FOMRHI Quarterly

BULLETIN 43
Bulletin Supplement
Plans: Edinburgh University collection
Plans and books: S.A.M.I., Paris
Plan: Eerens traverso
Plan: Vienna quint bass recorder
The Harley Foundation, Welbeck

COMMUNICATIONS

REVIEWS: The Sound of the Fortepiano! A Discography, by A. Basard;
Musical Instruments Through The Ages, ed M. Hamber & L. Stanners;
Music for Oboe 1650-1800, by B. Haynes
Maultrommel..., ed. F. Crane;
A Treatise on violin playing, by L. Mozart, trans. E. Knocker (paperback reissue);
Un Musee Aujourd'hui (exhibition cat.);
The Art of Fingering the Harpsichord, by N. Pasquali (facs. of 1757 print);
Musical and Poetical Relicks of the Welsh Bards, by E. Jones (facs. of 1784 print)

Changes at Prague
Musical Instruments Through The Ages, ed M. Hamber & L. Stanners;
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Are computers anything for us?

On computers, typewriters etc.

A matter of temperament

The proportional compass

A simple and cheap hygrometer

Digital and other calipers

Modification and sharpening of twist drills

Dehumidifiers

... Chitarra battente

Vihuela

An experimental method

On extended lutes

Neapolitan mandolins, wire strengths and violin stringing

Round bridges: the geometry of clearance angles

Flat bridges II: focus on the lira da braccio

Lyra and other viols that played from tablature

(Keyboard instrument classification)

Double, double, toil and trouble

Enquiries

Little harpsichord plan, asked for by Vojnic (Comm 685)

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On the skill of the Nurnberg brass instrument makers

(The pitches of flutes)

Building and playing a nahr

A peculiar Fornari oboe

FELLOWSHIP OF MAKERS AND RESEARCHERS OF HISTORICAL INSTRUMENTS
Hon. Sec. J. Montagu, c/o Faculty of Music, St. Aldate's, Oxford OX1 1DB, U.K.
I thought that the type size last time was too small, so this is one size larger, and we'll see if it's better. It should be much the same as my typewriter at the Faculty (what you've been used to for the last five years or so), whereas the last Bull was the same as my own typewriter, what you used to get before I came to Oxford and what a lot of you used to complain about. Also I have, I hope, found a source of carbon ribbons, which should get a sharper print if they arrive before I've finished writing all this. Maggie wrote to me and said why didn't I get a decent typewriter like their new one instead of this machine, and I must say that her type (see the Accounts below and a Comm from her in this Q) is much better than this, but this machine will do things that hers won't (whether this year's List of Members will be on database or by hand as usual will depend on whether I can learn to use the database in time) and as yet I can't afford to buy a better printer than the one that comes packaged with the Amstrad.

MAILING LIST: My computer, being a cheapy, can cope with all the Western European accents, though it's infuriating that it'll put in an acute accent and wait to have a vowel put under it, but it won't wait for a consonant and thus can't cope with anything beyond the Danube. Djilda's machine, being an expensive one, can't cope with anything except English (or maybe American) and so our apologies to all of you who have had accents left off your names and addresses on the envelopes, and please continue to forgive us for this discourtesy.

More seriously, please forgive the considerable chaos caused by a lot of printing errors on the January envelopes. The print-out was not properly proof-read (there were a lot of strong words and rude remarks about this), but I hope that this quarter's will be better, and that we shall continue to improve on this. There is a considerable saving on time and of your money in having computer-printed labels (money because we can't find anyone to do it free - labelling several hundred envelopes and then stuffing them is quite a job - and so we pay a fairly low rate to one of NRI's helpers to do the job, and the quicker it's done the less it costs), so please be patient while they get themselves sorted out.

LIST OF MEMBERS: The 1986 List of Members comes with this Q. Please check your own entry and tell me whether it's wrong in any respect, including the various cross-references to instrument or location. I try to get it right, but it's never yet been 100% and it probably never will be. It does represent a lot of work, so please make it worthwhile by using it. Take it with you when you travel and get in touch with colleagues in other places; write to people whose interests are similar to yours. We are a Fellowship, and a Fellowship should be an association of friends and colleagues and this is why I spend so much time on the List. I'm always surprised to get phone
calls from foreign visitors who want an address and who've left their list at home.

FoMRHI Accounts for 1985

<table>
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Maggie added some comments, which I'm expanding on somewhat. One was that the total income from 1985 subscription renewals was £2761, whereas the basic expenditure for that year excluding postage was £3500 (but bear in mind that we print something like 100 extra of each Q which will be sold as back numbers to future new members). Nevertheless, even including this future sale of spare Qs, the cost for the year is approximately £5 per member, including that future 100 new members. The postage rates at present are approximately, for the four mailings that you receive:

- Inland: 72p total: £5.72
- Overseas by surface: 92p total: £5.92
- Airmail to Europe: £2.12 total: £7.12
- Airmail to America, Africa etc: £3.44 total: £8.44
- Airmail to Australasia & Japan: £3.84 total: £8.84

So you can see that except for airmail to Europe, we are running at a loss (perhaps I should remind you that we decided a long time ago that for simplicity we would have only one airmail rate and that we would make a small profit on Europe and a small loss on Australia, New Zealand and the Far East, hoping that the two would more or less balance; this they do, or at least near enough).
Her second comment is that we have an accumulated surplus, and should we use that to hold the subscription for another year? We do need a surplus because, as you can see, the print bill is about £800 a quarter and the postage bill is about £250, and there is always the risk of running out of cash between one subscription year and the next. Her inclination, and mine also, is to hold the subscription at the present rate for one more year, but we'll have to see how we go and the Fellows will have to decide. We lost a lot of members at the beginning of 1985, and while we picked up many new ones at the end of that year at the Horticultural Hall, if we lose too many this year (not all renewals may be in yet, but we do always lose some each year, mostly those who joined and after a year decided that FoMRHI isn't really for them, but some, too, who get defeated by the rising cost of living and have to cut down somewhere), then we shall have to put up the sub for 1987.

This, perhaps I may add, is why we have always resisted the requests that some of you make for a bankers' order or for a three, five or more year subscription. I know that it would make things easier for you, but we are held to ransom by our printer (whose rates always have been and remain very reasonable; he's held to ransom by the paper suppliers and so on) and by the Post Office whose increases can be sudden and drastic. We can never tell from one year to the next how we are going to go. You can help to some extent by suggesting to friends and colleagues that they should join us, and also by persuading other friends and colleagues not to leave us. However, since I believe, as you know, that dissemination of information is our main purpose, even if they won't join and even if they do leave, go on letting them read your copies!

OBITUARY: You will be sorry to hear that Wilfred Allwood died in March. I had a very nice letter from Mrs Allwood saying how much he had always enjoyed the Qs and how much pleasure he got from his instrument making.

FURTHER TO: Bull.39, p.4: Raúl Orlando Pérez writes: "In response to your question to me about an uninterrupted tradition on vihuelas in this country [Argentina], unfortunately I cannot help very much. At least to my knowledge there is not any traces of that tradition. Some makers before me have made isolated vihuela like instruments, but always in the way of the Paris vihuela. In a local (folk) form the term vihuela subsisted for guitar."

JM adds that I have seen photographs of folk instruments that looked, from the front, very like vihuelas, that is to say that they had patterns, which looked like small sound holes, at the corners and so on, but this may of course just have been decorative features of guitars, and they may not have resembled vihuelas in other respects. This was a series of slides which came with a set of records of Folklore Musical y Musica Folklorica Argentina which I was given by a fellow ethnomusicologist many years ago. They may have been from a different area of the country, and anyway they must be over thirty years old. I should add that Raul apologises for so
late a reply, but things take six months to reach him, even by air.

Comm. 639: Alec Loretto writes: "Charles Stroom describes a recorder step measuring device, an idea for which he gives me credit. May I add that the idea came to me from another FoMRHI member, Josep Bartomeus - just one of the many ideas received from my ingenious students!"

Bull. 41, p.2: Lynette Hunter, who was then a Lost Member, writes that, while living in London, she was given the wrong information about her address-to-be, and that some of the confusion may have been caused by her name, which is Lynda Jeanette Hunter "but I'm known to all as 'Lynette'". I'm glad that we've found her and that she's getting the Qs OK now.

Bull. 42, p.3: Several people have said that they'd vote for accepting Qs from non-members, and nobody has written against it. I think, now, that they're probably right - after all, why refuse a free gift?

Bull. 42, p.4 (& Bull. 41, p.6): We thought that we had a volunteer to get a Thames Valley Early Music Forum off the ground, but unfortunately she has thought better (or worse) of it. Any volunteers? There is a volunteer for London, so they should be OK, and presumably the extent of the link-up between the two is open for general discussion, but it was fairly clear from things said at the Horticultural Hall and elsewhere that there should be a separate centre somewhere between the Chilterns and the Cotswolds. I can wangle use of the Faculty for a meeting-place, but I have no time to do any organising, not on top of running the Bate and FoMRHI. Any offers? I have an initial list of names here who might be interested (from the Horticultural Hall Exhibition), so to start with it's a matter of sending something to them.

Bull. 42, p.7: The Administrator of The Lute Society has moved, so if you want to get in touch with him, please note his new address: Stephen Haynes, 26B Hindes Road, Harrow, Middx HA1 1SL (tel: 01-863 8151).

Comm. 671 & 646: Luis Esteves Pereira has sent some notes additional to Eph's and mine on New Grove DOMI. He hasn't got a copy of DOMI, so his notes are on Portuguese material. One correction to what he has sent: there is nothing wrong with the spelling of Banjolin; this a small banjo set up and tuned as a mandoline, ie with a small open-backed drum as a body. The Bandolim is a different variant of the mandolin, and is described in DOMI:

**Banjo** - The banjo was known, in Portugal, only in the XXth century, imported from the jass-bands of the south of the States. Also, as far as I know, the bandore is not a native of Portuguese instrument but imported from elsewhere.

**Banjolin** - The spelling is wrong. This instrument built in Portugal for long, is named Bandolim, is a version of the Italian mandoline. Strung with four double courses. Flat back like the Portuguese guitar.
Bird instruments - Many Portuguese organs have a bird stop, usually named "rouxinol" (nightingale) or "passarinhos" (little birds). Two, three or four high pitched inverted pipes blowing into a small tin box filled with water.

Cuckoo - The Portuguese "cucu" is a pear shaped instrument, smaller than the ocarina, also made of chalk and with two holes to obtain the ou-ou effect.

Corneta - This is a stop of Portuguese organs, from 3 to 8 ranks, always including the 17th. In the Portuguese organs there are four types of "Cornetas":
Corneta Imperial - Open fundamental (8'), stopped fundamental, 8ve, 12th, 15th, 17th, 19th, 22nd.
Corneta Real - as above, without the two fundamentals (8'), sometimes without the 22nd.
Corneta Inglesa - only 15th, 17th and 19th.
Cornetilha - an octave higher, thus 22nd, 24th and 26th.
As the Portuguese organs have divided ranks, the Corneta belongs, always, to the right hand (treble).

Cornetim - This is the name used, until the last century, for the present "French "trompette de Orchestre". Now we write trompeta,"tou court".

Ctesibius - It seems to me that this entry should come in the letter K, or am I wrong?

Cimbala - More commonly written Cimbala. It is a high pitched mixture used in the Portuguese organs, usually starting at the 22nd, with two to five ranks, repeating at the c#’s and/or f#’s, according the builders.

Comm. 678 & 677 & 655: Nick Odell writes:

Gary Karp has given us plenty to think about. Our image may be of quill pens and parchment but surely our potential to be a more effective organisation lies in IT.
At the moment I know I do not use my computer as creatively as I could, but if we are planning for the near future we need to start now. May I add a couple of suggestions to the debate?

First that the 1987 members list should include categories for relevant databases maintained and the baud rate & protocol to access them. I suspect that the 1987 list may have fewer than ten of these entries, but by 1990 this will be a substantial and significant part of our communication.

Second, Eph is rightly concerned that if people start sending comms down the wire he may end up with more work reformatting and editing than he has at present. I would suggest that we quickly adopt a standard for electronic comms - whether sent on disc or by phone - much as we do on paper. One possibility would be a formatting standard for spooled text files but even better for Eph - and I'm confident he will correct me - would be totally unformatted text files except for carriage returns at the end of each paragraph. By gathering all these unformatted files together and setting his own parameters, most of each Q could be printed in a uniform typeface, paged and indexed with no annoying corners to fill.
Same Comms: Nicolas Meeus wrote to Cary and sent me a copy, which I'm not sure is for publication. He is interested in the idea but has the problem, which may affect others of you, that modems are not easy to get hold of in Belgium, where he lives, partly because they come free in France, and if they can be found they are very expensive and are only permitted to run on the most expensive computers. If any of the rest of you in Belgium, and maybe in Holland, are interested and are having the same problems, it might be worth getting in touch with Nicolas and sorting things out jointly; alternatively, if any of you have solved the problems, please help him.

Maggie Lyndon-Jones is less keen on the idea, and her letter, being a full page, can better stand as a separate Comm, so see elsewhere in this Q for it.

I'm holding back at the moment because the whole University telephone network is being rewired, and they are including computer access cables in the new set-up. This means, we think, that we should not need a modem to access the main-frame and run communication programmes, which will save either me or FoMRHI quite a lot of money. Whether this will be true or not, we'll find out when it's all done (you can imagine the yes you can / no you can't dialogue that's going on about all sorts of details at the moment) but that was not going to be until the beginning of the next academic year, and now is said not to be till the end of this calendar year (ever met a contractor who could hold to a date?).

Comm. 681: When John Barnes sent this Comm on Early Pianos at Ipswich, he also mentioned in his covering letter a few other instruments, which I meant to put in the last Bulletin, but forgot. So, with my apologies, here they are:

They have a few non-keyboard instruments in their store, and I don't know whether you already know about them. Those I saw included a 6-key bassoon by Gramf..tey, Pall Mall, London, a 6-string guitar-like hybrid by a Wornum, Wigmore St., a serpent by Key, a boxwood clarinet, about 12 keys, also by Key and a bugle. The latter, R 1936-137 has 3 rotary valves operated by keys via a thread, has imitation slides which don't detach and is probably a cheap toy. There is also a large dulcimer, looking about 1910 (no W380) with 15 choirs of 4 strings each, a double-bass, a cello and a post-horn.

