments.

Oboe by J. Denner, private collection Switzerland

This oboe was in the collection of Willy Burger, Zürich (Switzerland). I have seen and measured (but not played) this beautiful oboe. Nobody seems to know what happened after the death of Willy Burger to his collection (with several more historical woodwind instruments).



The colour of this boxwood oboe is light brown (actually lighter and less reddish than on the photos) and it has brass keys. At the the front of the bell is the Denner stamp, on the back is a beautiful carving with the year 1754. That doesn't meand that the oboe was made in that year; Jakob Denner died in 1735, the oboe could have been made by him, or by one of the other family members in the workshop. Characteristic for the oboes by J. Denner is the single fourth fingerhole, and the position of hole 5: closer to hole 6 than to hole 4.

I couldn't exactly measure the diameter of the key holes: hole 7 (of the small key) is c. 6 mm, hole 8 (of the great key) c. 6.5 mm. In the drawing is indicated at which angle the holes are drilled: hole 1 clearly upwards, holes 2 and 4 a bit upwards, holes 3, 5 and 6 (a bit) downwards.

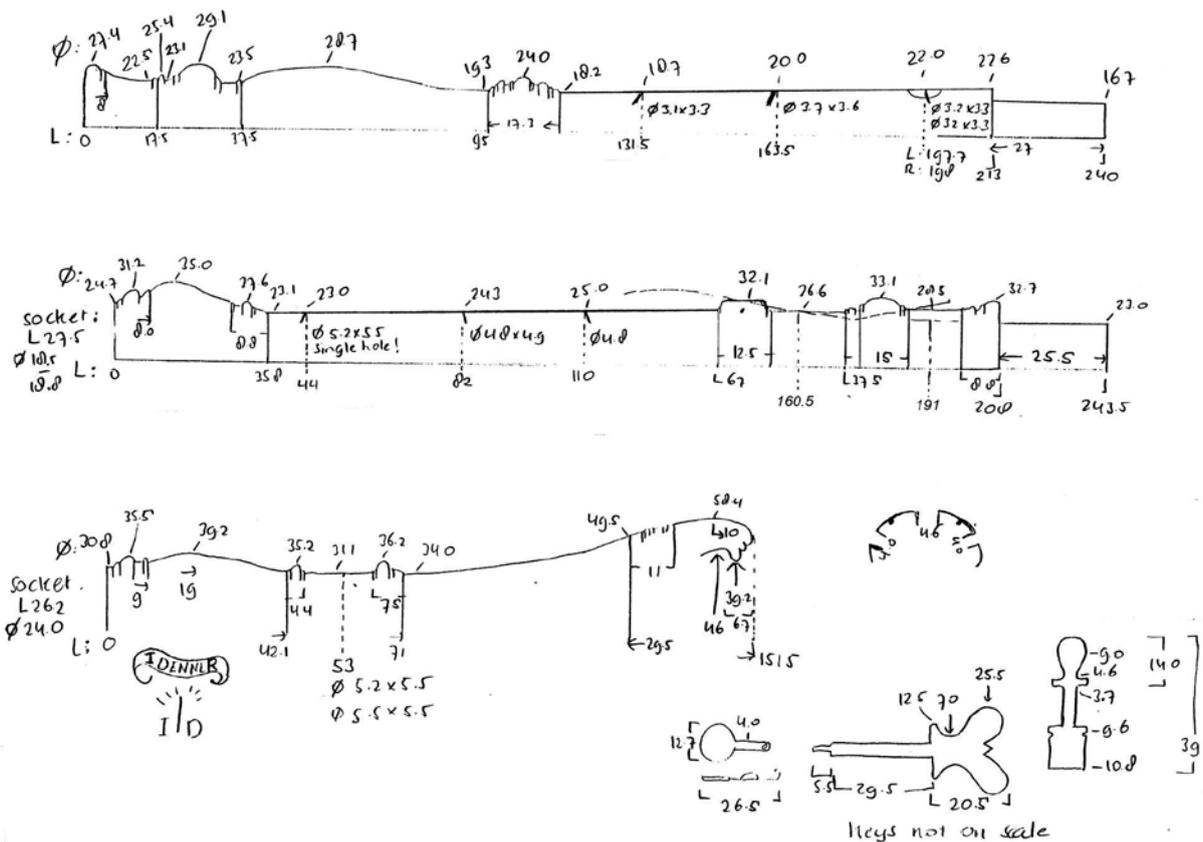
Measurements:

Upper joint, from lower end (Diameter-Length): D 11.0/11.33-L 0, 11.0-12/30, 10.8-32/39, 10.6-40/45, 10.4-43/54, 10.2-52/59, 10.0-59/63, 9.8-72/73, 9.6-79, 9.4-86/88, 9.2-91/94, 9.0-100, 8.8-102/106, 8.6-111, 8.4-115/118, 8.2-121/125, 8.0-128, 7.8-133/136, 7.6-140/142, 7.4-146/148, 7.2-149/153, 7.0-158, 6.8-169, 6.6-172/175, 6.4-178/180, 6.2-181, 6.0-187/188, 5.8-191, 5.7-198 and through.

Upper joint, from upper end (staple or counter bore): 8.5-0, 8.0-11, 7.5-16, 7.0-19, 6.5-24, 6.0-33, 5.8-39, 5.7-42 and through.

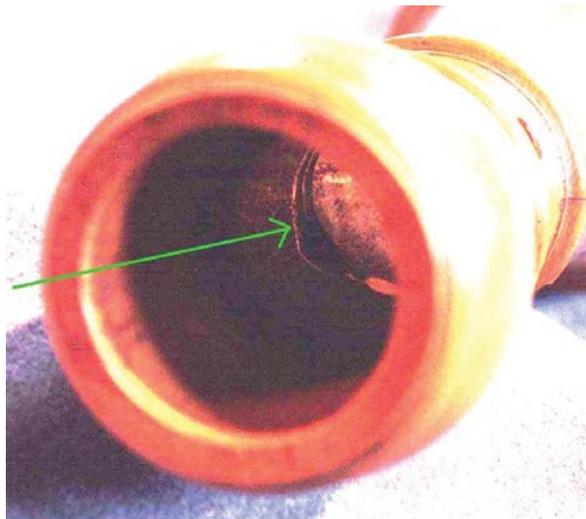
Middle joint, from lower end: 17.0-0, 16.8-10/18, 16.6-15/26, 16.4-28/32, 16.2-32/38, 16.0-38/46, 15.8-49/52, 15.6-52, 15.4-59/62, 15.2-64/68, 15.0-74/78, 14.8-84, 14.6-91, 14.4-97, 14.2-101/105, 14.0-110, 13.8-122, 13.6-128, 13.4-138/144, 13.2-148, 13.0-154/161, 12.8-164/174, 12.6-169/181, 12.5-178/196, 12.3-195 and through.

