The oboes of Richters: about methods of research in woodwind instruments

Part 6: Acoustical design of the instruments: the bore profiles

The interior (bore) is in a literal and figurative sense the heart of each woodwind instrument. In making an oboe (and most other types of woodwinds) the bore also comes first, before turning the exterior. Drilling and reaming the bore in a piece of wood is a precise job, because the bore profile is most important for the acoustical properties of the instrument: it defines very much the acoustical properties, such as the pitch. The position of the tone holes is also for the greater part related to the dimensions of the bore.

The profile of the bore is largely established by the shape of the reamers which were applied. With a specific reamer you can generally make only one, and usually clearly defined, bore profile. Bore profiles are therefore often better parameters for finding relations between instruments than other stylistic characteristics such as the turned exteriors. For instance: it is possible to find clues who might have made an oboe that has no maker’s marks.

Figure 1 is the well-known picture of the woodwind makers tools from the Encyclopédie ou dictionnaire raisonné des sciences, des arts et des métiers by Diderot and d'Alembert (1751-1780). It shows pointed drills (fig. 1 and 2) as well as short reamers (fig. 4 and 5), more or less in the shape of a spoon (fig. 4). The tool of fig. 3 is probably a ‘scraper’, for widening a bore over a short distance, for instance close to the fingerholes.

These tools are used while the wood is turned on a lathe. The lower (right) end of the wood is supported by a so-called fixed ‘steady’, allowing one to push the drill or the reamer against the centre of the end of the wood. No original tools of Dutch woodwind makers from the 17th and 18th centuries did survive (I do not know about reamers of other European makers) and I do not know whether the drills and reamers in the Encyclopédie are correctly rendered (some depictions of musical instruments in this book have rather odd details). Various tools, such as reamers or drills, are depicted on an engraving of a woodwind maker’s workshop (from 1698) by the German artist Christoff Weigel (see figure 2, next page). Several of these tools have a cross bar at the end, which makes it much easier to push them steady into the wood. The reamers against the back wall have a very strong conical profile; but for which type (or part) of instrument were they designed? They are not unlike the tools used until the 20th century by makers of wooden shoes in Holland.
Cecil Adkins gave full attention (18 pages in his 76 p. long article, Adkins 1990) to the bores of the Richters oboes. He opens with the following remark: ‘The congruity of the bores is surprising when one considers the simple tools available for shaping bores in the 18th century. Each of the Richters bores was shaped through the use of multiple reamers ... and as a result the bore profiles in the upper two joins are complex, often with marks of three different reamers.’ But this is actually in my view too easy a conclusion from Adkins, for instance: were the tools really so simple, and did that affect the congruity or incongruity of the bores? The illustrations in Adkins’ article are not very convincing (I must admit how difficult it is making photos of bores) and he gives in his article only a selection of measurements. It is good to put some question marks on his observations, but I am also aware that I myself can also give only concise data to support my own conclusions. That is why I will mainly concentrate on pointing to the dangers of this important part of woodwind research.

Another remark: there is always a relation between the techniques and comprehensiveness of measuring an instrument and the scope for interpreting the results. One of the research questions is about the accuracy applied by the Richters in making their oboes, and how accurate we nowadays have to be in assessing the instruments to answer that question.
Table 5: Bore measurements of the oboes by Richters and Rijkstijn

<table>
<thead>
<tr>
<th>instrument</th>
<th>Ø bore upper joint, middle joint, bell</th>
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<tr>
<td></td>
<td>top - min. - bottom</td>
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<tr>
<td>HR1:</td>
<td>8.9 - 6.3 - 11.0</td>
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<td>HR2:</td>
<td>8.5 - 6.6 - 11.2</td>
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<td>HR4:</td>
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<td>HR8:</td>
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<td>HR9:</td>
<td>8.4 - 6.4 - 11.1</td>
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<td>HR13:</td>
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<td>HR15:</td>
<td>8.4 - 6.4 - 11.2</td>
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<td>HR17:</td>
<td>8.5 - 5.6/6.8* - 10.7</td>
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<tr>
<td>HR18:</td>
<td>8.7 - 6.6 - 11.4</td>
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<td>HR20:</td>
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<td>HR21:</td>
<td>8.3 - 6.3 - 11.4</td>
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<td>HR24:</td>
<td>8.3 - 6.3 - 11.2</td>
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<td>HR27:</td>
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<td>FR2:</td>
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<tr>
<td>RS2:</td>
<td>9.4 - 7.4 - 13.0</td>
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<td>RS3:</td>
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<td>RS6:</td>
<td>8.8 - 6.4 - 11.1</td>
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<tr>
<td>Rijkstijn-1:</td>
<td>8.5 - 6.2 - 11.6</td>
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<tr>
<td>Rijkstijn-2:</td>
<td>8.1 - 6.0 - 11.0</td>
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HR = Hendrik Richters; FR = Fredrik Richters; RS = Richters-style; ca. = circa