Comm. 686: Andrew Bashford asked for references to Marianne Bröcker's book on the hurdy-gurdy. Uta Henning sent the references for both editions:

OUR NAME: You may remember that a while back, when we were discussing an alternative to Makers and Restorers of H..I., when we settled on Researchers, there was a grammatical problem which we never settled; one can be a restorer of but a researcher on, in, or into but not of. We never resolved this problem, and clearly I'm not the only one who does find it a problem. Nick Odell writes:

I have a confession to make: whenever I have to mention FoMRHI in full, in public, I call us Makers and Restorers not Researchers, because I just cannot bring myself to use the awful grammar wot is our title. Please has someone somewhere a sensible solution? This question came up a while ago but was never resolved as I recall.

COMPUTERS IN MUSEUMS: You will find elsewhere in this Q a Comm from Cary Karp titled 'Are Computers Anything for Us?'. This is reprinted from the latest CINCIM NEWSLETTER by the kind permission of Héléne La Rue, their editor. CINCIM stands for Comité International des Musées et Collections des Instruments de Musique and is the international organisation of musical instrument museum curators and is part of the International Council of Museums (ICOM). Cary and I thought that it would be useful for those of you who use museums to know what is being discussed there, as well as for those of us who work in the museums and who therefore see the CINCIM NEWSLETTER, and Héléne and her fellow officers agreed, hence the somewhat unusual all-but simultaneous publication there and here, instead of waiting a few months, for which our thanks.

PLANS: Lists from Edinburgh and Paris elsewhere in this Q.

Ture Bergström writes:

I can offer some measurements for sale from a trip to Italy and Austria some years ago. Since I had no scholarship and had to pay all expenses myself they will be rather expensive, i.e. Dkr. 100 (=9 £) for one instrument. The instruments are:

Kerano, Museo Civico 6846 Jörn Wier Bass crumhorn with extension keys
6647 " " alto crumhorn
6648 " " bass crumhorn
6649 " " tenor crumhorn

Vienna, Kunsthistorisches Museum 678 Jörn Wier great bass crumhorn
679 " " bass crumhorn with extension
116 great bass recorder in B flat
8517 soprano recorder in c"
8518 do.

Verona, Accademia Filarmonica 13245 (more measurements also from 13246) great bass recorder in B flat.

JM adds that Ture sent me a couple of examples. They are on A3 paper and are not full-size finished drawings. All the
necessary details and information seem to be there, and they look quite clear enough to work from, but they are not quite the same as the plans museums publish. I'm not certain whether he meant them to appear in FoMRHIQ or not, but I'll take a chance on including the drawing for the quint-bass recorder in Vienna, no. 116, because the bore measurements are on another sheet which you'll have to get from him unless he says OK to print it in the next Q. At least this lets you see what his drawings are like. The second sheet has a detail drawing of the crook, the bore measurements and the finger hole details.

**EXHIBITIONS ABROAD:** Malcolm Rose writes:

**DOING EXHIBITIONS IN EEC COUNTRIES:** since June 1985 a new carnet, called Community Carnet, has been available from H.M. Customs & Excise. Its effect is very much the same as the ATA Carnets, but unlike them there is no fee payable and no guarantee or deposit are required. As far as I can see there are no snags, though instruments must be called commercial samples to qualify. An information booklet, *Notice 756*, is available from your area Customs & Excise office (not VAT office).

**VARNISHES, ETC:** Richard Veils has come across a modern edition of an 18th century book, *The Painters Manual of Dionysius of Fourna*, translated by Dr. Paul Hetherington and published by the Sagittarius Press, London. He says it covers all the processes of making varnishes, gilding, etc. JM points out that so do Peter and Ann Mactaggart's books, probably more reliably for us since they are writing as instrument people and are FoMRHI members; in addition, they tell you exactly where you may go wrong (e.g., burning down your workshop) and how to avoid doing so. They also give sources of supply for materials, which an 18th century book is less likely to be useful for. Their address is in the List of Members herewith, and all their books have been reviewed, very favourably, in FoMRHIQ.

**TUNERS:** Marc Champollion writes:

After my long experiences with tuners of all kinds I can only recommend Clavitune pitchmeter, either the big one with the double scale (1/4 cent) or the new small digital one. Of course it would be better not to have to set the note each time and if the showing of the needle or the digit would be more stable. The big Korg, a bit cheaper as the Digituner, has a needle and automatically shows the note played but is not accurate enough for a keyboard instrument; for a wind player it can be of great help. The only help is when you want to know if you have strung correctly your harpsichord: as the Korg shows the octave you can see if your string gives the fundamental note. So for example if you put a steel string on a G of a Couyon and a copper one on the other G, then the tuner will show the correct octave for the copper and one (or even two!) octaves too high for the steel string. If you put a brass string on a G of Taskin the wrong octave will be shown. Of course a good musician should be able to hear if the string is correct but as 90% of the harpsichords of Taskin type are not strung correctly (that is, copper in the lowest fifth or so) so it means most makers have no ears, maybe only in Germany.
WIRE STRINGS: Marc also says:

I have got a German firm which makes on order beryllium-copper wire in all desirable dimensions and breaking stresses, so I will order some, say in 0.26 - 0.28 - 0.30 - 0.32 - 0.34 - 0.36 - 0.38 - 0.40 - 0.425 - 0.45 - and with different stress say from 600 Newton/mm² to 1000 to match ideally the stress. Brass has 300 to 870 but has in modern times (since Zinc is so cheap) the tendency to become brittle as experienced makers know, the same occurs with phosphor bronze, besides it phosphor bronze hasn't such a nice sound as Brass or Be-Copper.

I'm not yet quite sure which diameters to order, I will of course try to have a sensible stepping, i.e. not arithmetical like industrial or Rose's or Gug's old system, but geometric like the old ones or Gug's new one, maybe 6%. The breaking stress would begin at 600 (Gug's 505 and Roses 550 average) and reach 1000 at 0.34 so that it is possible to string an early French harpsichord up to c' in copper; French harpsichords like Tibaut & others had a fairly short scale (32.5 + 34 cm at c") and a shortening of the scale beginning earlier in the treble than a late French, so they had often c' of 56 to 50 cm which can be strung in brass if one is ready to tune a whole tone below 440 Hz; as most customers don't want it and most makers do what most customers want when it's a matter of life or death, (to get orders, I mean) all modern "copies" are strung in iron much too early in the bass. With a stronger material (of same density) one can tune same scale higher. Perhaps one day it will be accepted to build early French harpsichords like the originals, i.e. c' 95. Perhaps with transposing device/ to 4'5. Moroney did tune the three harpsichords he used for his recording of complete Louis Couperin in 1992 but I don't know if they were strung accordingly. Anyway, these instruments are not suited for a music written 100 years or so before they were made (or remade).

For Italians and clavichords which are entirely strung in copper I say the stronger "beryllium-copper is a must if one doesn't want to burden the customer with the risk of getting most of the strings broken in the more or less near future. The best maker uses never brass but I've often heard it's not an reason enough.

But perhaps some English harpsichord/clavichord makers would like to try. The point is that it's much cheaper to order such wire (say 5 Kg per diameter, so it would be about 200 DM/Kg) but I don't need so much of course. So please write to me.

JACKS: Marc says, too, that he is "looking for good jacks, I mean 'copies', not in the usual ... standard style. Does anyone know a jack maker who is able to make jacks on order? My jacks have to be of service wood, planed, bevelled, holly tongue, 'boar' bristle, no leather pads but silent, cotton wire behind the tongues, slots for thin delrin plectra ca 0.35mm x 1.9mm, slots 1 x 5mm for dampers which are cut at a 45° angle."
QUERIES: Marc Champollion again:

Finally, does anybody have lights on early French harpsichord of the Tibaut and Lebrèche types? In the literature available (mainly Hubbard) there is pretty little on that matter. Does one know more about the French double XVII of zublin (sold to the Stuttgart museum I'm told), on the Lebrèche 1699, on the very small (5' or so) French seen at Bingham's last year? Has anyone photos of the inside of XVII. French harpsichords? (Richard/Tibaut/DesRuisseaux/Jacquet/Denis/Lebrèche etc.) The Vaudry I know, they've mad. a plan, but I'm more looking for walnut thin-cased instruments like Tibaut.

Bert van Leeuwen asks whether anyone can tell him which late 18th and early 19th century flute tutors deal with 4, 5, 6, and 8-key flutes, and whether facsimiles are available. He says that tutors which are not in English, German or Dutch aren't much use to him because he only reads those languages (unless a modern translation is available, of course).

WORKSHOPS: Dominic Gwynn sent me a two-page handout about the Harley Foundation at Welbeck, which I'll send up for Eph to put in if there is room. Briefly, they are letting workshops at reasonable rates to established craftsmen of known quality (ie no beginners). There are already two keyboard firms, Dominic and Martin Goetze making organs and Adlam & Fischer on string keyboards, so they probably wouldn't want another keyboard maker, but there might be a vacancy for other instruments. If you are interested, get in touch with Dominic and he can tell you more about it.

MUSEUM NEWS: Cary Karp says that some people are still writing to the Stockholm instrument museum as the Musikmuseet or the Musikistoriska Museum, etc, and he points out that it was in July 1981, ie nearly five years ago, that the name was changed to Staten Musiksamlingar, and that it has a box number for postal communication, not a street number. If you don't write as in our List of Members (under M for Museum), your letter won't get there.

A few accessions at the Bate Collection that may be of interest. A lateish (I'd guess c.1820) anonymous vox humana (English tenor oboe), on loan, and a couple of 10ft plus Tibetan trumpets, a gift. More information from me if you want it. Also two sets of reamers which we bought from Robert Bigio, one set for his version of our ex-Hunt Bressan treble recorder, and the other for his version of a Stanesby junior traverso (I think one of the Horniman ones, not mine).

COURSES: I have the Huisemuziek list of courses for 1986 in case anyone feels like an instrument-making holiday in Holland (and presumably in Dutch). As always, there's an enormous amount, anything from an afternoon to a long weekend. Also a lot of playing, dancing, singing, etc courses. You'll have to come here to look at it, though (or write to Bouwerskontakt in our List of Members for your own copy).
The Bate Collection Traverso Weekend for players and makers is May 24/25, with Jonathan Morgan and Mathew Dart and will cost £15 as usual (£10 to full-time students). Mathew says will any makers intending to come please bring some of their own instruments. I've not yet fixed the autumn weekend, but I will do so before the July Bull.

The Bate Collection Javanese Gamelan Summer School will be July 20-27 and costs £40 (non-residential); full-time students £30; prior booking is essential because there are only about 40 seats at a gamelan. Tutors include Alec Roth, Neil Sorrell, Joko Purwanto, Dave Posnett and Nick Gray. The Gamelan Weekend last term was a great success, and the beginners played excellently at the final concert, and the more experienced very well indeed. Again beginners are welcome as well as the experienced, but do let me know which you are when booking as this makes planning easier.

There's been no reaction to my request for suggestions for other summer schools; does this mean that there are enough already? Or is £40 non-residential too expensive? The problem with residential is that you have to plan about two years ahead in Oxford to get College space, and make definite commitments on numbers most of a year ahead, and neither I nor, I suspect, you are good at committing ourselves so far ahead.

EXHIBITIONS: The Crafts Council (12 Waterloo Place at the bottom of Lower Regent Street in London) has a dual exhibition from 4th June to 31st August of instruments from David Munrow's collection and many new instruments by makers of all sorts. Not just early instruments, though they are in the majority, chiefly because they are on the whole the more practicable for craftsmen as distinct from factories. There will be an upright piano, though, at least one modern flute, and a double horn, so not all modern instruments are factory-made. The standard of entries was, on the whole, very high, and the only disappointment was that some of our better makers didn't send in anything. Still, one realises why; it's not easy to send in something in March and still have it available till the end of August; if you've got a waiting list (or an overdraft) you can't really do this. The Exhibition will be worth a visit, though, for there is a lot of good stuff.

The Galpin Society's 40th Anniversary Exhibition will be at Sotheby's Conduit Street Gallery in London from August 11th to 22nd. There should be a lot of important instruments there, and they are aiming in particular for things from the collections of the founding members, and wherever possible for things that are not normally on show to the public. So it should certainly be worth a special trip to London. They say that there will be a catalogue, though I don't know who's going to write it; they haven't yet decided what instruments to include (ie they haven't told me yet what they want to borrow from the Bate or me, and I've a few things that came from the Founders and the Bate has a lot), which suggests that they've not left a lot of time for compiling any real catalogue as distinct from a hand list.
FESTIVALS: I've been sent a brochure for the Ryedale Festival which runs from July 26th to August 17th. If you're in that part of Yorkshire there's a lot of early music there. For more information, write to Ryedale House, Malton, N.Yorks. Several of our members are likely to be performing in the various ensembles, but the only one named is Harvey Hope who is giving a lecture recital on some of his collection of early guitars.

Just in the nick of time (one of the advantages of this machine is that one can insert last minute items in the right place on the day that one is going to print it out), the brochure has arrived for the Swedish Baroque Festival in Malmö from August 16th to 23rd. A great deal of baroque music, far too much to list here. More information available from: Musikhögskolan i Malmö, Ystadvägen 25, Box 13515, S-200 44 Malmö, Sweden.

NEMA: I was rash enough to go to the NEMA AGM, and now I'm on the Council. A few things to report; John Thomson was elected Chairman Emeritus; they have at last come to see reason regarding societies such as us, Galpin, Lute, etc, etc, none of whom are in a position to pay for corporate membership, but all of whom are willing, as I am here, to put information about NEMA in their own newsletters. Terry Pamplin proposed that NEMA should suggest a reciprocal membership to such societies, which has now happened, at least as far as FoMRHI is concerned. This does not mean that you need not join NEMA yourselves; we do need a central voice for Early Music in this country, and NEMA is the only organisation that can provide it. It can and does speak to the BBC on our behalf, to the Department of Education, to the Incorporated Society of Musicians, and to a number of other bodies, but it can only do this effectively if it has a broad base of members (apart from anything else, this sort of propaganda work costs money, and such money only comes from subscriptions). In addition, it is, as I said in the last bulletin (p.6) reviving the Register of Early Music, and it needs money for as basic a job as printing and posting the forms for this. If you can afford £10 to help yourself and all your colleagues, please join; the address is in the List of Members.