Bell: 39.2 at open end; 46 at about 7, 32.5 at 32, 30 at 40, 25 at 60, 22 at 72, 20.3 going through.



Oboe by Jan Steenbergen - private collection (Japan?)

Oboe in ebony, with ivory rings and silver keys. This instrument, originally from the Mengelberg-collection which was sold on auction in 1952, is very well preserved and excellently playable. Characteristic and very strong for this oboe are the irregularities in the bore of the oboe, just around the undercutting of the tone and tuning holes, made by Steenbergen (and visible in the bore of some - but not all - of his other oboes). The bore profiles of head and middle joint are remarkably similar: almost regular conical with the same angle (about 5.5 difference in diameter over a length of *c.* 205 to 215 mm). I measured this oboe when it was still owned by a Dutch oboe player.



This photo is of the bell of another oboe by Steenbergen (collection Han de Vries, Amsterdam). The green arrow points to the grooves in the bore next to the resonance holes. I don't know why (and exactly how, with which tools) these grooves were made.

I have found similar irregularities on several oboes by Steenbergen, most remarkably around the tone holes in the middle joints. There must have been an acoustical reason: improving the pitch, sound or attack of the note?

Measurements of the Steenbergen oboe

upper joint (I): L 237.5, SL 212.5; tenon: L 25.0; baluster/finial: L 103.5; Øext at lower shoulder: 21.2;

finger-holes (L from lower shoulder to centre of hole; ØWxL; Øext-max):

hole 1- 74.3; 3.0 x 3.2; 18.8 up
hole 2- 38.6; 3.4 x 3.6; 19.8 slightly up
hole 3l 7.5; 2.7 x 2.9; 20.9 slightly down
hole 3- 7.3; 2.7 x 2.9; 20.9 slightly down

bore (Ø, Lmin/max, from lower end):

11.9/12.0- 0	11.2- 15/ 36	11.0- 41 /42	10.6- 49/ 50	10.2- 65 /68
9.6- 88/ 89	8.8- 113/114	8.4- 119	8.2- 127	7.8- 135
7.6- 141/142	7.4- 149/152	7.0- 176/178	6.8- 181/182	6.6- 188
6.4- 199	6.3- 200/ ->			

counter bore (from upper end):

8.8/8.9- 0	8.5- 7	8.0- 16	7.0- 26	6.4- 37
6.3- ->				

middle joint (II): L 236.8, SL 210.5; tenon: L 26.3; socket: L 26.0; Ø-max 17.5;

finger-holes (L from upper end to centre of hole; ØWxL; Øextmax):

hole 4l- 48.7; 3.8 x 3.8; 21.4 slightly up
hole 4r- 48.8; 3.7 x 4.0; 21.4 slightly up
hole 5- 85.4; 4.8 x 5.0; 22.5
hole 6- 117.8; 4.6 x 4.7; 23.9 down

L from lower shoulder:

d#-l- 47.8; ca 5.4; 25.8
d#-r- 47.5; ca 5.5; 25.8
c-hole- 16.0; ca 6.9 x 6.8; 26.8

bore (Ø, Lmin/max, from lower end):

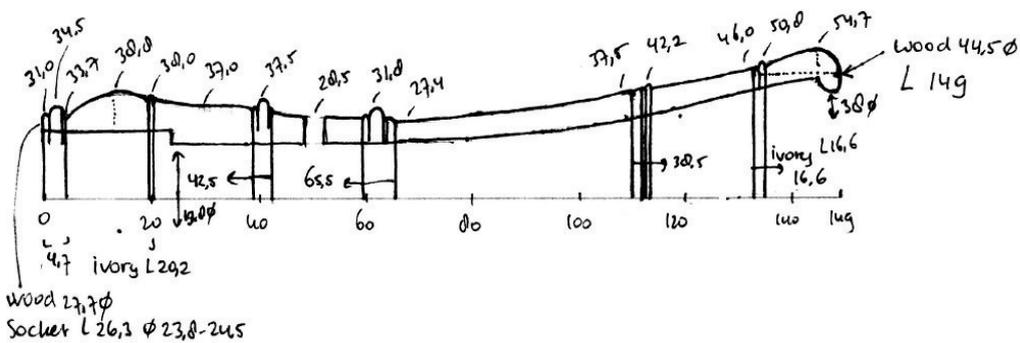
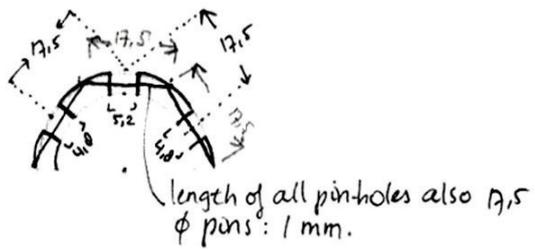
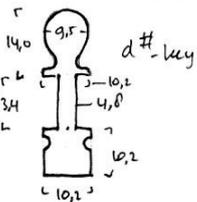
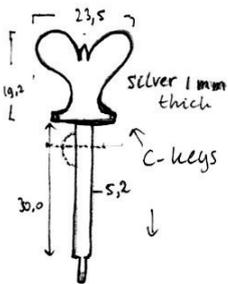
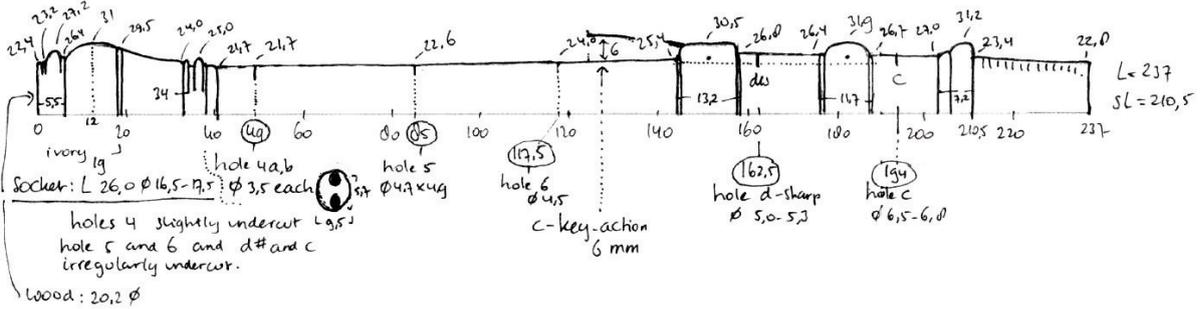
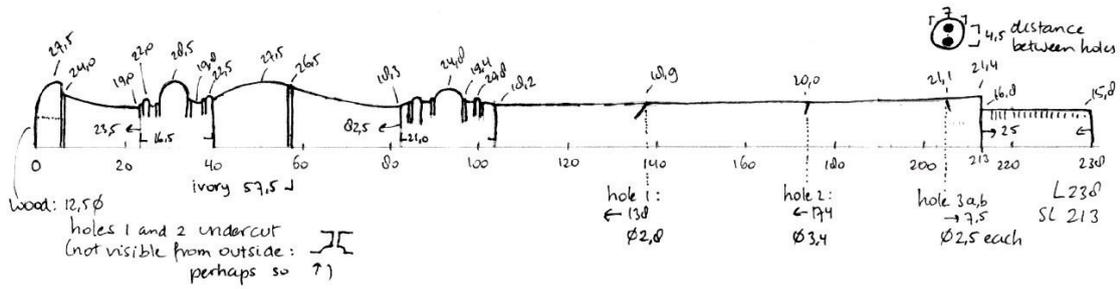
17.5- 0	17.0- 11/ 15	16.6- 28/ 30	16.0- 49/ 56	15.4- 80/ 86
15.0- 101/108	14.4- 125/130	14.0- 141/146	13.4- 165/167	13.0- 176/182
12.4- 199/200	12.2- 203/205	12.0- 211/ ->		