*: This oboe has a ivory finial which is put on a wooden ferrule. In this case the bore of the ferrule has apparently shrunk rather much (to a minimum diameter of 5.6 mm) and has a big step to the bore of the finial.

Table 5 gives the bore diameters for the three parts of each oboe. For the top joint at the entrance of the counter bore, the minimum bore at the interstice and at the lower end. For the middle joint just after the socket and at the lower end; for the bell just after the socket, for the widest point just before the bell rim, and of the bell rim. This table has its restrictions: it gives only concise information about the internal design of the oboes. Joints with aberrant bore profiles do not emerge instantly, with the exception of the top joint of RS2, which has deviant minimum and maximum bore diameters (the other joints of this oboe have also details - such as the keys - which are rather odd, the instrument has sustained a fair amount of damage and was probably kept under adverse conditions as well). But to get more information and not to drown in a sea of tables with hundreds of bore measurements, we have to go a different way.
Assessing and comparing bore profiles: the use of graphs

The best way to examine bore profiles of baroque oboes is to make graphs of the measurement results, and to do that systematically. There are in these measurements always two combined data: the diameter of the bore and the position (length or depth) for that diameter in the bore. Or even the diameters at that point. Because of shrinking the wood can warp, the bore in cross section becoming oval: there is often a maximum and a minimum diameter. But only on a very few instruments (i.e. HR9, see fig. 9) has this warping to be taken in account in comparing the bore profiles. For this article I have generally used the maximum diameters, as these are likely more representative for the original state of the oboes. Warping as result of irregular shrinking of the wood of course also affects the exterior of the instruments - but that is too often not reported in descriptions or recognizable in measurements!

Using graph paper, I put the length on the X-axis, and the diameter values on the Y-axis. To get a better view of the bore profile, I ‘blow up’ the diameters of the upper and middle joints with a factor 10. But that is not convenient for the much wider oboe bell: for that part I give the diameters 1:2 to the length measurement. Nota bene: this 1:2 scale means that this graph gives the actual shape of bore profile (because if gives the radius of the bore 1:1).

Figure 4 (next page) gives the graphs of the bore of HR2, a representative instrument of Hendrik Richters (see the first part of this series, Comm. 2000, for information about the numbering of the oboes by - or in the style of - Richters and Rijkstijn).

The tone holes are numbered 1 to 9; 7 is the hole for the small key, 8 for the great key, 9 are the resonance or tuning (or vent) holes on the bell. The bores are measured from the lower end (L 0) of each joint. It is immediately clear that the profiles of the bores of the upper and middle joint are not straight conical over the whole length, but that they have sections with a different conicity. In the middle joint is the steepest part of the slope from the top (Ø 11.8 mm) to just after hole 6; the conicity is here between 1:25 to 1:30 (a difference of 3.7 mm over a length of 97 mm). From L 0 tot about L 110 is the slope much flatter, with a difference of only 1.5 mm over a length of 110 mm. The bore is near hole 7 almost cylindrical.