JAAMIN: The present editor of this Journal of our opposite numbers in Australia asks me a question on which some of you may have views (he says he has had several different answers so far): When diameters are measured in an instrument bore which has become oval, is the true diameter closest to the mean diameter or to the largest diameter (since wood shrinks more in one direction than the other)? Answers (to me, please) eagerly awaited.

CANADIAN EARLY MUSIC: Ron Greedy, one of our Canadian members has started sending me his copies of a Canadian magazine, Continuo, which is their equivalent of Early Music, though nothing like as big. There is usually something interesting in it, and if you're in that part of the world, it would probably be worth reading. Its address is 6 Dartnell Ave, Toronto, Ontario, Canada M5R 3A4. It costs $22 for eleven issues a year.
MY MOVEMENTS: I shall certainly be here until after the July Q gets written, and probably till after it's appeared, what with exams, summer schools, and so on. I'm likely to be here for most of the summer, too, and will welcome any of you who are in Oxford; there's already quite a list of expected visitors, including Herbert Heyde from Leipzig, who is coming here after the Galpin Meeting in Edinburgh. Anyone who can't get there and who wants to meet him is welcome to get in touch with me. He will also be in London, after he leaves here, staying with Bill Waterhouse.

DEADLINE FOR NEXT Q: Let's say 1st July, and I'll try to get it out quickly. This one is behind because I was on holiday for the last week of March and first week of April and came back to the usual enormous pile of post much of which had to be dealt with before I could get down to this, and it'll be held up further while I do the List of Members which will be the same small type as last Q, unlike this. It fits the page much better, though maybe the answer would be to do the main list this size and just the indexes smaller; we'll see. You might tell me, for future reference, if the smaller print really makes it impossible to use.

Jeremy Montagu
Hon.Sec. FoMRHI

FINALLY: A contribution from Paul Madgwick which I thought would make a good tail-piece (but do please remember, and this applies to several of you, that things for FoMRHIQ should be typed single-spaced):

A FLEXIBLE RECORDER

The recent discussion on this subject reminds me of an interesting design by Richard Western of Bath as shown in British patent no. 17479 of 1889. Western makes an instrument with one long slot instead of tone holes. Over the instrument body he fits a rubber tube with the tone holes in it so that they line up with the slot. The top end of the tube is fixed at the top near the window, while the bottom end can be secured with any degree of stretch to give the desired tuning. Because the tube stretches uniformly the tone holes and spacings remain in the correct proportion.

It makes the eyes water to think of the consequences of the bottom fixing coming undone while the instrument is being played with the rubber at full stretch.

If, however, it is flexibility in function one wants, a few years later in British patent no. 28149 of 1896 there appears a flageolet that doubles as a chairman's hammer. Flexibility is again offered in German Patent no. 178889 published in 1906. A flageolet is described there that doubles as a smoking pipe; a quick turn of the mouthpiece connects it to a bowl of tobacco instead of to the windway.
In Bull 42, p 7, Jeremy mentioned the four working drawings available from the LUTE SOCIETY. "They are, of course, generalised, not copies of existing instruments, but a design by the drawer." I disagree with the policy of the Lute Society that produces such drawings. A creative approach to instrument design is necessary when typical high quality examples of the instruments do not survive to be copied. This is not the case here, and the creativity is not necessary but preferred. This reflects the philosophy of the Crafts establishment in Britain where copying is frowned upon and creativity in design is necessary for recognition. But whose creativity should we be concerned with if creativity must be: the maker of the drawing or the maker of the instrument? I say the latter. He will either execute what the drawing says or creatively transform it. In either case, starting with a drawing of an original instrument is more historical. Why interpose the creativity of the maker of the drawing between the instrument maker and the original instrument? I for one will never recommend these drawings to my instrument-making students.

Also on p 7 of Bull 42 is the report of Macaulay instruments given to the Edinburgh Collection which includes "a PASSAURO lute (1667)". It must surely be 1967. Passauro now makes viols outside of Brussels. He once told me that he noticed that some pardessus viols in the Brussels collection had bass bars in which the grain was horizontal, like on a lute, and not vertical as on fiddles. His guess was that this could have been normal in the early days of bowed instruments when the bass bar was not integrally carved.

In Comm 668 Jeremy mentioned a MOIRE FRINGE device made by John McLennon for measuring instrument contours. The way it works is this: the light goes through the screen onto the instrument; shadows of the screen lines fall on the instrument; one views the instrument through the screen; as the viewer sees it, where the screen lines superimpose on the shadow lines, one has a light patch and where the screen lines and the shadow lines interleave one has a dark patch; the dark and light patches continue over the instrument's surface, forming contours. Some four years ago, George Stoppani and myself set up a device like this using a perspex sheet with 1/16 inch black tape lines 1/16 inch apart for the screen, and a slide projector with a slit aperture in front for the light source. It worked fine visually, but photographs were too fuzzy to be useful. This is because the aperture of the eye is much smaller than that of the camera. When we put a slit in front of the camera, we had too little light intensity, so we suspended the project. McLennon's idea of using a quartz halogen photocopier strip light source would probably solve our problem. Incidentally, Jeremy's comment "What it amounts to is holograms on the cheap" is mistaken. Holograms give us vibration contours, not arching contours.

Under VARNISHES on p.9 of this O's Bull, JM uses the excuse of reporting about a modern edition of an 18th century book to plug the Mactaggart's books. That is fine, but he goes so far as saying that the modern books are more reliable, implying that there is no need to consult early sources any more. The Mactaggart's books might tell you all you need to know to accomplish certain tasks, but no modern books can be so comprehensive that they tell you all you might want to know about past methods.

Under JAAMIM on p.13 of this O's Bull, is a question about the original bore of a wind instrument when the surviving bore is oval. A solution to this problem was in Karp's paper (GSJ XXI (1978),p.13), improved by my Comm 460. This solution, which assumes that the wood has contracted from its original state, leads to the conclusion that the original bore diameter was approximately as much bigger than the maximum diameter of the oval as the minimum diameter is smaller. Instead of the mechanism of age contraction, one may postulate a mechanism of filler-swelling, where the wood has been swollen to larger than its original state by saliva and/or linseed oil, and locked in this
state by precipitated solids. In this case, the original diameter was approximately as much smaller than the smallest diameter of the oval than the largest diameter is bigger. Both mechanisms are possible, and one can readily deduce which one has operated in each individual case by observing which way the annual rings in the wood go. If the rings go across the smallest diameter of the oval, then the wood has contracted and the original bore was larger than the largest diameter of the oval. If the rings go across the largest diameter of the oval, then the wood has expanded and the original bore was smaller than the smallest diameter of the oval.

JORN STEINBERG has written to me about 16th century stringing in gut using high-twist basses (not catlines). His system incorporates Gerle’s stringing instruction that the octave strings of the three lowest courses are the same as the strings of the three highest courses. He makes the added assumption that the strings of each octave pair have the same tension. This leads to a tension profile that has the strings of the first two courses at the highest tension (no compensation is made for the first course being single), the strings of the third course are one semitone tension step lower, the strings of the fourth and fifth courses are two tension steps lower than the highest, and the strings of the sixth course are three tension steps lower.

This stringing system, of decreasing tension as one goes towards the bass, makes good sense since it is often worthwhile to sacrifice some power in a thick bass string to gain more focus in its sound by using a thinner string (less inharmonicity allows more harmonics to be heard). By having the higher octave at the same tension as the lower (rather than at a lower tension as is modern practice), richness is added to the sound. Steinberg insists that the two strings of an octave pair should be plucked with equal energy (not with the high octave suppressed, as is modern practice). He reports that his stringing system leads to perfect sound balance across his instrument.

Steinberg has more to say about the use of gut strings on lutes, but that will have to be a Comm in the next Q.

The "SURFACE PREPARATION AND VARNISHING" conference mentioned in the last Bull Supp is taking shape very well. It is taking place at the East Devon College of Further Education at Bolham Road, Tiverton, Devon EX16 6SH, phone Tiverton (0884) 254247, on the 17th and 18th of May. The contributors include John Dilworth of J & A Beare, Prof. Peter Felgett of Reading Univ., Peter Forrester, Reg Lawrence, Chris Nicholson of A F Suter, Roland Ross, Wilfred Saunders, me, George Stoppani, and Raymond White of the National Gallery. The fee is £25 (£15 for students). Well over 30 participants are already registered (as of early April). It promises to be very good.

FoMRHI Comm 72 G

Changes at Prague

The instruments of the Rozmberk collection (i.e. most of the renaissance woodwind) have been removed to the castle at Litomyšl, some 150 km east of Prague, and which is incidentally the birthplace of Smetana.

The main collection which is normally closed between October and May, may well be closed for longer this year for alterations to the museum. Prospective visitors should write to:

Mikaela Kopecka, Muzeum České Hudby, Lazeňská 2, 110 00 PRAHA 1, Malá Strana, Czechoslovakia.
EDINBURGH UNIVERSITY COLLECTION OF HISTORIC MUSICAL INSTRUMENTS

Workshop Drawings

Workshop drawings are being published by the Collection for the information of historical instrument makers and researchers. As far as possible, they will allow detailed study of the construction of historic instruments, though usually as the dimensions of instruments change somewhat over the years, one can never make a replica to very close tolerances.

Each drawing is accompanied by a data sheet, generally containing fuller information than is given by the entry in the check-lists of the collection.

Photographs are also available.

Available now


(287) Hurdy-gurdy (Low countries ?) Drawn by Peter Barnes, 1985.

In preparation

(300) Arch-lute (Martinus Harz, Rome, 1665)

(257) Treble recorder (Van Heerde, Amsterdam, c. 1675)

Prices on application to the curator. Please state if you require paper or plastic sheet. A fixed scale of prices will be drawn up after investigation into copying, packing and postage costs.

<table>
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<th>Nom des Instruments</th>
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Pour toute commande par correspondance, n'envoyez pas d'argent à l'avance. Une facture vous sera d'abord adressée, comportant les frais d'envoi et d'emballage. À réception du montant, la S.A.M.I. vous fera parvenir les ouvrages.

1. 12 cartes postales, vendues individuellement ........................................ 2 F
   Harpe dite de Marie-Antoinette - Clavecin Dumont-Taskin - Clavecin
   Hensch - Basso ruissé - Orgue positif - Violon Stradivarius de Sarasate
   Flûtes traversières du XVIIIe s. - Théorbe Matteo Sellas - Guitare
   Voboam - Virginale Ruckers - Clavecin Desruisseaux - Clavecin Ruckers-
   Taskin.

2. Série de cartes de voeux accompagnées de leur enveloppe dans une pochette
   scellée. Chaque série comprend : 1. Cistre, Stradivarius, Crémone, vers
   1700, détail du chevillier à tête de femme - 2. Clavecin, Joseph Collettes,
   Lyon, 1775, détail du clavier - 3. Harpe, Renault et Chastelain, Paris,
   vers 1780, détail du décor "au chinois" de la table d'harmonie avec motif
   d'une joueuse de flûte traversière - 4. Guitare, Anonyme, France, vers
   1780, ayant appartenu à Carulli, détail de la rosace ovale en ivoire découpé
   avec un motif de berger joueur de cornemuse au milieu de son troupeau -
   5. Clavecin, Jean-Henri Hemsch, Paris, 1764, détail de la rosace -
   6. Cornes de chasse, Italie, fin du XVle s. ........................................ La série
   Adhérents S.A.M.I. ................................................................. 30 F

3. Affiche du Musée Instrumental, 4 couleurs, 40 x 60 cm - Groupe de cors
   d'harmonie à pavillon décoré, exécutés par les facteurs Raoux et Courtois
   Paris, vers 1800 ......................................................... 20 F
   Adhérents S.A.M.I. ................................................................. 15 F

4. Affiche de l'exposition au Musée Instrumental, octobre-décembre 1983
   2 couleurs, 38 x 56 cm, Rameau, Le Coloris Instrumental ...................... 10 F

5. Catalogue d'exposition Musiques Anciennes, Paris, Bibliothèque Nationale,
   1980. Instruments et partitions de l'ancienne collection Geneviève
   Thibault de Chambure, 108 pages, 19 illustrations .................................. 35 F

   Juillet 1982. 4 planches couleur, 60 photos noir et blanc, 131 pages.... 40 F

   Rameau – Le Coloris Instrumental ................................................ 50 F

8. Geneviève Thibault, Comtesse Hubert de Chambure : Une vie au service
   de la Musique, Paris, 1981. S.A.M.I. 12 pages, 1 illustration ............. 6 F

9. Revue Métiers d'Art, Numéro spécial sur la facture instrumentale,
   n° 10-11, avril 1980, 176 pages, nombreuses illustrations noir et blanc
   et couleur ................................................................. 45 F

10. Florence Abondance, Restauration des Instruments de Musique, Collection
    "Découvrir, Conserver, Restaurer" dirigée par Madeleine Hours, Fribourg,
    Office du Livre, 1981. 130 pages, 84 illustrations dont 12 en couleur,
    22 schémas, relié Linson sous jaquette couleur ................................ 167 F

suite au verso......
Recently I discovered two quite extensive private collections of musical instruments - mainly woodwinds - in the province of Groningen, the Netherlands. Among the instruments in these collections are 18th and 19th century flutes, oboes, clarinets and bassoons. I am going to measure some of the 18th and early 19th century flutes and maybe one or two of the clarinets.

The first result of these measurements is a drawing of a traverso by Frederick Eerens of Utrecht, the Netherlands. A reduced copy of this drawing is enclosed; maybe you could publish it, as you did before with other drawings.