bell (III): L 149.0; socket: L 26.3, Ømax 24.4; tuning holes at L 51.0 and 50.7 from upper end, Ø 5.0 x 4.9 and 5.0 x 4.8, Øext 28.2;

bore (Ø, Lmin/max, from lower end):

38.2 x 38.3- 0	43.6 x 43.8 - 8			
40.0- 20	36.0- 28	28.0- 45	22.0- 69	21.0- 80
20.5- 89	20.0- 111/118	19.8- 115/ ->		

Steenbergen oboe (ebony, ivory, silver)



Richard Haka

Richard Haka (c.1646-1705) was undoubtedly one of the most gifted and prolific woodwind makers in Amsterdam. He not just made a lot of instruments, but was on the brink of two styles: 'early baroque', such as recorders in one part and 'new baroque': the woodwinds which were developed in France, in the new elaborate style, made in several parts etc. I believe that Haka played an important role in the further development of the oboe: there are some of them which can be seen as transitional instruments.

The oboe on the left photo is in the Gemeentemuseum in Den Haag. Mary Kirkpatrick made a copy that plays well (or best) at a-405 Hz: see her article in FoMRHI-Q 135 (Comm. 2055). The oboe in the centre is from the collection of Han de Vries; it is in all parts a bit shorter and is a better instrument as



starting point for making copies in a-415 Hz. The horn ring at the bell rim is a repair. Haka made also oboes which are even shorter and on which you can play without great difficulties in a-440 Hz. One of these oboes is in the museum of musical instruments in Stockholm (Sweden) - see the MIMO website for a photo.

The photo on the right shows a rare example of a transitional oboe, with a short bell (with no resonance holes) and remarkably large fingerholes, holes 3 and 4 are single. There is also a thumb hole (as on a recorder), and only one (great) key, with a fontanel. Copies of this instrument are perfectly playable at a-440 Hz.

The finial at the top has a rather deep cup (see photo below). Such cups are also on other short oboes by Haka and Rijkkel, and on many of the ebony oboes by Hendrik and Fredrik Richters. See the catalogue *Niederländische Doppelrohrblattinstrumente des 17. und 18. Jahrhunderts - Dutch double reed instruments of the 17th and 18th centuries* (Laaber 1997) by Van Acht, Bouterse and Dhont for full measurements of this instrument.

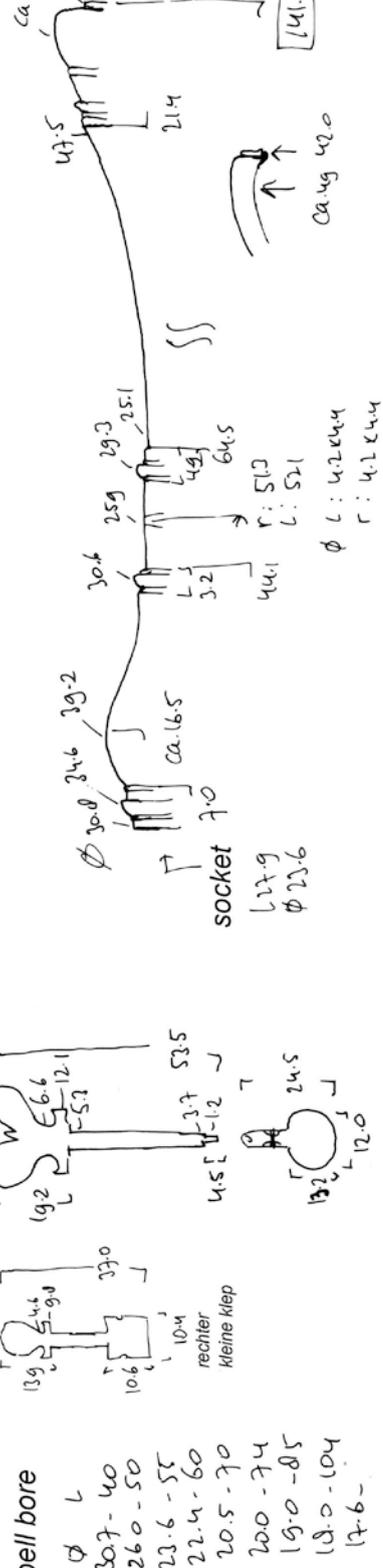
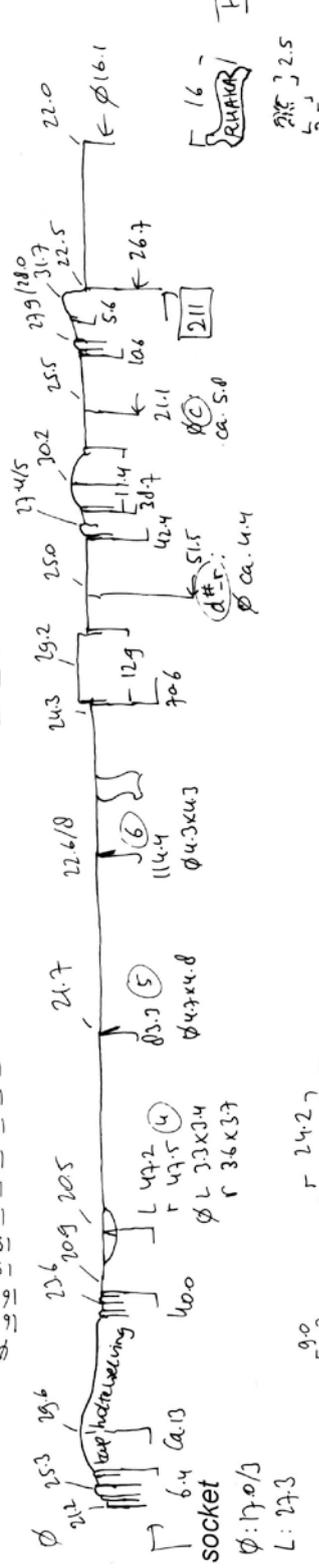
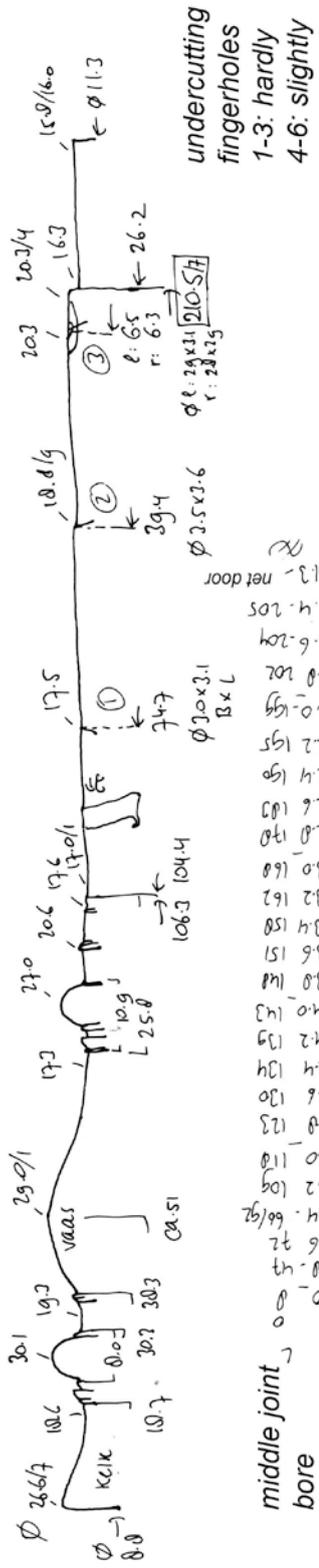