The bore of the top joint of this oboe has an almost straight course from hole 2 until L 170: from Ø 10.5 to 7, a difference of 3.5 mm over a length of about 120 mm, which means a conicity of about 1:35. The bore is in the lower end of this joint flatter, from L 0 to L 55 narrowing from 11.2 to 10.5 mm. There is a step in the bore (Ø 11.2 to 11.8 mm) between the upper and middle joint (leaving the bore down in the upper joint may give more stability in the critical octaves played on holes 5 and 6). There is even a bigger step from middle joint to the bell (Ø 17.0 to 19.3). This second step is common for many baroque oboes and seems to be necessary for some tones to speak and sound well. It is much less clear of the steps between the top and middle joints (which occur very often, see table 5) are intended by the maker as well. The question must be asked whether these steps are caused by tenon contractions. These contractions (or compressions) can be expected when players (or instrument collections) leave their instruments assembled, especially when the wrappings are tight. I also think that warping is promoted when after playing the parts are not dried properly, causing rapid changes in humidity of the wood.

I have seen many tenon contractions on historical recorders and traversos. They are easily recognizable, especially where the bore becomes wider after the opening (fig. 5). However, such obvious contractions are exceptions on the many (mainly Dutch) baroque oboes which I have investigated. Or they are more difficult to distinguish, such as small contractions where the bore has only slightly shrunk over a short distance. The graphs of the bores of HR2 (fig. 4) give no clear evidence for contractions. It is however possible that the bores of upper and middle joint of HR2 are wider over the first 20 mm; but if so, I think only a little bit.
Figure 5: graphs of the bore of a soprano recorder by Steenbergen (collection Frans Brüggen). There is a contraction at the tenon of the lower joint. From the graph may also be concluded that there is a ‘reamer end’ at L 170 in the lower joint, suggesting that Steenbergen used (at least) two reamers for the lower joint. But this conclusion comes actually from only one single point in the graph (Ø 9.2 at L 170), which was drawn using only a summary of the measurements which Fred Morgan made of the instrument. Graphic representations of bore profiles can therefore sometimes be rather suggestive and deceptive (especially graphics which are made using spreadsheet programs). Most important advice: go always back to the source, check measurements of other researchers (making graphs reveal sometimes errors they have made) and - if possible - take measurements the instruments yourself.

Figure 6: from Adkins 1990:

Figure 56. Tenon Compression in the Lower 50 mm of the Richters Top-Joint Bores.
Cecil Adkins touched in his article about the Richters’ oboes (Adkins 1990) also the question of tenon compression. See fig. 6 where he gives schematic bore graphs of the lower 50 mm of the top joint bores six oboes. The oboes BMFA (which is HR10) and MMA (HR16) probably have some tenon compression, but not very much. In a table on p. 94 the tenon contractions are given for 21 oboes; the degree of compression is given by Adkins as a number, from 0 to 10, which correspond with 0 to 0.3 mm. On p. 94 of his article he suggests that there is the possibility that the compressed area might be the result of something other than tenon pressure. In oboe HR11, an instrument whose bore was not measured by me, he saw active tool marks in the 30 to 50 mm area. The chambering which left these tool marks could have been done with a spoon shaped reamer, such as depicted by Diderot. Has Hendrik Richters made some bore corrections while tuning the instrument? I myself have not seen such tool marks: in most oboes by Richters and Rijkstijn are the bores very regular and smooth.

Comparing graphs

By using graph paper that is not too thick, it is possible to compare the graphs by superimposing the papers and holding them against a light. It is a simple technique, but it gives for the upper and middle joints a lot of information which is much more difficult to obtain when you use statistical methods. For instance: the bores of the middle joints of HR2 and HR9 are very much identical, but with a shift of 30 mm, with the result that the bore of the middle joint of H2 is in the top half about 1 mm wider. Similar differences can be seen between the oboes HR9 and HR18 and HR9 and HR27 (see fig. 7).

Why did Hendrik Richters do this? For the upper joints of the same oboes there is no such a shift. But can we conclude that one long reamer was used for the middle joints?