The complete set of drawings (2 sheets: A3 & A4), bore measurements and a short description of the instrument can be ordered by writing a short letter or postcard to:

Bert van Leeuwen
p/a Schimmelpennln 20
9601 AP HOOGEZAND
the Netherlands

The charge will be hfl 20,- (equal to about £4) mailing included, which can be paid by Giro account 4045989, by international money order or by enclosing the money in a registered letter (only Dutch guilders please). If anyone is having difficulties in transferring the money, write anyway: I am for instance also willing to change my plans against other plans of my interest.
cork position cc 175 when upper body II is used

END CAP
(ivory)

dimensions as indicated by lowercase characters
a ring 27.7 x 0.4 wide
b ring 26.6 x 1.1 wide
c shallow groove 0.05 wide
d ring 27.4 x 1.1 wide
e ring 26.7 x 0.8 wide
f ring 29.5 x 0.8 wide
g ring 30.5 x 1.0 wide
h shallow groove 0.3 wide
j ring 30.9 x 1.2 wide

dimensions in table 1

UPPER BODY

LOWEY BODY

dimensions mm
scale full size
measured & drawn by BE van Leeuwen © 1984

transverse flute by Frederick Eerens, 1st half 18th century, Utrecht,
the Netherlands. (private collection, Groningen, the Netherlands)
description: transverse flute, rosewood & ivory, 1 silver key. 4 upper body joints (I,II,III and IV), resulting in the pitches:
- A4 = 423 Hz (I)
- A4 = 414 Hz (II)
- A4 = 407 Hz (III)
- A4 = 402 Hz (IV)
All parts except upper body joints II and IV bear the stamp: F EERENS

general remarks
The instrument is in fairly good condition, only on the back of the head joint there is a crack, which does not extend to the inside bore. There are also some small cracks in the ivory end cap (see drawing).

The instrument is well in tune, only D is a little flat. Tones in the 3rd register speak well. The tone is fine but rather soft and thin due to the very small mouth hole. When making a copy of the instrument, a slightly larger mouth hole may result in a somewhat thicker tone.

some remarks on the measurements and drawing
The instrument has been measured for the purpose of making copies. Therefore only those upper body joints were measured which result in today's commonly used 'baroque' pitch A4 = 415 Hz. With upper body joint III the pitch is A4 = 407 Hz, but by enlarging the mouth hole to ø9.5 mm, the pitch is raised to A4 = 415 Hz. The same result can be achieved with an oval mouth hole LxW = 10.3x8.5 mm.

The bore diameter is measured in both horizontal and vertical directions. The vertical direction is defined as being perpendicular to mouth hole, finger holes and key hole.
Quint bass recorder in Bb at a' = about 460
Stained maple, Signed W below edge, A on bottom, and FG on fontanelle

Original winding, fontanelle, lower part of key. Crook is old, but it probably not the original one.

Probably a closed joint above fontanelle but it is hard to see as the inner is very dark stained and covered with lacquer.
ORIGINS

Not long after the death of the 7th Duke of Portland in 1977 his widow, Ivy Duchess of Portland, D.B.E., generously agreed to set up a Charity Foundation with the basic aim of encouraging high skills in craftsmanship. Although she was aged 90 at the time she lived long enough to see the Foundation established and the work start on the construction of the new craft workshops.

THE PURPOSE AND AIMS OF THE TRUSTEES OF THE HARLEY FOUNDATION

The original Trustees of the Foundation are The Lady Anne Bentinck, Mr. William Parente, the late Duke's grandson, and Mr. Neil Elliott, the Agent on the Welbeck Estate.

Knowing the wishes of the late Duchess the Trustees have resolved to establish at Welbeck a centre for the establishment and practice of high skills in craftsmanship and to this end they have leased the old Tan Gallop and some adjacent land from the Estate on long lease where new workshops are being built.

They were fortunate in having the willing help of Mr. Les Howis, a craftsman skilled in the development of modern bows and arrows, who was already resident on the Estate and who had considerable knowledge and experience in the building trade. Mr. Howis has overseen the arrangements for the construction of the new workshops and has been responsible for introducing the first groups of crafts people who have successfully applied for craft facilities.

In order to fulfil their charitable function the Trustees have the following objects in mind:

a) To encourage the maintenance and development of high standards of craftsmanship.

b) To help the fulfilment of a) above by grouping various crafts together so that the knowledge, experience and ideas of the various craftsmen can be pooled to the mutual benefit of them all.

c) To provide a suitable working environment in which a) and b) above can be achieved by the provision of suitable workshops, a pool of equipment and tools and financial help where needs become apparent for the establishment and improvement of the various crafts.

d) To encourage the teaching of high standards of craftsmanship to students (apprentices or others) by the craftsmen who are accepted and granted facilities in the Harley Foundation workshops.

e) To promote activity in high standards of craftsmanship in such a way that public interest, education and taste is improved.
Up to the end of 1985 the following craft activities have been established:

The designing and making of modern bows and arrows (Mr. Howis).

The designing and making of modern competition canoes (Mr. Rennocks).

The reproduction and restoration of early clavichords, harpsichords and fortepianos (Messrs. Adlam and Fischer).

The reproduction and repair of antique organs (Messrs. Gwynn, Goetze and Bennett).

The restoration of damaged and broken porcelain (Miss Hutchinson).

The sculpting of houses in their curtilage in ceramics (Mr. Revell).

Seven new workshops are to be built shortly and the Trustees will be sympathetic to applicants who are in need of workshop space and suitable equipment and who can demonstrate that they possess skills of a high enough standard to meet the requirements of the Trustees. The Trustees will also wish to be satisfied on several other matters, e.g. that the applicant will be able to sustain himself or herself financially within a short period of settling in at Welbeck, and furthermore will be prepared to instruct or educate others in his/her craft.

An applicant can obtain, on request from the Trustees (or Mr. Howis), a form setting out the provisions governing the craft activities and the requirements of the Trustees and this form also includes a form of application.

A successful applicant can expect to be provided with modern workshop space and help can also be given with the provision of tools and equipment if needed initially.

The Welbeck Estate tries to make available suitable living accommodation for crafts people on a normal tenancy basis.
FoMRHI Comm. 688

Jeremy Montagu


Like the Bruce Haynes bibliography, this arrived just in the nick of time for this Q. It will be useful to those interested in the early piano, and I must confess that I had no idea that there were, at the time of writing (any discography must be out of date by the time that it appears; records go on appearing while it is being printed) over 900 records played on pianos dating between 1720 and 1870 (reproduction instruments are of course included). However, this number is slightly misleading since there are many entries which appear to be duplicates or more-plicates; where a record appears under different labels, which may often happen as a result of modern marketing methods, then each one is entered here. Sensible, of course, to help people find a recording, but it does make the list much longer than it would otherwise be. And also it leaves the reader guessing: is this in fact a duplicate, or did the same pianist record the same piece on the same instrument more than once? There should be some indication (though perhaps the information isn't always available) to tell us whether two entries indicate a reprint or a new recording.

The Discography is in several parts: A Composer/Title List, which is the main entry for each recording; a Pianist List; a Piano Manufacturers List; and a Record Manufacturers/Labels List. There are then several indexes, covering Performance Medium, Performers other than Pianists, Titles of Record Albums, Pianos by Date, and finally Piano Collections and Owners. It's wonderful what can be done with a computer, and this does mean that one can get at the information in almost any way; the only missing index that I can think of is one of other instruments, and that really is off the subject of the book however useful it would be to the rest of us.

The Fallen Leaf Reference Books in Music series is clearly one to keep an eye on; this is no. 3, Bruce Haynes's Oboe Bibliography is no. 4. No. 2 was the Eddy Checklist reviewed one or two Qs ago, and no. 1 was out of our area of interest, a book on New Music also by Ann Basart. I look forward to future volumes in this series, and hope that they will all be as good and as useful as these two.
I'm not quite sure whether this is a review or a report. Len stayed with us for a few days two or three years back while he was doing a world tour, and he sent me a copy of this catalogue along with a long letter describing the very enterprising exhibition he and his colleagues in Auckland have put on at the Auckland Institute and Museum. The Society approached the Museum and suggested doing this, and they managed to persuade the Museum to dig out of their store rooms quite a collection of instruments, many of them non-European and many of them that had not seen the light of day for a century or more. That alone was quite an achievement. In addition, they have got hold of a whole lot of other instruments from makers and private collectors, to such an extent that there is a very impressive list of 502 instruments. But they have not stopped at an exhibition. In addition, there is the book whose title appears above (which has the list of instruments in the exhibition stapled into it). There is also a live music programme of concerts and demonstrations, every day for a fortnight, and there is also a comprehensive programme of activities for school children. Len seems to have been responsible for a good deal of this activity, in addition to which he has been rash enough to offer to make a new list of the instruments in the museum, with the result that they have asked him to write a proper catalogue, to which I look forward.

The one thing that they have not managed to achieve, yet at least, is the preservation in New Zealand of the Ronald and Zillah Castle Collection (I should have a catalogue of this somewhere; I was in correspondence with the Castles in the late 1960s when I was Hon. Sec. of the Galpin Society, though it's possible that it went into the GS Archives when I retired; at the moment I can't put a hand on it). There are some important instruments in it, including a Stanesby senior tenor recorder and a Kirckmann single manual harpsichord, both in magnificent condition Len says. Unfortunately, unless the government can be persuaded to take an interest in musical instruments, the Collection is likely to be sold abroad; Ronald Castle is dead and his sister is now very elderly. Though they always hoped that it would stay in New Zealand as a national possession, they have never managed to persuade the government to take sufficient interest. One hope is that this present exhibition, which is apparently causing great interest in Auckland and has already led to several new acquisitions for the Museum, may stir things up sufficiently that some definite arrangements will be made before it is too late. Good luck to them - it would be a great pity for New Zealand to lose so important a collection.

The book itself is a very brief history and description of world instruments, very well laid out and printed and well illustrated. It is an excellent introduction to the subject,
and I wish that my museum could afford to produce anything as good. While it might be thought that any specialists could pick on all sorts of things to cavil at (inevitably perhaps with such compression), there is in fact very little that one could pick up in this way. And with authorities such as Alec Loretto writing on recorders, one would not expect to find anything wrong. The one subject apparently neglected is that of post-renaissance percussion (early music is separately covered), but Len tells me that that is because the author of that section stubbornly declined to get his copy in until several days after the completed book had to go to press. As someone who has acted as an editor once (and, please God, never again), I sympathise with him. If you should be looking for a small, cheap, well-illustrated introduction to the whole subject of musical instruments, you could do worse than write to Len (in our List of Members) and ask if there are any copies left, though if the Exhibition is the success that it looks like being from the interest it's aroused, they may well have sold out.

FoMRHI Comm. 690

Jeremy Montagu


This is "a complete revision of Music for Oboe to 1800 (interim edition, June 1982), published privately by the author", and it's a terrific piece of work. It covers all the works that Bruce knows of for oboe, oboe d'amore and F-Oboe (a useful term to cover all the various types of tenor oboe), and of course it doesn't end there. Since the list includes chamber music as well as solo, and since the oboe was used with other instruments, it's also a list of all the chamber works that included the oboe, and thus is a list of a good deal of the chamber repertoire of the period. The Index by Instrumentation is very useful in this respect. Unfortunately, from my point of view, there is another bibliography of wind chamber music (by David Whitwell) which covers some 30,000 works from 1600 to 1900, and very sensibly Bruce decided not to overlap with this, and therefore he has a cut-off of no more than five-part music; unfortunate for me, as I said, because I now have Bruce's list, and I haven't got David Whitwell's. However, I can't really complain; there is a tremendous amount here, too, some 10,000 pieces, and I can't recommend this book too highly to anyone interested either in the oboe or in the chamber music of this two-and-a-half centuries. It will be enormously useful to many of us.
I put a brief note about this interesting journal in Q.31, April 1983; I called it then a spasmodical, rather than a periodical, a title which the editor, Frederick Crane, seems to like, judging by his remarks in this issue. Certainly the spasms are to be encouraged; there is a lot of good material here on this much neglected instrument, one which was an important virtuoso instrument at one time in 'respectable' music, even though today its virtuosi must be sought in folk and non-European music.

The title is, of course, a spoof; I still have not made up my mind about the first article, 'Mrs Midnight, Dr. Burney, the Jews Harp, and the Salt-Box' by David Lasocki, a lengthy description of a mock-St. Cecilia's Day Ode of 1749. Only by chasing up all the references in the Bodleian, which I regret that I cannot be bothered to do, can I discover whether Lasocki is having us on or not (I'm not committing myself either way; I well remember a respected colleague, now a member of FoMRHI, congratulating me on fooling everybody with a spoof article when he had read my perfectly serious field-work report on the Midwinterhoorn in the Galpin Society Journal).

Other articles include a report on the International Jews Harp Congress in 1984; an Annotated Checklist of Microgroove Records with Jews Harp Music, by Trân Quang Hai, himself an excellent performer on the instrument; Punch and the Jews Harp, by Frederick Crane; Trumping Around Scotland, by Lindsay Porteous; Some Strategies for Tuning and Improving a Factory Jews Harp, by Mike Seeger (ideas well worth trying on some of the instruments that one buys today); and a very useful list of the Jews Harps in the Collection of the Metropolitan Museum of Art, by the curator of the instruments in that collection, Laurence Libin (I must send him a list of mine; it's one of the instruments that fascinates me, partly because one can do so much on something so small, and I collect all the types that I can find).

Anyone who shares my, and Professor Crane's, interest in this instrument is encouraged to write to the address given above. And if anyone can put Professor Crane on to a copy of a record of Harvey Matusow's Jews Harp Band, they will find him very grateful.