The drawing on the next page is of an oboe from the collection of Paul Dombrecht (Belgium). It matches very much the Haka-oboe of Han de Vries (which only has a much wider bore in the top section).



R.Haka hobo
coll. Dombrecht (België)
metingen Jan Bouterse

head bore	vanaf bovenkant
17.0	62.197
15.0	64.185
12.0	66.445
10.6	68.169
10.0	70.161
9.4	72.151
8.8	74.147
8.2	76.144
7.6	78.141
7.0	80.138
6.4	82.135
5.8	84.132
5.2	86.129
4.6	88.126
4.0	90.123
3.4	92.120
2.8	94.117
2.2	96.114
1.6	98.111
1.0	100.108
0.4	102.105
0.0	104.102
0.0	106.99
0.0	108.96
0.0	110.93
0.0	112.90
0.0	114.87
0.0	116.84
0.0	118.81
0.0	120.78
0.0	122.75
0.0	124.72
0.0	126.69
0.0	128.66
0.0	130.63
0.0	132.60
0.0	134.57
0.0	136.54
0.0	138.51
0.0	140.48
0.0	142.45
0.0	144.42
0.0	146.39
0.0	148.36
0.0	150.33
0.0	152.30
0.0	154.27
0.0	156.24
0.0	158.21
0.0	160.18
0.0	162.15
0.0	164.12
0.0	166.09
0.0	168.06
0.0	170.03
0.0	172.00
0.0	174.00
0.0	176.00
0.0	178.00
0.0	180.00
0.0	182.00
0.0	184.00
0.0	186.00
0.0	188.00
0.0	190.00
0.0	192.00
0.0	194.00
0.0	196.00
0.0	198.00
0.0	200.00



head bore

middle joint bore

socket
φ: 17.0/3
L: 27.3

bell bore
φ L
30.7-40
26.0-50
23.6-55
22.4-60
20.5-70
20.0-74
19.0-85
18.0-104
17.6-

A short oboe by Rijkel

Two oboes by Richard Haka (Museum of musical instruments Stockholm) and his sister's son Coenraad Rijkel (Boers Collection, Rijksmuseum Amsterdam, photo right) are preserved which are in all joints about 6% shorter than the other oboes in this supplement. That means that playing in a-440 Hz (or even higher) is possible. Remarkable: both instruments have bore profiles which are not narrower than of those longer oboes. And both oboes have a finial cup at the top end of the head.

Measurements of the Rijkel oboe

These measurements by Jan Bouterse are different from those by Marius Lutgerink which were published in the catalogue *Niederländische Doppelrohrblattinstrumente des 17. und 18. Jahrhunderts - Dutch double reed instruments of the 17th and 18th centuries* (Laaber 1997) by Rob van Acht, Jan Bouterse and Piet Dhont.

upper joint (I): Lmax 224.5; L from upper end to lower shoulder: 198.5; SL from bottom of finial cup to lower shoulder: 194.1; tenon: L 26; Øext-max at lower shoulder: 21.1;

finger-holes (Ø, Lmax, from lower end):

hole 1- 66.0; 3.1 x 3.5; 19.0 up
 hole 2- 36.5; 3.6 x 4.0; 20.0 upwards undercut
 hole 3l- 6.6; 2.7 x 2.8; 21.0
 hole 3r- 6.5; 2.7 x 2.7; 21.0

bore (Ø, Lmax, from lower end):

11.3-	0	11.0-	23	10.6-	33	10.2-	47	10.0-	55
9.6-	66	9.2-	79	8.8-	101	8.4-	102	8.0-	121.5
7.6-	131	7.2-	149	6.8-	154	6.5-	178/ ->		

staple bore, from bottom of finial cup (depth of finial cup: 4.1):

8.7-	0	8.6-	4	7.8-	17	7.0-	33	6.6-	38
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middle joint(II): SL 203.5; socket: L 26.7; Ømax 17.3; tenon: Lmax 27.4, Ømax ca. 23.1;

finger-holes (L from upper end to centre of hole; ØWxL; Øext-max):

hole 4l- 45; 3.3 x 3.3; 19.7
 hole 4r- 45; 3.3 x 3.3; 19.7
 from lower shoulder:
 hole 5- 126; 4.0 x 4.1; 21.1
 hole 6- 96.5; 3.9 x 3.8; 22.7 down
 d#-hole-r- 53; ca 4.4; 23.9
 c-hole- 20; ca 6.0x6.4; 24.6

bore (Ø, Lmax, from lower end):

17.2-	0	17.0-	14	16.6-	56	16.2-	70	15.8-	76
15.4-	119	15.0-	97	14.6-	111	14.2-	129	13.8-	141
13.4-	155	13.0-	159	12.6-	163	12.2-	169	11.8-	174
11.6-	->								

bell (III): Lmax 135.3; socket: Lmax 28.5; Ømax 24.8; tuning holes at L 51.7 and 51.6 from upper end; Ø 4.0 (round), Øext: 27.8;

bore (Ø, Lmax, from lower end):

46.9 x 47.6 - 0	ca 54 - ca.10			
40.0- 27	28.0- 50	24.0- 63	21.0- 85	
20.5- 87- >	20.5/20.0 - going through			



The Steinkopf oboe

Otto Steinkopf studied musical sciences in Berlin under Curt Sachs, played bassoon in the Berliner Philharmoniker, was saxophone teacher at the Musikhochschule in Berlin and restored instruments in the Musikinstrumenten-Museum in that city. He also started there with making copies.