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**Fig. 7**: The bore profiles of HR9 and HR27. The joints of HR9 are on cross section rather oval, the lines in the graphic connect the minimum and maximum depth (length) for each of the bore gauges (which were used with diameter steps of 0.2 mm).
Superimposing graphs is the best way to discover similarities or differences in bore profiles, such as the conicity of (parts of) the bores. But for the bell bores is the method of superimposing not so enlightening, this because of the different scale of these graphs: the lines come often very close and only big differences in design will be revealed (see fig. 8, in which two oboes in Richters style have some deviating bell bore profiles). The variations in the bell bore profiles are caused by the way they were made: not by using reamers with fixed dimensions, but by turning on a lathe. These differences in the bell bores are also acoustically not important: making the bore of the bell (for instance) 0.5 mm wider does hardly change the sound and pitch of the tones, whereas in the top joint the same 0.5 mm makes a huge difference.

Fig. 8: bell bore profiles (from Adkins 1990, fig. 66). MMA = HR16; HGM 624 = FR2; BMI = HR12; BWM = RS5; HGM 436 = HR2; HGM 5-x = RS3; HGM 286 = HR1.

Apart from the scale of the graphs there is another issue: the accuracy of the measurements. Not in the sense of how precise each assessment of an internal diameter is, but with what diameter or length intervals the measurements are taken (see also the remarks I have made to figure 5). The method I mostly use is measuring the length (or depth) in the bore where a gauge with a specific diameter touches the wall of the bore. For the top and middle joints of the most important or rare oboes in the collection of the Gemeentemuseum in The Hague I used diameter intervals of 0.1 mm. For other instruments intervals of 0.2 mm were used (and of 0.1 mm for the interstices). For oboes in other collections, where there was often not much time for taking measurements, I have used sometimes intervals of 0.5 mm: enough to have an approximate impression of the bore profiles, but surely not enough to assess smaller differences and peculiarities.

An example: the bore of oboe HR2 was measured with diameter intervals of 0.2 mm; for the bore of the bell of that instrument the following diameters were choosen: 19.3*, 19.4, 19.5, 20.0, 21, 22, 24, 28, 32, 36 and 42mm. The bell rim and the widest point ca. 10 behind that rim were measured separately (42.9 and 47.7 mm).

* There is an error in the catalogue from 1997: the smallest diameter of the bell bore is not 18.3, but 19.3 mm.
About statistical technics

In his article from 1990 Adkins compares the bores of the Richters oboes by resorting to standard deviation, a term from mathematical statistics. As far as I was able to determine, Adkins adopted the following procedure: every 10 mm he determined the diameter of an oboe joint's bore, beginning at the narrowest place in that bore. This yielded a series of numbers which he compared (correlated) with a similarly obtained series from the same joint of a different oboe. He probably took then the difference between each pair of numbers to use in a new series that was processed statistically. In this manner the corresponding joints of two oboes were compared with one another; the closer their resemblance, the smaller the difference in the diameter of the bore and the smaller the value of the standard deviation calculated by Adkins. His conclusion is that the bores of the oboes by Hendrik and Fredrik Richters that he examined bear a statistically and demonstrably closer likeness to each other than is the case of instruments by, say, Beukers, Haka, Steenbergen and Terton, the bores of whose oboes (chosen at random) he compared in pairs each time.

Adkins does put the use of standard deviations into perspective on p. 91 of his article:

'The use of standard deviations of the bore segments simplifies the comparison of the amount of divergence in bore congruity throughout the length of the instruments; however, the effects of these differences on the pitch and tone of the several instruments that have been played are not obvious, since there has been no opportunity to bring them together for extensive testing.'

Adkins goes on to conclude: 'The consistency of design and dimension in the upper segments suggests that the concept of the top-joint bore was well established in the minds of the Richters-brothers, and that they found little in its variations to cause problems. Further, the use of multiple reamers gives this bore section the kind of arch (i.e. parabolic profile) that produced the full tone and powerful low register preferred by many northern eighteenth- and nineteenth-century makers. If these reamers had been used simply to chamber the top segment for the adjustment of certain pitches, timbres, or ease of speech, one would expect the same sort of variation between the intervals of the arches that is found in the rest of the instrument where such techniques are known to have been applied. Indeed, it seems logical to conclude that the bore variations in the two lower segments of the oboes directly relate to voicing corrections needed because of the lack of precision in the manufacture of the top joints.'