It is not, I think, necessary to write a proper review of this famous book. I asked OUP to send a copy for review really because I thought that it was important that you should know that it was once again available. I also hope that it may interest some of our violin- and bow-making and -playing members to start some discussion of the relevance of this tutor, and of David Boydens facsimile edition of Francesco Geminiani's The Art of Playing on the Violin, which is still available, also from OUP, but alas not at the price of 16s, which my copy cost me when it first appeared; it now costs £6.50. Ever since I noticed the publication dates of these two treatises, 1751 for Geminiani and 1756 for Leopold Mozart, I have been fascinated by the contrasts between them. Mozart is, of course, much the more detailed (though the first and most important detail has been deleted from this edition: the frontispiece, which shows "the first way of holding the violin" is missing; a pity, and surely an unnecessary economy even though the picture is tolerably well-known), but both contain a wealth of information not merely on playing technique, but also on how the music was played. We have no more reliable guides to the performance of music in the 18th century than such treatises as these.

Their interpretation is, only too often however, a matter of dispute. Should every note be played with a bulge (Geminiani suggests that it should); should every note "have a small, even if barely audible, softness at the beginning of the stroke" (Mozart says it should). One of our modern bands plays like this, and I must confess that I often dislike it, but the treatises suggest that they are right and that I, and the bands who do not play in this way, are wrong. Many other such details could be adduced, among them Geminiani's liking for a continuous vibrato.

Geminiani does not say anything about the violin, but Mozart does, and he also goes into some detail about strings, implying incidentally that all four are plain gut; he is sufficiently detailed that if the G were covered, one would expect him to have said so.

We are a Fellowship of Makers & Researchers, but we have many players among our members, and so I make no apology for going this far outside our normal orbit, nor for stressing the importance of the reissue of Mozart's Treatise, and the continued availability of Geminiani's, both for us and for our customers.
This is well out of date, but I’ve only just been sent a copy of the catalogue. As a museum curator, it interests me; as Hon. Sec. of FoMRHI it interests me, too. It is not often that a major instrument museum collaborates in an exhibition of reproduction instruments, even if, as in this case, the reproductions are based on instruments in that museum (in fact that is usually enough to put them off the idea even more). Museums are not quite the ivory-tower places that they used to be, but even though they almost all have shops nowadays, if only for postcards, they (should I say ‘we’?) tend to be frightened of the idea of being tarred with commercialism, and frightened, too, of giving a cachet of respectability to those who copy our instruments (make forgeries of them, an earlier generation would have said). There was resistance here to the idea of my having a stand at the Horticultural Hall; OK as FoMRHI, but disapproved as Bate Collection (I’m afraid that I went ahead, being more interested in getting people aware of and into the Bate Collection than in academic respectability; respectability isn’t really my line when it conflicts with efficiency, as you must have learned by now).

Even the exhibition which is the subject of this catalogue wasn’t in the Conservatoire Museum; it was at the Paris equivalent of Broadcasting House. But why shouldn’t we museums find the space from time to time for an exhibition of modern reproductions of our instruments? Would you, as makers, be interested in such an exhibition? Of course, one snag is that it means committing yourselves well ahead to having instruments available, and then to having them stuck in the museum for some months (my Special Exhibitions, for instance, are for a term plus the following vacation, ie for anything from four to six months, and they are usually planned at least three, and sometimes six months in advance). Would you, my museum colleagues, be interested in allocating some of your space for this purpose, and for giving your imitators this cachet of your authority?

Personally, I think that it is quite a good idea, and I’d be willing to stick my neck out and try it. How many of you, the makers, would be interested and willing to have your copies of Bate Collection instruments stuck here from mid-April 1987 (ie next year) until the beginning of October? The advantage of that term is that through the summer term and the summer vacation we get more visitors, so you’d get better exposure. There’d be a catalogue (FoMRHI style, reproduced reduced typescript on the photocopier) which could include your addresses, and for that matter your prices (we might as well go the whole hog). If you’re interested, let me know. Space is limited (I have only one show case for Special Exhibitions, and
it's not very big), so it might have to be selective, probably on a first-come basis, plus the fact that there might be a limit to the number of Bressan trebles that I'd want to show, though, on the other hand, it might be quite interesting to show how different 'reproductions' can be!

Your general reactions to the whole idea would also be of interest, for such an exhibition, with 'reproductions' close to the originals, is quite different from the normal craft, Horticultural Hall, Boston, etc exhibitions.

PoMRHI Comm. 69

Jeremy Montagu

Review of: Nicola Pasquali, The Art of Fingering the Harpsichord; illustrated with Examples in Notes; To Which is added An approved Method of Tuning this Instrument, facsimile of the Bremner print of c.1757 by Robert Morley and Co, Ltd, 4 Belmont Hill, London SE13, 1985. £10 (p&p £2 UK, £3 Europe and probably the same for further afield by surface).

A nicely produced facsimile, very clearly printed on good paper with a plastic comb binding of this simple but very useful tutor. The work is addressed to beginners, quite possibly to children, though I doubt whether modern children could progress quite as fast as Pasquali expected 18th century children to learn, and there is a good mixture of tunes and exercises. As I have said in relation to the violin treatise which is also reviewed in this Q, there is little point in producing 'authentic' instruments if we do not play them authentically; the harpsichord played with Czerny fingering is not really a harpsichord, though plenty of modern players do their best to disprove that statement; still, there are a few, and more coming along all the time, who do try to play the instrument properly, and it is for these that facsimiles such as this are valuable. This is, in fact, an excellent first tutor for any modern keyboard player who is thinking of taking up historic instruments, and it is worth recommending it for that purpose to any of your first-time customers; I'd be surprised if most of you have not been asked from time to time 'and how do you play the thing?'.

The tuning schema is a straight-forward mean-tone. Starting on G and going 'forward' to G#, with G/B as a trial when B is reached, and E/G# as the second trial; then 5ths tuned 'backward' from G, with E'/G as the third trial; all "the 5ths must be Tuned rather flat than otherways......By this Method of Tuning the imperfection of the Instrument is thrown in Ab & Eb its 5ths". Again, a very simple first guide for anyone who'd like to try an early tuning method and who is somewhat flummoxed on his or her first attempt to tune a keyboard instrument (it comes as a nasty shock when one has spent one's life ringing up the tuner every few months; the first time I had to do my own there wasn't a lot of difference between B natural and C when I'd got round that far).

So, thanks to Morley & Co for something that could come in very useful.
Review of: Edward Jones, Musical and Poetical Relicks of the Welsh Bards; preserved by Tradition, and Authentic Manuscripts, From Remote Antiquity; never before published. (etc), 1784. Facsimile reprint by Robert Morley and Company Ltd, 4 Belmont Hill, London SE13, 1985; 78 pp, £15.00 (p&p £2 UK, £3 Europe, you'll have to guess for further afield, but surface is probably the same as Europe).

This is the first of a series of facsimiles of early harp material which Morley are producing (others include Bunting's The Ancient Music of Ireland, The Highland and Scottish Harp, and Edward Jones's The Bardic Museum). The facsimile is well printed on good paper (I think of the sort called parchment, quite stiff and slightly creamy in colour), with a plastic comb binding. This volume, unlike the Pasquali Harpsichord Lessons also reviewed in this Q, has a one-page introduction (on the series, rather than specifically on this volume) with, on the back, a genealogical tree of the Morley family, who have been harp makers since 1817. This series of facsimiles derives from the library built up by the firm, and Clive Morley states in the Introduction that it is his policy to republish some of the early and now rare publications which form the history of the harp.

This work, the first of the series, is one of the most famous and one of the most important texts for the history of the harp in Wales. A number of bardic poems are printed both in Welsh and in translation, as are some examples of pennillion. This section is followed by the description of The Musical Instruments of the Welsh, including "the triple or modern Welsh Harp" which "has been recently improved by the invention of pedals": the latter statement is not one with which everyone would agree today. The crwth is also described, with its tuning, as is the pibgorn, by this time surviving only in Anglesey. The tabwrdd, or drum, seems to have been already extinct, but Jones found and describes one Corn Hirlas or ox horn, whose dimensions he gives and which he also drew.

The last part of the work consists of a considerable collection of music, much of it with the sets of variations typical of this genre, and it is probably for this section that the work is best known today. In my copy, one double-sided page is missing and the following sheet duplicated, always a danger with this type of binding, which depends upon the accurate collation of a number of separate sheets.

All who are interested in the harp must be grateful to Clive Morley for initiating this series, and we wish him all success in so important a project of making available once again these important texts.

As Jeremy pointed out in his letter asking me to make this review: This book has one error; it is not printed in an English version. And for him and may be some other not been able to learn this wonderful musical language I hereby give my review.

Peter Andreas Kjeldsberg is curator at the Ringve Museum in Trondheim, one of the most popular museums in Norway. Ringve Museum is provided with all sorts of instruments, and on guided tours people can listen to music played on the historical instruments.

His book "The Piano in Norway" take the reader on a stroll of 200 years with pianoes in Norway, give the history of development and origin, tells about Norwegian Piano-Forte makers, export and import, and put the piano on the right place in the frame of culture and social life. The book also gives details of what kind of persons making use of the instrument, and what kind of music they preferred to play during the time.

In older days we used the word "Claveer" on piano, and this could mean Clavichord as well. The Clavichord was well known in Norway about year 1600, and was very popular in the next century and up to 1830. To day only 29 instruments remain, mostly imported, but some also made in Norway. The Harpsichord is first mentioned in 1622, but was never so popular as the Clavichord. It was mainly used for conserts. Some Harpsichords was also made in Norway.

About 1780 the first Piano-Forte was advertised in the newspaper, and few years later the first Norwegian builders advertised instruments made in English style. Probably they learned the trade in England. The first public concert on piano was in Christiania (Oslo) 1793, and the first Piano- and Musicshop was set up in Christiania 1809.

1780-1840 was the years of the Square-Piano. The Country was very poor, and the group of people that could afford an instrument was limited. Only a few people could buy a Grand Piano. A Square-Piano would cost the wages of three years work for an ordinary worker. From 1850 the Upright Piano is the leading instrument. Our biggest factory, Brodrene Hals, made from 1847 to 1925 about 15 Squares, 233 Grands and roughly 24,000 Uprights. To follow their salesbook is to follow the growth of the Norwegian middle classes.

All together we have knowledge of some 40 Piano-Forte makers in Norway. The last Norwegian Piano was made in 1981.

The book is well illustrated, and is worth the trouble to learn Norwegian.
New Grove DOMI; JM4; Further Detailed Comments

Comm.604 covered the As; Comm.646 the Bs; Comm.671 the Cs; now it's the turn for D and E.

Dala-fandir: It would be useful if the anonymous author of this entry had told us whether this two- or three-string lute was plucked or bowed.

Dân bâu: The player... strikes the string... at the vibration nodes; what are the vibration nodes? Surely this depends on which harmonic is sounded (the fundamental has no nodes), and since the author goes on to say that the little finger touches the string to produce harmonics, the whole thing sounds even less probable.

Darabukka: Other primitive forms are found in Malaysia and Indonesia; what, I wonder do they mean by primitive? Some of the Malaysian examples I know are by no means primitive, and this is a pejorative word which should be avoided.

Davui: I said last time that we'd forget conch-shell trumpets from now on, but with this one they've got the species wrong; the Fijian end-blown shell is Bursa bubo, not B. lampas, and they've omitted to mention the most important thing about it, the one which makes it unique among conch trumpets, that it has a finger hole. This is fully described in one of the books cited in the bibliography, that by Karl Erik Larsson.

Davul: It seems a little odd not to mention the 18th century European alla turca here; the European use of the long drum, with beater and switch, is a direct derivative from and imitation of the Turkish use of the davul.

Demeraye: What does The instruments form an acoustical series mean?

Derbanka: is not mentioned under Darabukka.

Dikembe: I said, too, that I wouldn't mention xylophones or sansas/mbiras with keys any more, either.

Dolzaina: I find the whole entry somewhat confused (and confusing). Certainly I can think of no reason why the medieval dolzaina or douçaine may be identifiable with the shawm with a cup-shaped bell.

Dörvon chikhtei khuur: The pegs are dorsal, not frontal. It seems curious not to mention any of the Chinese fiddles which are so similar, and which are often said to derive from this instrument.

Double bass: I don't think that many would agree that the German bow is a viol-type bow. It is held underhand, but it looks like no known type of viol bow.
Drone: The Provencal tabor is not a string drum; it is the tambourin scored for by Bizet in *L'Arlesienne*, a deep tabor. It is the Basques, not the Provencaux, who use the string drum to provide both rhythm and drone, and the name varies; one that I've met is *tsountsounia*.

Drum: I have numerous reservations here. The friction drum is not used in many parts of Africa; in some parts certainly, but this is somewhat misleading. I do not believe that drums ....were probably among the earliest instruments; a drum is quite a complex construction, a skin fixed so that it retains its tension over a resonator, and I would be surprised if it were much earlier than the neolithic, or at least the latter part of the palaeolithic. The large tabor did not appear in Europe in the 13th century; all 13th century tabors are small, and large ones don't appear before the late 15th at the earliest. Timpani beaters are not used on the bass drum; they are too light; we ignore composers' instructions to use them, and use a pair of heavier felt-headed (or lambs-wool headed) beaters instead. No Sumerian sculptures are dated 2500 BC; nothing can be dated BC; dated to, yes, but dated, no. Fig.10 shows makers as well as a tabor. Fig.11 is a side drum (much the size described by Arbeau), not a tabor. Handel asked for side drums in *La Régouissance* as well as in the Menuet of the *Fireworks Music*; if Marais asked for a tambourin in *Alcione*, it's likely that he wanted a tambourin (the Provencal tabor), not a side drum.

Drum set: And here, too. The jawbone is seldom a rasp; it's more often a rattle. Only the cheapest drum sets use a European cymbal, and even then it is an imitation of the Turkish instrument which, whether made in Turkey or Boston, is the norm. I know I've used the term, too, but foot-pedal is a tautology.

Dulce melos: While it is quite true that there is no documentary evidence for Galpin's suggestion that the mysterious chekker employed the action of Arnault's dulce melos, there is equally no evidence for any other sort of action; Galpin's guess is as good as anyone else's.

Dulcimer: It is by no means only mirror-image printing that is responsible for depictions of left-handed fiddles, flutes, and so on; there are plenty of paintings and other media showing these. See Jack Schuman's article in GSJ 24 for a few of the many examples. I'm sorry that there is no mention of the klesmerim in this article.