Steinkopf became in 1954 member of the Cappella Coloniensis, the first ensemble that played on historical instruments. From 1964 to 1970 he was the chef of the studio for renaissance instruments at the Moeck factory (which was - and is now again - well-known for recorders) Moeck. He published also some books *Zur Akustik der Blasinstrumente* (1983) and with Volker Kernbach, the *Anleitung für das Musizieren auf Pommern, Dulcianen und Ranketten* (1978).

The oboe designed by Otto Steinkopf is a clearly not an exact copy of a historical instrument. It has a rather hybrid character, can (or must) be played with a modern oboe reed (and staple, the counterbore is cylindrical with a ledge at its lower end) at a pitch of a-440 Hz. However, with a wider and longer baroque reed, the oboe can be played at a much lower pitch (even close to a-415 Hz). The bore of the oboe is very narrow, and the toneholes are small as well. It is strange the way the double holes 3 and 4 are drilled: one of the small holes upwards, the other downwards. The bell is very long, but with the resonance holes very high positioned. The keys are simply made, see the photos for which type of springs are used. The instrument is made of fruit wood.

Measurements:

head (upper joint, I): SL 204; tenon: L 16.7

fingerholes (L from lower shoulder to centre of hole; Ømin/max):

hole 1-	70	2.6/2.7	45 degr. upwards
hole 2-	36	3.2/3.4	almost straight
hole 3a-	8.5	2.0/2.1	45 degr. downwards
hole 3b-	9	2.2/2.2	upwards

bore (Ø, Lmax, from lower end)

9.5-0; 9.3-5; 9.2-14; 9.0-20; 8.8-28; 8.6-37; 8.4-53; 8.2-54; 8.0-62; 7.8-64; 7.7-70; 7.6-76;
7.5-80; 7.3-88; 7.2-91; 7.1-96; 7.0-98; 6.9-103; 6.8-107; 6.7-113; 6.6-116; 6.5-120; 6.4-122;
6.2-123; 6.0-134; 5.8-142; 5.6-147; 5.4-155; 5.3-166; 5.2-172; 5.0-186; 4.7-188; 4.6-192;
4.5- just through

counter bore from upper end:

L 21, Ø 7.0 (cylindrical)

middle joint (II): L 203.5, L tenon to bell 20.2; L socket to head: 16.5, L tenon to bell 20.2

fingerholes (L from upper end to centre hole; Ø):

hole 4a-	46	2.6	slightly upwards
hole 4b	48	1.9	almost straight
hole 5-	80	4.0	slightly upwards
hole 6-	111	4.1	slightly downwards
d#-hole(r)-	160	5.6	straight
c-hole-	189	7.5/8	straight

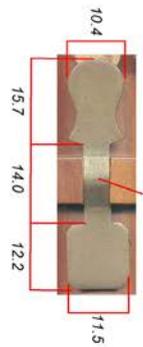
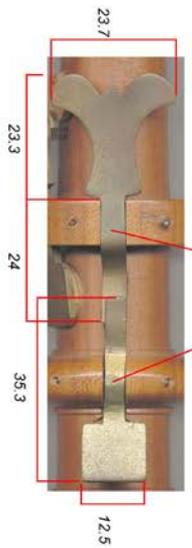
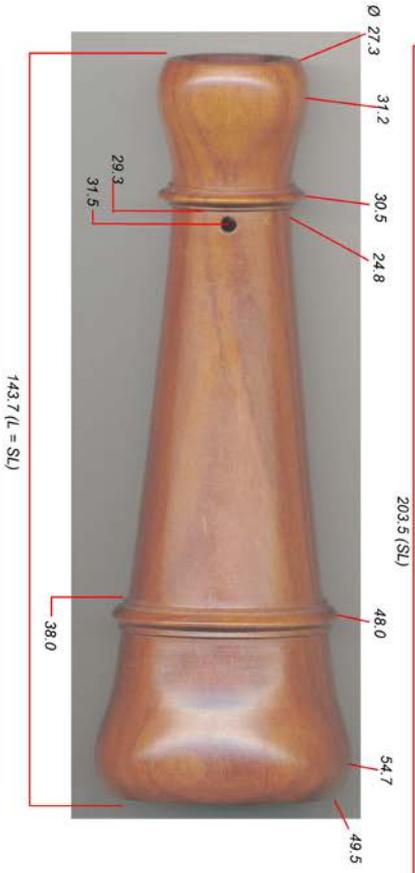
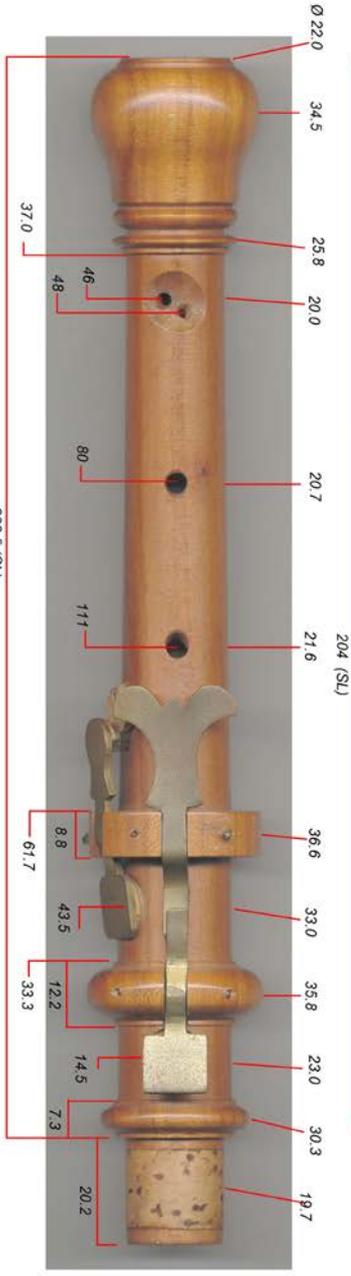
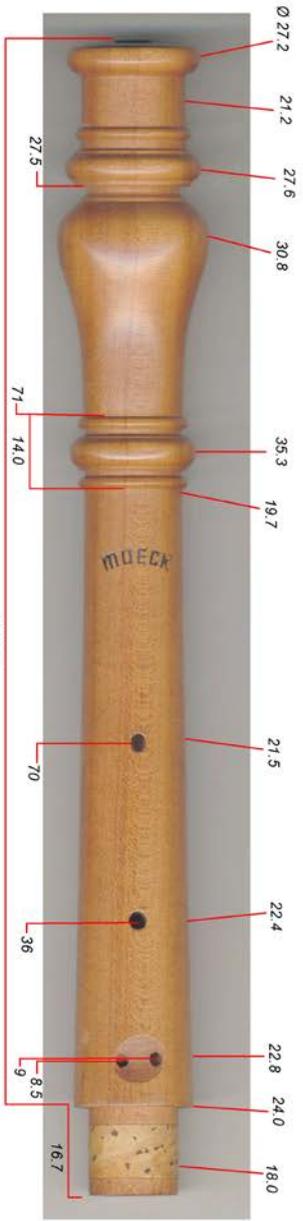
bore of middle joint (Ø, Lmax, from lower end):