. . . On which I comment: Adkins combines a variety of interesting aspects here, such as the accuracy with which old oboe makers worked, the sound-concept of the oboes and the technique of bore-correction. In that light, his conclusion that makers had a clear-cut idea of the upper-section bores, and that bore corrections were still subsequently needed is paradoxical. The question is whether these corrections were actually carried out on the Richters oboes, seeing that the bore profiles of most instruments pursue a very regular parabolic course, with hardly any variation in the smoothness of the bore walls.

We observe a problem in the use of the standard deviation method described above as a means of comparing two bores with virtually identical profiles (and conicity) but slightly different dimensions. This is because such bores display the same or even bigger differences in standard deviation than two bores whose dimensions do not appreciably differ but do not have the same conicity either. In the first case the same reamers could have been used; in the second case this is improbable. Adkins points out the problem of 'shifted bores' (fig. 51 in his article), when the reamer is inserted further into one instrument than another. The conclusion is that even when the bores of two instruments are not related in terms of absolute dimensions, the maker did use the same reamer(s). All this is immediately apparent when the bore diagrams are superimposed, showing where bores are identical and where they differ and, for instance, where the top-joint passage (interstice) is.
Some observations

Comparing the graphs of a group of 25 oboes is a useful method of research, but it is a problem where to start. The outcomes of the observations are rapidly becoming confusing, there is so much to see. A systematical research is required, concentrating on some clearly defined aspects. I selected the following questions (as explained above, only the bore profiles of the top and middle joints are taken in account in comparing the graphs):

a- Are there oboes or oboe joints with identical bore profiles?
b- Is it possible to establish how many reamers were used for each oboe joint?
c- About divergent (parts of) bore profiles: can they be explained?
d- Are there notable differences in the bore profiles of the oboes of Hendrik and Fredrik Richters?
e- What is the relation between the oboes in Richters-style and by Rijkstijn with the instruments of Hendrik and Fredrik Richters?

Question (a)
- There are no Richters oboes with completely identical bore profiles for all three joints. This corresponds with the observation (see part 5 of this series) that there are no two oboes with exactly the same length of the joints - nor (see part 3) with exactly the same execution of the exterior profiles and embellishments. There are no historical records that Hendrik and Fredrik Richters sold oboes as matching pairs, nor I have seen records in sales or inventories of such pairs (see Bouterse 2005 par. 4.21 and Appendix B for more information about these sales and inventories).
- There are oboes with identical or almost identical bores of the top joints (the counter bores may differ, see below). For instance RH1, RH3, RH4 and RH6. The bore of this part of RH18 is also almost identical, but with a ‘horizontal shift’ of circa 5 mm (HR18 has a slightly wider bore). This is an indication that for these oboe parts only one single reamer has been used.
- RH1 and RH6 have also much identical bores in the interstices and counter bores, but RH4 is here quite different. Within the group of upper joint of these oboes mentioned above, there are, however, regularly differences in the profiles of the counter bores and interstices. Sometimes these differences are caused by reamers that were put further in: for instance between HR1 and HR9, where the minimum diameter of the interstice of HR9 is longer, because the reamer for the fingerhole section in HR1 is circa 10 mm put further in the bore. But minimum and maximum diameters and conicity vary sometimes much more. There might be an easy explanation for that: counter bores could have been adapted by the players (or by the oboe maker) according to the shape of their preferred staples. But this explanation is perhaps too simple, because I have no further proofs of such adaptations.