Duplex: It is not true that it is not possible to use the duplex principle in constructing woodwind instruments; I've seen pictures of a duplex clarinet (one mouthpiece with a Y-shaped diverging barrel and then two parallel tubes), and there's no reason why this cannot be done with other woodwind, though a transverse flute would be tricky (come to think of it, there's an Indian one in the Pitt Rivers Museum).
Ebim / Ebongei / Ebumba: These are three all-but successive entries (there is one other entry between each); all three are what are called Lamellaphones, instruments of the sanza or mbira type. The first and last have metal keys; the middle one has metal tongues. This is a good example of why I have kept picking up this misnomer of keys; if one can be called tongues, which is the English for lamellae, why can't they all be? After all, we don't call this type of instrument a kleiophone, do we?

Eight foot: Why do they say now based on $c' = 256$ Hz? Nobody but some acousticians who find it easier to use the twice-times table, working from a theoretical basis of 1 Hz, ever uses 256 Hz for $c'$; most of us use the modern International pitch of 261.3 (i.e. $c'$ at $A = 440$ in Equal Temperament) unless we are using a different pitch for $A$, and I don't think any of the commonly used $A$'s come out to 256 Hz for $C$, though perhaps if you struggled hard enough with different temperaments you could fudge one to do so. Over to any of you interested to see what you can do with your pocket calculators and computers.

Electrophone: I disagreed with Hugh Davies in my initial review (I can't remember whether of this DOMI or of The New Grove) over what is an electronic instrument, and he produced a number of cogent arguments to prove me wrong, in particular that the use of electronics really does change a pre-existing instrument which belongs in some other classificatory category (eg a guitar) into something different. Musically speaking I take his point, and clearly he is right. However, I was writing from the point of view of classification, which is as much, or perhaps even more, a matter of morphology, than of music. If you have a room full of instruments which you have to sort into coherent heaps (this is the essence of classification, what it's about and what it's for, putting like things together into meaningful groups), then you are more likely to put an electric guitar into the same pile as the acoustic guitar, rather than into the same pile as the electronic organ (and you wouldn't put the electronic organ into the same pile as the pipe organ because the latter has pipes and the former has transistors etc). Classification of musical instruments, on the Hornbostel/Sachs System, has nothing to do with their musical use; if it had, you would find cornetti and trumpets in the same pile, and in jazz the banjos and drums (and the piano). And Grove, very sensibly (because it is still the only internationally recognised system) uses Hornbostel/Sachs. And so, for me and, I believe, for Hornbostel & Sachs, the only electrophones are the instruments whose sound is generated electronically; the instruments whose sound is generated by other means and which is then amplified electronically are not electrophones, though obviously their classification numbers (the Hornbostel/Sachs system is a numerical one) would need to show both elements with, for example, their normal number followed by a / or a - and a further number to show the electronic element.

Perhaps I should add that this article is much the best survey of the field that I've met.
Embouchure: It's a pity that fig. 7 is shown with a trombone mouthpiece and trombone; it would be much more effective if a photo had been taken with someone blowing on a mouthpiece ring, as in Philip Farkas's books on playing the horn and on brass instruments, where one can see very clearly the different embouchures used by different players on different instruments.

English flageolet: This was not the term only for Bainbridge's type of flageolet, but also for any six-fingerhole flageolet as distinct from the four-fingerhole and two-thumbhole French flageolet; in other words, it's the posh term for the penny whistle.

Ennanga: The ring of banana fibre does go round the neck of the instrument, as the article says, but it does not go round each string; the string passes across it (each ring is placed on the neck so that it is just below one of the strings) so that it (the ring) acts as a bray to add a buzz.

Erhu: Where does one find erhus with steel strings? Mine are strung with silk, and so are all others that I've seen and heard. If the strings run...over a lower bridge, one would ask 'lower than what?'

Eunuch-flute: The instrument illustrated is now said to be a reconstruction, presumably based on Mersenne. The membrane does not give out notes of its own; it vibrates in sympathy with the voice. A membrane can only produce a single note, depending on its mass, diameter, and tension (and, if it's large enough for them to be heard, as on a timpano, the overtones thereof, which raises the problem, irrelevant in this context, of why at least some of them are harmonic).

Euphonium: It seems very possible that some of Berlioz's high ophicleide parts were actually written for the instrument that we would today call a euphonium (or maybe a baritone), i.e. a small tuba in 9' B flat. It has been suggested that when Berlioz complained of the lack of tubas, saying that only ophicleides were available, he didn't mean the things with keys like saucepan lids but small 9' B flat valve instruments, which were in those days often close-folded upright instruments in the same shape as the real ophicleide, rather than 12' F real tubas. If so, and I find this theory fairly convincing, then he may have meant the same thing when he wrote for ophicleide. No guarantees, but maybe.

Either these two entries have less to pick up, or they are shorter than C was, or I'm suffering too badly from end-of-termitis and not spotting things I ought to spot. Anyway, two letters knocked off at one go.
Cammer-Ton (by G. Oldham)

The only truly objectional statement here is the identification of Chor-ton of the early 18th century with "the old Renaissance pitch". This article could benefit greatly from considering the issues raised in Comms 442 and 683.

Ceterone (by J. Tyler)

The statement that this instrument was in use throughout the 17th century probably relies on evidence from the Talbot ms (c. 1690) for the latter half of the century. This evidence is probably not relevant to Talbot's time since his two statements mentioning "the Citteron or Guitteron" are just his translations of the passages in Mersenne (1636) Livre 2, Propositions 11 and 12, as Talbot indicated.

The ferrous wire strings used for musical instruments early in the 17th century were, as far as I know, either made of wrought iron or a steel of indeterminate type that is so strong that it could be tuned at least as high as gut. The "low-temper steel" mentioned in the entry does not seem to fall into either of these categories.

It is mentioned that Mersenne's report on the "cisteron" specifies 14 single courses and a flat back. This is what Mersenne wrote in Prop. 11. In Prop. 12 he repeated the statement except that the number of courses is 15. In both statements the subject was "Cisteron ou Guierron" and it is not clear whether these were two names for the same instrument with different stringing (ie metal or gut), or different but similar instruments.

Tyler gives the tuning of Praetorius's 12 courses arch cittern where the basses have a sequence going around the circle of fifths from e to e₀, with intervals alternating between going up a fourth and down a fifth. He then suggests that "Mersenne's tuning also seems to imply this arrangement, although it is difficult to be certain since the printing of this tuning table is corrupt." This is the table:

```
Or il eft ay fe de faire la tabic, & le corps du Cifre plus large, & d'y mettre
autant de chordes que fur le Luth, ou fur l'Epinette, car toutes fortes d'in-
strumens font capables de rant de chordes que l'on veut, pourquio qu'on les
faile afez larges & afez grands. Les Italiens y mettent iulques à neuf ou dix
rang de chordes, qu'ils accordent à l'ouvert en cette maniere.
```

I can't see any hint of a circle-of-fifths tuning in the basses. There are mistakes but it is not difficult to guess what they are. To start with, clefs come before notes and not after them, so the one at the end of the line is meaningless as it stands. But if one turns the page upside-down, the section from this C3 clef to the double bars is just the usual Italian hexachord tuning, identical to that given by Mersenne on the previous page. Next, we note that the pitches of the sixth and seventh courses are apparently the same: This is highly unlikely, so there probably is a missing clef sign before the seventh course. The eighth-course note has a flat in front of it. The most likely
accidental is $b^\flat$, and this would make the missing clef in front of the seventh course a C4. The C4 clef at the beginning is suspect, and this could well be where the missing C4 clef ended up. If we postulate a C1 clef at the beginning, the tuning of the first six courses is of the Virchi type, with the remaining four courses chromatically filling in the range of a to c' in the spirit of the hexachord tuning in which the courses after the basic four help fill the gap of a fifth between the second and third courses. The tuning would then be e' d' g b f d a b c'. Though Mersenne mentions that this tuning refers to a large cittern, the largeness is in the soundboard and body, with no mention of neck length. This tuning works as well on a single nut as the Virchi tuning. In fact, there is no connection implied by Mersenne between this cittern and the cisteron (or cetarone).

Chanterelle (by I. Harwood)

The definition given "The highest-pitched string of any instrument" is inconsistent with one of the examples "the melody string of the five-string banjo" because the banjo fifth string is higher. If the definition excluded strings which usually sounded a single pitch, it would properly exclude the banjo fifth as well as harps, harpsichords, psalteries, etc.

The usual German equivalent of "chanterelle" was "quintsaite", not "chorsaite". "Gesangsaite" was usually used for the second (and sometimes third) courses of the lute. In Italian the highest string was called "canto" in the 16th century, while later, "cantino" was the highest string and "canto" was the next.

It is stated that "It is likely to have originated with the vielle-a-roue or hurdy gurdy...". These are relatively modern names while what I'm sure was meant was the earliest form of this type of instrument (organistrum or symphony) on which the keyed action did not operate on all of the strings simultaneously. It is quite possible that the organistrum or symphony performed a particular musical function of normal medieval fiddles, but with mechanical aids for both the bowing and the fingering. If this were the case, the ultimate origin of the term signifying "melody string" would have been the medieval fiddle.

Charango (by T. Turino)

The fact that this instrument is ultimately descended from the Spanish Renaissance guitar is omitted.

Chest of Viols (by H. M. Brown)

The definition given is for a box made to contain a set of viols. The quotation from Mace given in the entry is clearly using "chest of viols" as a term equivalent to "set of viols".

Chimes (by P. Price)

It is stated that "In western Europe cymbala ... were used for adding brilliance to concerted music". My comment on Bell in Comm 692 is relevant here. Laurence Wright has reminded me that the person who did the research I mentioned was Helene La Rue. His own research in the area confirms her conclusions.

Chitarra Battente

This is a very inadequate entry. Characteristics of this instrument that are not mentioned include the bend in the soundboard near the bridge, metal strings, and fixing of the strings at the bottom of the belly (not on the bridge).

The origins of this instrument have been very poorly researched. My guess is that it was a wire-strung version of the Spanish guitar (inspired by the English Guitar) that
was developed in the third quarter of the 18th century.

I am surprised that it is supposed to be played with a plectrum. Is there evidence for this? I would have expected some soundboard protection as on the Neapolitan mandolin if this were the case.

**Chitarrone** (by I. Harwood and R. Spencer)

It is stated that the oldest known reference to the theorbo appeared in 1595. I can't identify this reference. If it can truly be associated with a large lute with reentrant tuning and extended neck for basses, and not just a hurdy gurdy, then it would prove that Piccinini's chronology of the development of the chitarrone and theorbo is wrong. I very much doubt whether this is the case, for if it were, it would have been used by Smith in his feeble attempt to discredit Piccinini. The authors have unfortunately taken Smith seriously enough to write that in the 16th century "chitarrone" may have referred to an instrument without a second pegbox. For more detailed discussion of Smith, Piccinini and the origins of the chitarrone, see the Comm "On Extended Lutes" in this Q.

The authors write that "Praetorius said that the longest instruments were made in Rome while those in Padua had larger bodies. But this is not confirmed by surviving instruments ...". This would seem to imply that Praetorius was somehow mistaken. There is no basis for this implication. It is more likely that the Paduan theorbo mentioned by Praetorius was soon superceded by the Roman type and that there are no surviving examples of the Paduan type.

**Chordophone** (by H. M. Brown)

The definition given is "General term for musical instruments that produce their sound by means of strings stretched between fixed points." Since the sound energy in the string rattle of a snare drum is probably greater than that of the skin alone, a snare drum would then be a chordophone. But that is not what we want. All instrumental sound is the result of the interaction between an energy source and a resonator or series of coupled resonators. I would define a chordophone as an instrument in which the primary pitch-controlling resonator is a string stretched between substantially fixed points (if the points were truly rigid, no energy would be transmitted to other resonators).

**Chor-Ton** (by G. Oldham)

This very naive little article would benefit from an injection of some of Comm 683.

**Chorus** (by M. Remnant)

This entry starts with "the spurious letter of 'Jerome' to 'Dardanus'" mentioning that the term meant both a type of bagpipe with brass mouthpiece and chanter and a stringed instrument "which would presumable have been plucked, as the bow had not reached Europe by the 9th century". Why should two so different instruments be called by the same name in the same source? In "Pedigree: Essays on the Etymology of Words from Nature" by S. Potter and L. Sargent (London, 1973), it is shown that in medieval times, animals with very different appearances would have the same name if they moved in the same way, or were otherwise functionally equivalent. This has led to my supposition that names for musical instruments were associated primarily with playing technique. Now if the bagpipe were not a bagpipe but two brass tubular bells suspended in a hanging bag, and the stringed instrument was a string drum, they then could both be played by the same technique.

Further references in the entry are not inconsistent with this interpretation. Gerson (1363 - 1429) described the chorus clearly as a string drum with two or three strings.
Americ de Peyrac (c. 1300) said that the chorus had two pairs of strings tuned a fourth apart (a rather more modern string drum used for accompanying a pipe had two strings tuned to tonic and dominant of the pipe's scale). John of Trevisa's translation of Higden gave "tabour" as an equivalent to "chorus". The tabour was functionally very similar to the string drum, so this fits.

But two other sources gave "crowde" as equivalent to chorus. I haven't seen any evidence on what the crowde or crwth was like in medieval times, but people seem to think that it was a bowed lyre (perhaps because this was what the 18th century crwth was like). Assuming that this was the case, let us consider illustrations of bowed lyres.

First take the famous St Martial Troper picture with the lyre player sporting a crown while sitting on a throne. This picture has been used by the author of this entry for light relief in lectures about medieval instruments since it shows how ridiculously wrong medieval artists can be. The hilarity results from the bow being on the wrong side of the big flat bridge. But consider how sensible this really is if the fellow wanted to produce a string-drum effect. A bowing motion bouncing the bow hair off the strings would do it nicely. This lyre looks like it was designed especially long to provide this facility. It also had a fingerboard so the fellow could do other tricks with it as well.

But what about the lyres without fingerboards that were bowed in the middle of the string (a not unusual medieval position)? What can one do with them? Doing the string-drum act is an option that cannot be ignored.