14.6-0; 14.4-12; 14.2-23; 14.0-33; 13.8-39; 13.6-45; 13.4-55; 13.2-61; 13.0-69; 12.8-78;
12.6-88; 12.4-95; 12.2-100; 12.0-114; 11.8-122; 11.6-127; 11.4-139; 11.2-149; 11.0-156;
10.8-161; 10.6-166; 10.4-175; 10.2-181; 10.0-192; 9.8-197; 9.6- just through

bell (III): L 143.7; socket: L 20.0, Ø 20

two tuning holes at L 31.5; Ø 3.0

bore (Ø, Lmax, from lower end): 41.6-0 (at bell rim, which is 4.6 mm long); 44.5-5; 40-23;
36-31; 32-40; 30-45; 28- 50; 26-56; 24-58; 22-65; 20-72; 19.0-70; 18.0-75; 17.0-80; 16.5-84;
16.0-86; 15.5-92; 15.0-115; 14.8-120 and through



3D printed conical crook for a baroque bass racket

Introduction

A crook for a bassoon or a racket is also called an Es or S, according to its form.

As early as 1685 we read the following in the Amsterdam builder Richard Haka's fee statement for the delivery of musical instruments to Sweden: 'Kooper Es tot dulcian Basson' (which probably meant a baroque bassoon).

An Es was and still is made by first folding a flat piece of brass around a conical spine, then soldering the joint and finally bending the straight piece of soldered brass into the Es form.

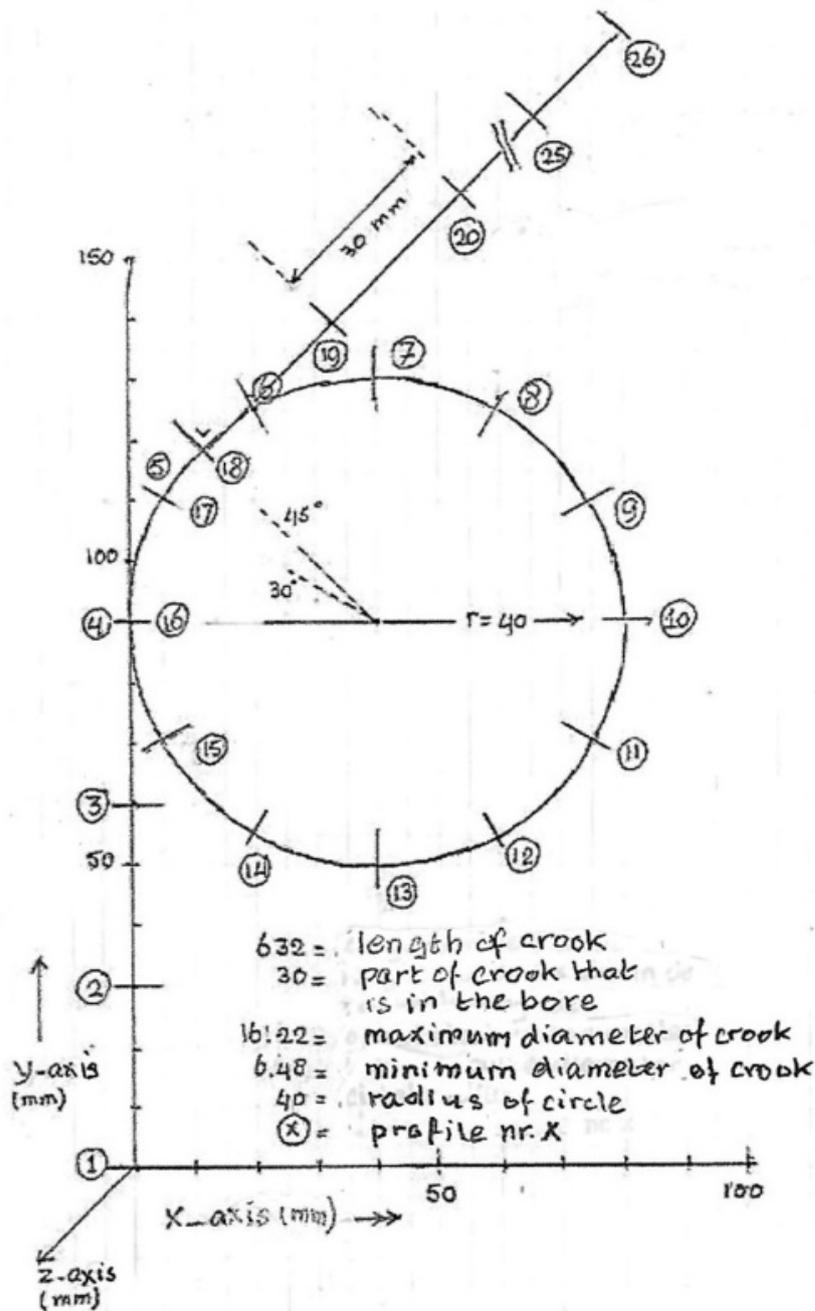
Other method and material

It is quite complicated to make a conical Es. Amateurs do not usually achieve a flawless result. On the other hand, buying an Es is costly. In my experience a 3D printed Es is a good alternative acoustically, visually and financially.

How can it be done? A step by step plan is given below.

Step 1: Make a drawing of the centre line of the Es, scale 1:1

First you make a drawing of the centre line of the Es. The line should have the same length as the crook whose dimensions you know. If you put a mark on the centre line every 30 mm, you can imagine at each mark two circles square and centred on the centre line: the inner and outer profile of the crook. If you know the measurements of the narrowest and widest profiles at each end of the crook, the reduction of the profile sizes from bottom to mouth piece can be calculated, assuming that this reduction is linear over the length of the crook. As you will notice from the drawing below, my crook goes up under an angle of 45 degrees, whereas the original¹ ends horizontally. That is a choice determined by the (expected) playability of the instrument.



Step 2: Calculate x,y and z coordinates, profile sizes and angles with a spreadsheet

The centre line of the crook can be modelled mathematicallyⁱⁱ, in parts. You start with part 1: a straight line extending vertically. Continue with part 2: a circle with a little overlap where the circle evolves into the straight line towards the mouthpiece. Finally, part 3: a straight line running at an angle of 45 degrees. If you have your base data and formulae right, you can easily calculate coordinates, angles and sizes for each part of the model. The following Excel spreadsheet shows the results: the calculated profile angles, x,y and z coordinates, crook length at each profile (to calculate the outside size of the profile) and the size reduction factor relative to profiles 0, 1 and 2. For profile 11 and 25 the applicable formulae also are shown.