Questions (b) and (c)
- There are some oboes with identical or almost identical bores of the top joints, the counter bores may differ, see below). For instance RH1, RH3, RH4 and RH6. The bore of this part of RH18 is also almost identical, but with a ‘horizontal shift’ of circa 5 mm (HR18 has a slightly wider bore). This is an indication that for these oboe parts only one single reamer has been used.
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- There are some oboes with differences in the bore profiles of the top joints, which differences are not easy to explain. In Part 2 of this series (Comm. 2011) is the boxwood oboe HR27 presented. There is much the same profile when the graph of the top joint is superimposed on that of HR9, but between L150 and L200 there is a huge difference. HR27 is here (the section which includes the interstice) much narrower, see fig. 7. The section of the bore between fingerhole 1 and the interstice is very important for the quality of several tones, and I suppose that the oboe makers 300 years ago must have known that very well. Hendrik Richters must have used here different drills or reamers. Apart from the question: why?, there is also the question: when? Was this an early instrument in his career and decided later to make wider top joint bores? Or was this just a late instrument, when he was using drills or reamers which had become a bit smaller in diameter, the result of many sharpenings?
- The middle joints show also variations in bore profiles. Some graphs have a regular parabolic shape: from the lower end towards the socket at the top with gradually stronger conicity. Other oboes, such as HR1 or HR27 (see fig. 7) there are two sections: a steeper one at the top (with the fingerholes 4 to 6), and a flatter one at the lower one (with the holes for the small and great key). Both types of bore profile can be made with only one, or with two or more reamers. There is sometimes between two oboe bores an obvious ‘horizontal shift’ (a reamer which is put further in the bore) over the whole length of the middle joint, which can be seen as an indication that only one reamer has been used. But between other instruments there is mainly a difference in dimensions of the ‘flat’ (wider) section. Tenon compression is one possibility for that, the use of different reamers the other.

If Hendrik and Fredrik Richters had used systematically two reamers for the middle joints of their oboes, I should have expect clearer sections in the bore profiles, and also some shifts between two sections (when one reamer was put further in the bore, and the other one not).

![Figure 9](image.png)

**Question (d)**

- Figure 9 shows the bore graphs of three oboes, two by Fredrik and one by Hendrik Richters. It is clear for me that the bore profiles are related, but the question is how closely. The top joint bore of FR1 is wider than FR4, especially from L 110 onwards including the interstice. These bores must have been made with different reamers or combinations of reamers. The differences between FR4 and HR1 are smaller: the same reamer(s) could have been used. The differences between FR1 and FR4 for the middle joint bores are small and can be explained by shrinking of the wood, tenon contractions or even by the effects of polishing the wood after reaming. But how vigorously was that done? The German restorer Rainer Weber (who died in February last year) didn’t mention it in his restoration report of HR10 (Zur Restaurierung von Holzblasinstrumenten aus der Sammlung von Dr. Josef Zimmermann im Bonner Beethoven-Haus. Celle 1993.) that this instrument was polished, but he found traces of polishing slate (or comparable stuff) when he did microscope research in the bores of other
woodwind instruments. HR1 is in the middle joint wider between L80 and 130, at the same time the bore is also markedly ‘flat’ between L10 and L90. It is not quite clear what the acoustical effect is of that bore profile: it is hardly possible assess deviations in bore profiles separately from all other parameters (for instance wall thickness). As a matter of fact, I wasn’t able to find systematic differences between the bores of the oboes by the brothers Fredrik and Hendrik Richters. I do not know how closely they have worked together; there is also the complication that two persons with the name Fredrik Richters have separately made and stamped oboes. The other Fredrik was the son of an older brother (Johannes Richters) and was in 1731 apprenticed to his uncle Fredrik (Hendrik Richters died on October 20 1727). It is possible that the oboe FR2 was made by this second Fredrik, because of the different stamp with ‘IS’ below the name Richters.

**Question (e): The oboes in Richters style**
- RS1: this oboe is a very beautiful instrument in brown stained boxwood, with silver mounts and chain and engraved silver keys, designed and turned completely in the Richters-style. The instrument, which is not stamped with maker’s marks has an inscription on c-key with the year 1744. It is also unlikely that this oboe was made by Hendrik Richters. The bore of the top joint comes close to that of FR2. In the middle joint is RS1 slightly wider between L80 and 120. The bore of the middle joint is also much alike those of FR1 and FR4.
- RS2: this oboe has a rather irregular bore, very wide in the interstice. I doubt that this instrument was made in the workshop of one of the Richters brothers.
- RS3: the centre joint and bell of RS3 are possibly made of a light-coloured wood varnished and stained in a dark colour. The upper joint is of real ebony and has some elements of the turnery which are slightly unconventional and do suppose that this joint was not originally made for this instrument. The bore of the middle joint resembles much of that of HR18, but the very strong tenon compression is strange.
- RS4: I have no information about the bore profiles of this instrument.
- RS5: this oboe with its gorgeous silver keys and mounts has an upper joint which bore profile is - with some horizontal shift - not unlike that of HR3 and HR4. The counter bore at the top is a bit strange, different in shape from all other oboes I have seen (fig. 12). The bore of the middle joint is in the lower part rather wide, more or less like HR27, but there are also similarities with FR3 and FR4. It is difficult to say who made this oboe: Hendrik, Fredrik-1 or Fredrik-2 Richters.
- RS6: this is an enigmatic oboe. It is made of dark brown stained boxwood, with silver keys and rings. The ring at the bell rim has...
an inscription (Klaas Gerbens), probably the name of the (first) owner of the instrument and further the year Anno 1753 (fig. 11). The oboe is made in the Richters style, but there are some deviating details, of which is the touch of the C-key the most obvious. It is made in the shape of a d#-key (fig. 10), and is thus too small to be used properly.