Consequently, there is no need to be coy about saying what a chorus was in the name of scholarly caution. The simplest hypothesis that fits all of the surviving information is that the chorus was either a string drum or any other instrument that can function like a string drum.

Cithrinchen (by J. Tyler)

The entry states "A confusion between guitar and cittern is evident in James Talbot's famous manuscript ... ". The confusion is not Talbot's. What Tyler had not realised at the time of writing this is that the term "gittern" or "guittern" in England after the beginning of the 17th century referred to a cittern-like instrument with guitar-like tuning. Playford made no mistake when he depicted a cittern-like instrument for the title page of his gittern music. The evolution of this gittern from the small cittern played by Robinson and Holborne is clearly related in one of the Tabley manuscripts.

Citole (by L. Wright)

The entry starts off by stating that the citole was related to the fiddle, but the possible nature of this relationship is never discussed. Wright knows as well as I do that evidence for the instrument name "fiddle" exists from much earlier than evidence for "citole", yet Wright does not make the obvious step of suggesting that the fiddle might have fathered the citole, or even that the citole was one of the surviving types of plucked fiddle after most others adopted the bow. (Juan Ruiz (c. 1330) mentioned both "citola" and "vihuela de pendola", so at least in Spain late in the citole's heyday, the term "citole" did not just mean plucked fiddle.) And when almost everyone else would call the relevant 9th century Stuttgart psalter instruments "plucked fiddles", Wright calls the one he illustrates "? citole" in spite of his stating that it is "related to the fiddle" and his research showing that the name "citole" appears no earlier than around 1200. Also, how can he label the three-string plucked instrument on the keystone of the church of St Serge, Angers, as "? Citole" when it is so similar to the instruments he shows in his article "Sculptures of Medieval Fiddles at Gargilesse" (GSJ XXXII (1979), 66) when there is not a bow in sight? I wonder whether Wright considers that all plucked fiddle-like instruments were citoles, and when plucking is not clearly indicated the instrument is a fiddle (presumably bowed). What would he call the plucked four-string instrument in Lincoln Cathedral (Plate 18 in Jeremy's "Med. and Ren"), or the somewhat similar four-string instrument called "fiddle" by Page (GSJ XXXIII (1980)
Wright mentions evidence for the same player playing both the citole and the bowed fiddle, and the appearance of frets on both which could make this easier (it would be easier yet if they had the same tuning). The distinctions between citole and fiddle need clarification, and if there is no historical information to help, Wright should state the provisional assumptions that he does make so we can argue about them.

In two places in the entry Wright worries about Tinctoris (c. 1487) writing that "the cetula was only used by rustics" while depictions of this 15th century Italian instrument imply high status. It is my impression that these depictions are from at least a generation earlier, and that is plenty of time to go thoroughly out of fashion in high places.

I am sure that Wright is wrong about the touching and sloping of the block frets of the 15th century Italian instrument. The proof is in Comm 125.

**Cittern** (by I. Harwood and J. Tyler)

The entry states that "the cittern was played with a plectrum". The word "usually" belongs before "played" since English 17th century practice sometimes involved finger playing.

When describing the early carved citterns, the comb is mentioned "with slots between the teeth through which the strings are attached." The method of attachment is not stated. As Forrester has pointed out in Comm 466, for each pair of strings, the wire is threaded down through one slot, around a bar and up through the next slot. The bar is held in place against the comb only by the strings.

The construction of the built-up cittern is described with much less detail than the carved type, so I suggest that the following be added: Hadaway has observed that the sides are wrapped around the back, as contrasted with guitars in which the back is glued over the edges of the sides. The back usually has two bars, one of which is directly below the centre of the soundhole and the other one is lower on the instrument than any of the soundboard bars. The rose is usually higher on the soundboard than on the carved design so there is usually another bar between the rose and the bridge.

It is stated that "a characteristic of the cittern is its unusual neck, which is half cut away ". This is stated too strongly, as if a half-cut-away neck was necessary for identification as a cittern. Comm 16 concludes from observing illustrations that this neck design was rare in English and French citterns. This is well demonstrated by comparing the entry’s Fig. 6 (the Le Roy and Ballard drawing) with Fig. 7 (the Virchi cittern in Vienna). They both are shown with almost identical views, almost face on but rotated so that one can see some of the left side. On the Virchi cittern (which has a cut-away neck) we see the fingerboard but none of the side of the neck, while on the Le Roy and Ballard cittern we see what is apparently a full neck.

The authors closely follow Winternitz’s theory about the evolution of the cittern from the kithara. The main virtue of this theory is its simplicity. It characterizes a cittern as a strung instrument with a fingerboard played with a plectrum that has the non-functional decorative feature of ears or wings on the body on either side of where the body and neck meet. These wings are assumed to be vestigial remains of the arms of the original kithara. That the wings were inspired by the kithara or lyre cannot be denied. The shape of these arms is a powerful image of the ancient Greek and Roman civilizations, and they can arise independently in the design of objects including, as Winternitz has pointed out, in the design of musical instruments. For a musically significant relationship between common design features of different instruments, opportunity for one influencing the other by continual intervening use needs to be established. This can be done (more or less) between the citole of 1200 onwards, but
going farther back from then, the relationships postulated by Winternitz are too far-fetched to be convincing. His link between the kithara itself (with no fingerboard) and the citole (with fingerboard about the same size as the body) is a 6th century Byzantine instrument (with practically all fingerboard and very little body) which is obviously an ancestor to the saz bouzouki and colascione, and unlikely to be musically related to either the kithara or citole. Wright goes much more deeply into design aspects of the citole in his entry on the subject and sensibly comes to the conclusion that the wings, though common, are not an essential characteristic of the instrument.

The authors have not inspected the geometry of the block frets and strings on the 15th century instruments carefully enough. They mistakenly claim that the blocks decrease in height from the tuning-peg end of the neck to the body end. They also suggest that the spacing between the strings might often have decreased when observing in this direction (as would be the case with the kithara). In the six different depictions of this instrument given by Winternitz, the strings in four are very close to being parallel, and the remaining two are clearly splayed out in the opposite direction than that postulated. The only example I know of the splaying that they describe is the late 12th century sculpture in Parma of a tiny citole (where the splaying is necessary to have room for fingering on the fingerboard and still keep the bridge width well-proportioned with the body width).

The entry has the statement "at what stage the medieval citole became the Renaissance cittern is impossible to determine exactly, since they share the same essential characteristics." There is more known about the transition than is implied here. As Wright has shown, the citole was well out of fashion by 1400 everywhere in Europe except Spain (where it held on a bit longer). The development of what Tinctoris called the "cetula" happened in Italy somewhat later in the 15th century and the main difference was that the citole used gut strings and the cetula used metal strings which were associated with wooden block frets which extended past the neck on the "bass" side. I suspect that the extra width of the block frets is spare for moving the fret a bit (and sawing off the "treble"-side overhang) whenever wear from the metal strings requires renewal. There may have been a tuning change from citole to cetula as there was in Italy from cetula to the proper Renaissance cittern (the fourth between middle strings expanded to a fifth). The 16th century French cittern preserved the cetula's tuning except that a single octave-lower string was added to each of the two highest courses (which were a unison pair), and the music for this instrument exploits the octave ambiguity of these two courses (being either the highest or the lowest).

Another useful addition to mention is that Virchi indicated that the hexachord tuning was the standard one in Italy. It was also mentioned by Lanfranco, Cerone, Praetorius and Mersenne. Another useful addition would be to specify the six-course tuning by Kargel and Lais, for which there is much music. Another would be the colour coding of the wooden fret-fixing wedges as described by Forrester in Comm 466.

The entry claims that Virchi invented the built-up cittern. This would imply that the cittern of Le Roy and Ballkard was of the carved type. The shape of that cittern is much closer to that of surviving built-up citterns than to carved ones, so this is unlikely. It is more probable that the perfection supposedly introduced by Virchi was in making the fretting fully chromatic.

The small English cittern is mentioned and associated with the higher of two pitch standards a fourth apart around 1600. I have mentioned (Comm 597) three secular English pitch standards at this time and indeed the highest (similar to Praetorius's Cammerthon and the late 17th century Chappell Pitch) and the lowest (for viol playing alone, as reported by Praetorius) are a fourth apart and the cittern seems usually to have played at the higher of these. But these are not the pitches Harwood had in mind when he wrote his article proposing the fourth-apart theory (E.M. Oct 1981). They are my third standard (Consort Pitch, a tone below my highest) and a standard a fourth above
The fourth-higher standard of Harwood would be natural whenever a high treble viol existed. There would be little use for this standard without the high treble viol. That these viols were a rarity in 17th century England is testified to by the following points:

1. Praetorius had some experience with the English playing viols and he was not aware that this size of viol existed.

2. The sizes of viols in late 17th century England are well established by the information given by Talbot and Simpson (essentially the same as given by Praetorius, and a high treble viol is not included), and there is reason to believe that those sizes (except for the lyra viol) did not change during the century.

3. Rousseau (1687) wrote of a decrease in viol sizes in England and France since the Renaissance, so he could not have been aware of a small set led by a high treble viol.

4. Treble viols were often mentioned throughout the century with never an apparent need to qualify the name with words like "high", "low", "large", or "small".

In consequence the large treble viol was the standard instrument in England and the small one was not widely enough used to have been worth mentioning. Harwood's fourth-apart "double standards" theory is not to be taken seriously unless or until he can answer these points. The small English cittern stands on its own without association with the fourth-higher standard. It works superbly at both the highest secular pitch (which I sometimes like to call 'English Light-Music Pitch') and at Consort Pitch.
The recent CIMCIM extravaganza in Washington D.C., New York City, and Boston provided CIMCIM members with a number of opportunities for discussions about various aspects of the applications of computers to our work. A formal CIMCIM meeting devoted to the subject was arranged in New York City by Barbara Lambert both for CIMCIM members and guests. The Boston Computer Exchange was host to a second meeting arranged both for CIMCIM members, and for interested colleagues who were in Boston for the AMIS/GS meetings. In addition, the Historical Instruments Conservators Computer Users' Programming Society (see Appendix) met in Washington D.C. during the week of CIMCIM's gathering there. This conference was also attended by several of our members.

This article is not intended as a detailed report of what was said at these meetings. Instead, it will attempt to provide a selective review of that portion of the material presented which is most likely to be of direct practical use for future development within the CIMCIM community.

The question of greatest interest, and most extensive discussion, was the means by which microcomputers could be used to establish electronically-based catalogues of our collections. This gave rise to a second question concerning the possibilities of making each museum's individual computerized catalogues available to other museums. Applications of telecommunications technology, such as allowing one computer access to another via direct telephone connection, were also discussed.

It was obvious that the CIMCIM membership spans a broad range of experience and erudition when it actually comes to having worked with computers. Several members had been using personal computers for some time, and were well aware of their possibilities for extensive use in cataloguing. Others had used terminal connections to larger computers, as well. There were also a number of people who knew relatively little about the technology being discussed and had difficulty envisioning how these machines could help us do our work substantially more efficiently than we already were doing it. (The reader who is similarly unfamiliar with the fundamentals of the subject will find that bookstores and libraries abound with introductory literature. Technical jargon has been avoided to the extent possible in this article.)

Despite all this, little more than brief discussion was necessary before there was general agreement that computerized catalogues indeed might prove to be more useful than conventional accession books and card files. The reasons for this become obvious if one considers a typical card catalogue of a museum collection arranged systematically according to instrument type. It would be quite easy to use this catalogue to locate, for example, all saxhorns in the collection. Difficult, if not impossible, would be the use of the same catalogue to determine the collection's holdings of all instruments from a given builder, or all instruments made during a given period regardless of type. A computerized database may be searched with no difficulty for all conceivable combinations of information which it contains, as for example every hornhostel made in London before 1873, signed by someone who also made timpani. The largest portion of the time at the meetings was therefore spent in considering realistic means for initiating a transition away from the familiar techniques, towards those of potentially greater utility.

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With due consideration taken to the various levels of our individual involvement with computers, the New York meeting was summarized in two more or less emphatic suggestions. First, no general recommendations about computer hardware or software could, or should, be given. Our membership is international and must deal with different languages, alphabets, and systems of alphabetization — as well as often substantially different local market offerings of hardware and software. Advice about the acquisition of basic systems should therefore be obtained from local sources. For similar linguistic reasons, if none others, it was regarded as unrealistic to hope to establish a uniform format for the computerized catalogues of all our member museums. Therefore, the second recommendation made, and by far the most important aspect of all the meetings, was what in effect was a CIMCIM policy decision about the adopting of a small number of elements which all our individually developed databases should contain. A provisional working group, led by Barbara Lambert, was established to serve as a forum for discussing our continuing experiences with computers.

The initial structuring of a database determines its ultimate utility. The individual needs of the collection at hand will determine the most sensible structure for its computerized catalogue, given the limitations imposed by available technology. (In fact, it would be extremely wise to have considered both aspects of this with the greatest care before making any hardware or software acquisitions.) A large collection of mixed types of instruments from all parts of the world should not be treated in the same manner as a smaller specialized collection of 18th century central-European woodwind instruments. There will, however, be a certain number of descriptive elements which will be relevant to both of these collections. Every object will have a name, catalogue number, place of origin, etc. For this reason CIMCIM has decided to urge its members to include nine common fields in any computerized catalogues which they may develop. This will enable us to exchange basic information from our catalogues in the most efficient manner possible. For example, a search for information from these nine fields in one catalogue can be repeated in identical form in any other catalogue using the same nine fields. This will also provide straightforward means for initiating more specific inquiries about the detailed, individually structured information in these catalogues, as well as enabling more advanced searching techniques (more about this below).

Here then are the "CIMCIM Big Nine":

1. COLLECTION The first field in any catalogue entry should bear this name, and will simply contain the name of the collection which holds the object.

2. NUMBER This is the signum and catalogue number of the object, in the format normally used by the collection.

3. LASTNAME This is the last name of the maker of the object. This, and the following two fields may be used as appears most sensible from case to case. The names of these fields do not impose any rigid constraints on the nature of the information which they may contain.
4. **FIRSTNAME**

5. **MIDDLENAME**

6. **DATE**
   This is the known or assumed date of the instrument's manufacture.