A few words about z coordinates: adjacent to the number tables a view of the crook in the xy plane is shown. Profiles 4 and 16 have the same x and y coordinates. However, they have different z coordinates. Profile 4 is on z=0. Profile 16 is closer to the viewer. There should be room between those profiles. The centre of profile 16 should be at z= 0.5* (profile 4 size + profile 16 size) +3 mm (3 mm is chosen the distance between the outer sides of profiles 4 and 16. This z value can be linearly reduced to 0 over profiles 15,14....,4. With all the data calculated, you can make graphs of the crook. These can be used for a final check of your design.

Step 3: Make a 3D model with a design programmeⁱⁱⁱ

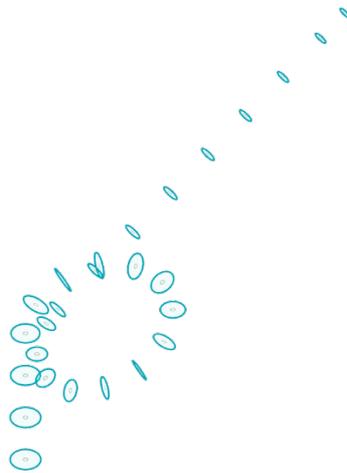
The next step is to make a 3D model of the crook with a 3D design programme. For the

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	Calculations - base for the design of a crook for a baroque bass racket																
2																	
3	mm															mm	
4	632	Length of the crook according to the drawing										40,00	Radius of the circle				
5	30	Part of the crook that is in the bore										251,20	Circumference of the circle				
6	602	Part of the crook where profiles are reduced										20,93	Length of 1/12 circle segment				
7	16,22	Maximum diameter of the crook										31,40	Length of 1/8 circle segment				
8	6,481	Minimum diameter of the crook										10,47	Length van cirkelsegment 17-18				
9	9,734	Diameter reduction, totally										30,00	Distance between profiles on straight vertical line				
10	0,016	Reduction of diameter per mm length										19,47	Remaining length near the mouth piece				
11											21,21	x and y deviation over 30 mm length, under 45 degr angle					
12											13,77	x and y deviation over remaining length, under 45 degr angle					
13											16,21	z distance between centre poits of profiles 4 and 16					
14											1,474	deviation of z coordinate between profile 4 en 16, per profile					
15																	
16																	
17																	
18	Model	Profile	Profile	profile coordinates	Length relevant	Outer	Reduction										
19	part	number	angle (degr)	angle (rad)	x	y	z	diameter	factor								
20																	
21	Part 1	0	0	0,00	0,00	-2,50	0,00	0,00	16,22	1,000							
22		1	0	0,00	0,00	0,00	0,00	0,00	16,22	1,000							
23		2	0	0,00	0,00	30,00	0,00	0,00	16,22	1,000							
24		3	0	0,00	0,00	60,00	0,00	30,00	15,73	0,970							
25		4	0	0,00	0,00	90,00	0,00	60,00	15,25	0,940							
26	Part 2	5	30	0,52	5,36	110,00	1,47	80,93	14,91	0,919							
27		6	60	1,05	20,00	124,64	2,95	101,87	14,57	0,898							
28		7	90	1,57	40,00	130,00	4,42	122,80	14,23	0,878							
29		8	120	2,09	60,00	124,64	5,90	143,73	13,89	0,857							
30		9	150	2,62	74,64	110,00	7,37	164,67	13,55	0,836							
31		10	180	3,14	80,00	90,00	8,84	185,60	13,21	0,815							
32		11	210	3,67	74,64	70,00	10,32	206,53	12,88	0,794							
33		12	240	4,19	60,00	55,36	11,79	227,47	12,54	0,773							
34		13	270	4,71	40,00	50,00	13,27	248,40	12,20	0,752							
35		14	300	5,24	20,00	55,36	14,74	269,33	11,86	0,731							
36		15	330	5,76	5,36	70,00	16,21	290,27	11,52	0,711							
37		16	360	6,28	0,00	90,00	17,69	311,20	11,18	0,690							
38		17				0,00				10,84	0,669						
39	18								10,68	0,658							
40	Part 3	19	45	0,79	32,93	139,50	17,69										
41		20	45	0,79	54,14	160,71	17,69										
42		21	45	0,79	75,36	181,92	17,69	432,60	9,22	0,569							
43		22	45	0,79	96,57	203,14	17,69	462,60	8,74	0,539							
44		23	45	0,79	117,78	224,35	17,69	492,60	8,25	0,509							
45		24	45	0,79	138,99	245,56	17,69	522,60	7,76	0,479							
46		25	45	0,79	160,21	266,78	17,69	552,60	7,28	0,449							
47		26	45	0,79	173,98	280,54	17,69	572,07	6,96	0,430							
48																	
49																	

Side view of crook for a baroque bass racket

programme I used, only the outside sizes of the profiles were relevant (I shall explain this later). First you put the profile of largest size in the drawing plane. The centre of this profile is on $x=y=z=0$. Then you copy this profile and move the copy to the next mark point (x , y and z are known), set the angle of the profile and reduce the size. Repeat this another 23 times, using the data from your spreadsheet. This may seem a lot of work, but an experienced user of a design programme can accomplish this task in a little more than an hour. It is important to always start from the profile on $x=y=z=0$, so profile 1, for the construction of each following profile. Copying other profiles potentially containing an error will adversely affect all following profiles.

Following this method three-dimensional images of subsequent, ever smaller profiles at different angles evolves.



You then connect all the profiles by mouse-clicking them in sequence and using a feature of the programme. The result of this is a massive, transparent, conical staff in the form of the crook design. Remove all profiles and transform the massive crook into a hollow one, by applying a programme feature which allows you to choose the final thickness (my choice: 1 mm). The programme has feature to check and eventually adapt all dimensions before you go printing. The 3D model of the crook is ready.



Step 4: Have your 3D model printed by an industrial manufacturer

I do not have my own 3D printer. I prefer to make use of the services manufactures offer on the internet. A home printer cannot match the quality of industrial printers. You send your 3D-model file (in STL format) to a few manufacturers. Various options are on offer: the type of print process, the type of material (including metals) and various finishes. Manufacturers check the printability of your model and give a price quotation (ex VAT and delivery costs). If you accept an offer, advance payment is required. Delivery is generally within ten working days.

For prototyping I advise the print process Selective Laser Sintering, material nylon, with no finish. This gives a very detailed and strong print result at an affordable price. Costs are important if you want to improve your design by repeatedly printing augmented models. I strongly advise to ask price quotations from a few manufacturers. Their prices for the printing the same object (probably with the same type of industrial printer) can be as much as three times higher from one manufacturer to another.