The bore of the top joint if RS6 is a bit irregular (fig. 12), but that is maybe caused by a bore correction. At L130 is the diameter of the bore 8.5 mm, that is about 0.5 wider than most other oboes in this article. The middle joint has a strong tenon compression (from L0 to bout L40). The family name Gerbens was common in Friesland. Maybe that the oboe was made by a woodwind maker who lived in this province.

**Question (e): the oboes stamped Rijkstijn**

Nothing is known about a woodwind maker with the name H.Rykstyn (in modern Dutch spelling: H.Rijkstijn). I have not found records of this familyname in the Netherlands. Maybe there is a relation to the name Reichstein, which occur in Poland and Germany.

There are two oboes with the stamp of Rijkstijn, both made in the style of Richters, including the stamp with a clover leaf. All the joints of RS1 (which is made of boxwood) are distinctly stamped H.RYKSTYN in a flat curve, no scroll, exactly in the same style as the stamps of Hendrik and Fredrik Richters. Stamped below the name is a 4.0 mm tall clover leaf,
its stalk bending towards the right. This stamp looks very much like those used by Hendrik and Fredrik Richters, but it is in mirror image. The names stamped on RS2 (which is made of ebony and is - apart from the fingerholes 5 and 6 - preserved very well) are anything but distinct, being blurred and crumbling at the edges. Adkins wrote that the American oboe-maker Mary Kirkpatrick reported a Richters stamp over which Rijkstijn's was superimposed. However, personal inspection revealed no trace whatsoever of a Richters stamp. Because the clover leaf clearly differs from the one found on the Richters brothers' stamps but does resemble the clover leaf on Rijkstijn's oboe no. 1, there can be no doubt as to the instrument's provenance, and both Richters can be ruled out as its makers.

Concerning the bore profiles of the Rijkstijn oboes: in the top joints the bores between L60 and 160 are almost identical (see fig. 13), but Rijkstijn-2 is wider between L0 and L60, and the counter bores differ very much. The bores of the middle joints are - with some shift - not far apart in the section of the fingerholes 4 to 6, but the graphs do not give enough information for drawing conclusions about the number of reamers that were used. There is much similarity with the oboes by Hendrik and Fredrik Richters. But that is also because there are these variations in their instruments.

The oboe Rijkstijn-1 comes from the collection of the Frysk Museum in Leeuwarden, the capital of the province Friesland. It has an inscription on the bell rim, similar to RS6, again with a name and a date: *Doue de Boer, Anno 1761*. And just as with RS6 I will consider the possibility that this oboe was made in Friesland, and that Rijkstijn could have lived there. But did he learn the profession of making oboes in the Richters workshop in Amsterdam, or was he just copying their instruments? If that is the case, he did it very well. Maybe he had problems stamping his name on the hard ebony wood of oboe no. 2, but apart from that and the problems with the lower fingerholes (which are maybe widened in a very sloppy way by a player), it is a very fine and luxuriously executed oboe.