First impressions of playing

I put the crook in the proper bore of a 3D printed prototype of a baroque bass racket. I could play it with a good quality double reed made by an experienced bassoon player. The sound was surprisingly good according to a few former professional bassoon players. Of course, this is not a scientific judgement.

As the racket has no keys some of the chromatic notes cannot or hardly can be played. My next step is to find out how I can improve this by tuning the instrument using cork stops.

Finally

Please send me an email in case you have any comment or question: ton_pel@hotmail.com

ⁱ I used measurements made by Jan Bouterse of a baroque racket with original crook, from the collection Boers, Rijksmuseum, Amsterdam, inventory nr. BK-NM-11430-111;

ⁱⁱ If the crook cannot be described mathematically, you can of course apply measured values (without a spreadsheet) or even invented measures if you want to make a unique design;

ⁱⁱⁱ Design programmes have nothing to do with programming in the classical sense. Modern design programmes, often available free of charge, are visually strong and can be operated intuitively. For instance, if you want a sphere somewhere, you click on a pull-down menu, select a sphere, input the radius and place it where you want. It is easy to merge different objects into one new object. On YouTube you can find many 'how to' videos explaining programmes like 123D Design, TinkerCad, or SolidEdge.

Castanets in mediaeval Sephardic manuscript illuminations

The humble castanet has not been mentioned much in these recondite pages, with only half a dozen references in more than 2,000 Comms. This brief Communication reproduces three pictures which we have come across in a search of the internet for musical instruments in images of the dances of Salome, and of Miriam; our broader findings are shortly to appear in the Lute Society's *Lutezine* quarterly PDF colour supplement. Three images, not directly copies of one another, is probably enough evidence to suggest that the instruments represented are 'an actual thing', to use contemporary parlance.

The occasion for the Dance of Miriam was the rejoicing at the destruction of Pharaoh's army in the Red Sea as Moses led his people out of Egypt.

Sumpsit ergo Maria prophetis soror Aaron tympanum in manu egressaeque sunt omnes mulieres post eam cum tympanis et choris, quibus praecinebat dicens cantemus Domino gloriose enim magnificatus est equum et ascensorem eius deiecit in mare.

So Miriam the prophetess, the sister of Aaron, took a timbrel in her hand: and all the women went out after her with timbrels and with dances. And Miriam answered them, Sing ye to the Lord, for he hath triumphed gloriously, the horse and his rider hath he thrown into the sea.

The three images showing castanets – assuming that is what they are – all come from 14th century Jewish Spain, from Haggadah manuscripts, setting out the order of the Passover Seder, and recounting the story of the Exodus from Egypt; their narrative element made them a natural object for manuscript illumination.

The earliest and simplest is the BL Oriental MS 2737, f.86v, the Hispano-Moresque Haggadah, from Castile, c.1300. It shows Miriam(?) with a painted round tambour, a woman with long 'Turkish'-style castanets, and a third woman - perhaps clicking her fingers, corresponding to *jaleo* in modern flamenco? Or is she supposed to be playing (invisible!) round castanets of the more familiar variety?

The other two images both come from mid-14th century Barcelona. BL Oriental MS 2884, the Sister Haggadah, shows the dancers doing a rather interesting and complex dance, involving some sort of interweaving 'hay' or 'farandole' figure, rather than solo 'freestyle' dancing, to the music of a square frame drum, and with the long castanets played by the third woman from the left.

The beautiful and luxurious Golden Haggadah. BL Add. MS 27210 is lavish both in execution and in the instrumentation it depicts: a lute or gittern, a tambourine (which seems to have slits in its sides for the metal jingles), a painted square frame drum, horizontal cymbals, and held by a lady behind the square frame drummer we can just see castanets, this time in a pair played in one hand, with the join of the two blocks clearly visible. (Dancing to the lute in the late Middle Ages is something above all seen in sources from Italy and the Crown of Aragon, which ruled southern Italy; and there may be a Jewish connection; Joachim Lüdtke and Andreas Schlegel speculate in *The Lute in Europe 2* (pp. 194–8) that Sephardic traders and merchants may have had a role in disseminating lute culture.)



BL Oriental MS 2737, f.86v, the Hispano-Moresque Haggadah, from Castile, c.1300.

47
וקלים לקחם מה גילינס וולאגלים
חמים להם חומה מימינם ומשמאלם

49
ופנה הקריב
ופנה הקריב



ותקולרים הנביח אתהתקין צלה ותצאן ט הנשים חקיה צרכס ועלמולת
ותקח מרים הנביאה את התוף בידה ותצאן כל הנשים אחריה בתפנים ובמחולות

BL Oriental MS 2884, the Sister Haggadah, mid-14th century Barcelona



Golden Haggadah. BL Add. MS 27210, mid-14th century Barcelona.

The Sephardic Jewish community forms a bridge between Europe and the Levant or 'Orient'. It is interesting to see that in Christian iconography of the same subject, we see the square frame drum, but not the castanets.

Illustrating the text of the Vulgate, quoted above, here is an image from Amiens, Bibliotheque Municipale 108, f. 49v, from 1197.



And in Limoges MS B.M. 0002 f.182v, a gradual for Notre-dame de Fontevrault, from 1250-60, again we have the square frame drum only.



Praetorius, in his *Syntagma Musicum* plate XXX, shows a square hand-drum which he describes as 'Moscowitsche', and does illustrate the horizontal cymbals, but even among the rude or ancient instruments in the final plates of his famous collection, does not have anything quite like the castanets shown here. Incidentally, Praetorius (cribbing extensively from Virdung) seems to get hopelessly muddled on the meaning of 'tympanum' taking it to be a wind instrument; (volume II, (1619) p. 77, 'Tympanum Hieronymi', translated by David Z. Crookes in his commentary:

The tympanum was used a great deal in the praise of Almighty God, and is mentioned frequently in Holy Scripture. I find it depicted as a long pipe with a mouthpiece at the top, into which the player blows, and two holes at the lower end through which the sound and the wind escape. It was made of such a size that a woman could carry it in one hand. Nowadays, however, 'tympanum' refers to the large military drums . . .'

Needless to say, no manuscript or other illustrations of Miriam show her playing a wind instrument.

In the admirably broad-minded and ethnographically curious *Gabinetto Harmonico* (1723) of Filippo Bonanni we do, however, find a later image of the wooden clappers of the Golden Haggadah; he calls them 'Gnacchare delli Turchi' (Turkish castanets) apparently drawing on the earlier writings of Ottavio Ferrari.



Finally, the Wikipedia entry for castanets has a Turkish image of c.1720, of a troupe of dancers, celebrating the circumcision of Sultan Ahmed's son, clearly playing the same kind of castanets and dancing in the same way as in our Sephardic images.



There is clearly a place for the square-frame hand drum in early mediaeval music performances, including those of 'Christian' music, and these can still be bought – I got mine in the casbah in Marrakesh. But does anyone make, or know where you buy 'Turkish castanets' for the early Jewish – or Convivencia – repertoires?