![Bore profiles of two oboes by Rijkstijn](image)
Conclusions
The execution of many oboes by Richters and Rijkstijn is very special, with luxuriously and
nicely finished materials and a high quality of the turned profiles. The bore profiles and tone-
holes are also nicely finished as well, but these elements do not stand out from the (many)
oboos from other makers. The acoustical concept of the oboos is also not extraordinary and
can be described as ‘middle of the road’, the Richters brothers always playing safe without the
introduction of novel ideas or experiments. There are differences for the lengths of the joints,
the bore profiles and the tone-holes, but these differences are not big, they are maybe
accidental or can be explained as adaptations or minor corrections. Sometimes these differ-
ences are rather enigmatic: for instance why has HR27 so much wider a bore in the middle
joint than HR9? The much narrower section just before the interstice of HR27 is also
puzzling.

The only way to find an answer to these questions is making exact copies of both
instruments and then exchanging the parts. Or even better: to make several copies of the
joints with variations in the bore profile, and try these out on the original oboe (which is
maybe allowed on HR27). But you must be also a good player, who has experience on
several baroque oboos and who knows how to assess the differences between the
instruments, and who has several combinations of reeds and staples at his or her disposal. I
believe that’s the only way to discover the secrets of these variations in bore profiles (and
other parameters).

The question is how the Richters brothers made their oboes: strictly after the wishes of the
player who ordered an instrument, or in a more free way, where they used a standard concept
which was perhaps flexible enough to make some adaptations afterwards, if necessary.

Fig. 14: The fingerholes of HR9 (this oboe is made from boxwood), a bit rounded around the
edges but with hardly any wear on the wood around the holes.

Makers (and players) of modern woodwinds are very critical and strict about the tuning of
their instruments, which must be perfect for all tones, using standard fingerings. But players
of baroque woodwinds must have (or ought to have) a certain amount of flexibility: some-
times a tone needs a bit of correction, for instance to make the sound better (for instance using the small key to improve the sound of the f1), or to make a difference between enharmonic tones such as g-sharp and a-flat. Baroque woodwinds are therefore often not so much good or bad, it is better to say that they are more or less flexible, or suitable for your way of playing, or they are more or less suitable for a specific kind of music.

Sometimes an oboe plays more easily in keys with flat tones (e-flat, f1 and b-flat), while another will more easily play notes such as d-sharp and f-sharp.

In part 5 of this series I mentioned the aspect of resistance, which allows a player to aim for a precise and well-balanced attack, whether he is playing legato or piano, staccato or louder. An instrument's condition may also affect its playing. Two oboes on my research (Van Heerde's no. 13 in The Hague and Terton's no. 10 in Stockholm,) show traces of intensive use in the past (wear at the fingerholes, repaired cracks); perhaps this accounts for their very fine playing qualities. I have not seen traces of such intensive use of the oboes by (or in the style of) Richters and Rijkstijn. Several of these instruments are damaged, but that may be have other causes, such as preservation in bad conditions.

**Some final remarks**

Oboes are musical instruments, made with the purpose to be used for playing music. That includes also the instruments of, or in the style of, Richters and Rijkstijn, with their posh embellishments. Are their oboes ‘instruments beyond compare’, or just cleverly made ‘status symbols’ for rich people, which by chance, were perhaps good players as well? However it might be, we can learn a great deal from these oboes, just because they were carefully designed and finished, and because there are still so many of them. We also have a lot data about these oboes, but grasping their playing qualities is difficult. That is always a matter of comparing with other instruments, copies and original ones. One person playing one original oboe with only one reed and staple gives only very restricted information.

Assessing the qualities of the Richters oboes means also that you have to compare them with oboes by other makers, in the first place from Amsterdam but also from other major European workshops. And there is a problem: it is very difficult to get sufficient and systematical information about those instruments. Each drawing with measurements has its limitations, as I discovered again in the research for this article.

One of the questions I meet in investigating woodwind instruments is how elaborate and accurate specific measurements have to be, especially of the bore profiles and tone-holes. What do I want to know? Too exhaustive information may hamper a good survey of the way of how the oboes were made. For making a copy: do you want to, to make an exact copy, or one ‘in the style of’? Is it perhaps enough to take measurements with the same accuracy (or lack of it) as Richters and Rijkstijn applied in making their instruments. One of their secrets was that they exactly knew where they could afford some liberties, and where to be very precise, or make small changes in the acoustical design necessary to meet the needs or wishes of the players. And that is exactly what we have to learn today, to make better instruments.