7. **ORIGIN**
   This is the geographic location at which the instrument was made. If no information is available which might otherwise be placed in the three name fields, this field may contain more elaborate details about the instrument's point of origin.

8. **TYPE**
   This is the name by which the instrument is identified (discussed below).

9. **COMMENTS**
   This is quite simply any additional commentary which might be felt necessary, such as reference to where additional information about the object may be found.

If the information in any of the fields is to be used as a key for the generation of a sorted list, such as a chronological list of trumpets according to date of manufacture, it will be necessary to place the sorting key as the first word in the field. For the example given, the numerical value of the dates would be the first entry in the date field, followed by any additional commentary. Those fields for which no information is available may be kept empty. The vitally important point is that the basic structure of the database must contain each of these fields bearing the exact names, and in the exact order given above. These fields are not intended to be exhaustive, and should not be used to store information lying entirely outside the basic framework described. Highly detailed additional information, such as measurements and similar data, is best stored in separate fields.

The **TYPE** field can present substantial problems. If a correct non-ambiguous name for the instrument is known to whomever is cataloguing it, there should be little difficulty. In absence of this information, writing an easily locatable catalogue entry will be no less difficult when using a computer than it otherwise would be. The process of searching through a catalogue containing objects with unspecified names is, however, greatly eased by using a computer. A blank **TYPE** field will indicate that a proper name for the object was unknown to the cataloguer. The search must then be conducted on the basis of the other fields. It may be useful in such cases to provide a summary description of the instrument's appearance in the **COMMENTS** field. An entry here of the type, "looks like a pitchfork", will be found by anyone imaginative enough to suspect that such a commentary might have been made, and therefore to search for words describing the appearance of the sought object. It would be difficult to design similar techniques for use with a card file.

Since each field will be searched by the computer with little effort on the part of whomever it is that is conducting the inquiry, there is no need for the systematological stringency which conventional cataloguing requires. Assume that of three player pianos, one is catalogued as a "player piano", another as a "piano, player", and a third as a "great big thing with wide pedals -- player piano?". A catalogue search on the **TYPE** field for everything containing the words "piano" and "player" will turn up these three objects.
Additional player pianos not catalogued using both these words might be revealed by examining the contents of all TYPE fields in the catalogue containing the word "piano" and more than one additional word. One could also check to see if there were any "planers" by looking for TYPE entries containing the letters "plan" at the beginning of all words. The advantages of this kind of catalogue search should be apparent. (Dare one suggest that the problem of developing a logically perfect terminological and systematological means for classifying musical instruments hereby loses the urgency which has plagued us all for so long?)

Implementing all that has been said thus far will greatly aid the individual museum in retrieving information from its own catalogues. It can thereby enable speedier and more effective communication between museums about information to be found in these catalogues. This is a goal well worth working towards. It will also be discovered that the word-processing abilities of even the most unassuming microcomputer are overwhelmingly superior to those of a typewriter. In fact, alleviating the drudgery of daily correspondence and other scribal chores is probably more than enough justification for the acquisition of a computer, whether or not it ever will do actual service in connection with database management. (To say nothing of the utility of computers in such things as climate monitoring and control, and surveillance.)

The meeting in Boston dealt with means by which the information in our computerized catalogues might be exchanged on a computer-to-computer basis. At present it is common for one museum to write a letter requesting a database search at another museum, with the second museum performing the search and writing a return letter containing the results. In this case it is essentially irrelevant if the database itself is stored on pieces of paper, or on a magnetic medium. Assuming, however, that the entire database could easily be placed on magnetic tape or a few diskettes, it would be possible to provide copies of this database to be searched in at liberty by anyone with a suitable computer. Providing updates of this information would be a simple task. There is no equivalent procedure for dealing with substantial card catalogues other than having their contents distributed in printed form. Making photocopies of a limited number of cards may be easy enough. Printing a full catalogue in book form is not.

It would also be possible for the first museum to use its computer as a terminal to the other museum's computer and search directly in the latter's database. The techniques by which this can be done are very well established and require no expensive hardware. Although they have yet to be implemented in our field they would involve no substantially greater expense than the telephone calls necessary to connect the computers.

To illustrate this type of cost we may consider another telecommunications task which would in all likelihood be of immediate interest to most of us. Assume that the full text of this article were to be transmitted via a normal telephone from the computer on which it was written (a real cheapo machine, of the sort unlikely to be beyond any museum's or individual's financial means) to a similar computer which, for the sake of argument, might be found at the editorial offices of the CIMCIM Newsletter. At the fastest rate presently in common use for this sort of task, this would take just under three minutes. (Current or foreseeable technological developments will result in a
substantial decrease in this transmission time during the next few years.)
The Swedish telephone company charges less for a three minute connection to
the United Kingdom than it costs to purchase the postage necessary to forward
the typescript for this article as an airmail letter.

The telephone option would, however, result in substantial additional
savings. The manuscript could be sent immediately upon its completion without
the expense of having it typed out, or any delay in the post. It could then
be edited without any typing or retyping of anything. The final typescript
copy could be produced directly under computer control using no more elabo­
rate a device than an electric typewriter connected to the computer. (The
market abounds with such machines.) It would also be possible to adopt the
very common procedure of having the editor's computer forward the entire text
file to a typesetting establishment. Almost all of the manuscripts submitted
for publication in this Newsletter will have been retyped manually subsequent
to their having been submitted to the editor. The present article was typed
in its final form by an electric typewriter under the control of the author's
computer. A preliminary draft had also been printed out, sent to the editor,
discussed in a far longer than three-minute telephone conversation, and then
printed out a second time and posted once again to the editor. The services
of a typist were not necessary for the final transcription, thereby resulting
in tangible savings of time and labor. These costs could, however, easily
have been reduced even more substantially if only the Newsletter editor also
had been working with a computer. All this makes it reasonable to wonder
when, and not if, it would be sensible to computerize the entire process.

Searching another museum's database over the telephone may take noticeably
more time than that used in the previous example. If, however, the "Big Nine"
format is widely adopted, this search time will be reduced to a minimum.
Since we would know the basic structure of each database with which we would
be dealing, the search procedure could be prepared in detail before going on­
line. It may, nonetheless, be difficult to evaluate the justification for any
expense of this type at present. We have no comparable items currently in our
budgets, and any costs for joining our computers to telenetworks may possibly
appear extreme if for no other reason than their novelty. Once the desirabi­
licity of this type of communication has been established we will presumably
find little difficulty in allocating what, despite everything, will be the
rather modest funding which it requires. It should also be noted that the
currently available alternatives to directly dialed telephone connections may
cost as little as one quarter of normal telephone time.

There is much which could be said about various alternatives for this type of
communication. As we have yet to determine if we will successfully deal with
the basic task of setting up our computerized catalogues, this is probably
best regarded as a "Phase 2" project for CIMCIM. (Nonetheless, experimental
work in various forms of non-paper information interchange is already being
conducted by several CIMCIM members!) First we must get started cataloguing
our new acquisitions with the help of computers, and then we must worry about
transferring the contents of our older catalogues into the new databases.
Here as well, help may be on the horizon in the form of optical character
reading equipment which can read catalogue cards directly into computer mem­
ory. We were shown quite an impressive, yet relatively inexpensive set up for
doing exactly this type of work, at the National Air and Space Museum of the
Smithsonian Institution. The first advertisements for genuinely inexpensive
equipment of this type have already begun to appear in computer magazines.
By whatever means it might ultimately be attained, there can be little doubt as to the potential value of a museum having immediate access both to its own up-to-date catalogues, and to those of as many other museums as possible. Although this may presently appear as somewhat of a utopian vision, it should not be forgotten that there are many professions which have long since accomplished comparable electronic revolutionary feats. Should we succeed in similarly broadening the scope of our own field, we would certainly have achieved something of inestimable organological value.

* * *

APPENDIX

The Historical Instrument Conservators Computer Users' Programming Society was established in 1982, both in reaction to the growing practice of organizations choosing names with cute acronyms, and to provide a corporate identity for musical instrument conservators interested in electronic computational devices. By the time it was realized that their own name entirely coincidentally had an acronym which might be regarded as deliberately mirthful, they had become so widely established that it was no longer possible to consider a change. Quoting from their own material, the organization, "is dedicated to encouraging the use of CAC-CAO (Computer Aided Conservation - Computer Aided Organology) techniques in both the musical instrument museum field and in general conservation". Several research projects in this field have been conducted by the membership, resulting both in journal articles and books. Additionally, HICCUPS has produced its own series of "Applications Notes", which thus far have given documented programs for pocket calculators, dealing with various organological and museum climatological problems. (Initially, the second C in HICCUPS stood for "Calculator", having been changed to "Computer" at their 1985 Global Convocation held in Washington D.C.)

As might be expected, a large number of HICCUPS members are also members of CIMCIM. Hopefully both organizations will often collaborate on projects of mutual interest. The experiments in various types of computerized information interchange which are mentioned in the main body of this article are, for example, being conducted by individuals who are members of both groups. Anyone interested in further details about the Historical Instrument Conservators Computer Users' Programming Society may contact them care of the present author.

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I am not completely averse to modern technology, having just obtained an excellent electronic typewriter, and so I have carefully read both of Mr Karp's computer Communications. He asks for responses, so here is mine.

My immediate impression is that Mr Karp is a very able and enthusiastic computer buff trying to find applications for telecommunications technology in all his interests, including FoMRHI. My second is that perhaps we are not ready for him yet. I suspect that if we were to conduct a survey of our members we would find surprisingly few with access to micro­computers, and even fewer actually owning them. A large proportion of FoMRHI members are full-time instrument makers, and usually don't have any pressing need to own a home computer, or the time to play with them, remembering that the biggest single selling point of them is being able to play space invaders or similar games!

However, if Cary says that if FoMRHI is to survive it must adapt, there must be something wrong with the present system. Perhaps we had better investigate. As far as I am aware, the most important aims of FoMRHI are as follows: The circulation of ideas too informal to be published elsewhere; friendly discussion of these ideas; no editing of Communications and rapid distribution.

Looking back at various Qs from the previous 10 years, I get the impression that a fairly large number of articles would have been better suited to more 'permanent' publications such as the Galpin Society Journal (and some of their articles would have been better suited to FoMRHI!). Telecommunications technology would do nothing to help solve this problem.

Communications are discussed to a certain extent, but there are probably many more opinions left unsaid. This could be where the CBBSs would be useful, but I think so few members would have access to it that we would find some matters all labelled and filed away by the FoMRHI Computer Club before the rest of us had had a chance to put our oar in. I don't think being able to telephone latest ideas to a computer will encourage members to become more involved in discussions. If people are enthusiastic enough they will write anyway, and a short note in an envelope is quick to write, and certainly much cheaper. This seems to be the most important consideration for more than half of our overseas members, as they won't even pay the extra £2.50 for airmail.

I think it is vital to preserve our present no-editing style. At present, all the editing that occurs is that the Comms are cut in appropriate (or rarely, inappropriate) places to fit the pages most economically. Cary suggests that Comms fed to a CBBS could be edited by a spokesman and the pickings printed in FoMRHIQs. He also suggests that Comms could be fed directly into the Editor's computer, so that they could be edited before being printed out. We all know how easily authors can be misrepresented when this is allowed to happen. Also, who would pay the editor for doing this? Once editing is introduced, FoMRHI is no longer the friendly informal fellowship it originally set out to be.
As about four years ago the Bulletin was typewritten with that horrible computer type I wrote to Ephraim Segerman to complaint, and he answered me that he did completely agree with me. In the next issue the bulletin was typed with a different type, but still one of these horrible computer types. So I stopped reading Fomrhiq's comms and Bulletin which were typed that way, because it is too big a waste of time. Now when I just joined again it was to see how proud Jeremy was of his new computer-typewriter. Perhaps I'm the exception, perhaps it's because I live in Gutemberg's country or because I studied Typography a few months or because I used to collect pre-1500 prints (especially printed music), but I can't help it not to like those illegible computer's types. More: I don't understand why these machines do cost ten times more and deliver such a poor typestyle. It takes five times more to read the same text in a bad, small, faint type than in a classic type, round, with serifes like a Garamond or a Baskerville or even a Times Bold. Even an old typewriter with its big, 10-types-to-an-inch typestyle Pica (like mine) is far more superior than any computer-print-machine. As Fomrhiq's are reduced at a rate
of 40%, it is better to use a 1/10 type-style because it will always be readable enough even if the ribbon is not new, the types irregular or the Xerox grey. Some 1/12-typestyles however are still good in reduction, like the ones by Cary Carp and Jacques D. Way; a bold 1/12 is still better as one can see in Jan Bouterse's comm. 641, all taken from № 40, July 85. The new type used by Cary Carp (Comm. 678, № 42, Jan. 86) is the lower limit. By the way, it shows that computer technology can be used with "normal" typewriters (e.g. Olympia, Canon, Brothers, Triumph-Adler etc.) which all offer models with proportional typefaces (like the ones used since writing and printing exist) and block-printing, and even automatic syllabes-separation (IBM). Jeremy's and Eph's don't separate syllabes, I never seen one, but Carp's do. Unfortunately Carp's typeface is not very good, any kind of antiqua would make his texts easier to read. I'm sure he could get such a typeface.

I must confess that I don't know what a computer is and obviously it shows that I don't need one. (I even can't use a pocket calculator for anything else than the four simple operations and root calculation). If a computer would help me getting all the written information on harpsichord which is scattered all over the world I would immediately buy one,
but as long as the software don't exist it's useless. I know of hundreds of articles and books, the most of them being still available at least in some library but the difficulty is to GET them! I have perhaps 1,000 printed items on keyboard organology, the University library of Siegen perhaps another 1,000 but there are perhaps 10,000 others! The problem is that one has neither the money nor the time to get all this information. A good system would be to have some sort of screen which would show you any text one wants to see; if one think it's worth having it, one could have it printed immediately by Xerox. So you could have a glance on it before "buying". If such a system were perfect, information could be immediately available at any time and to everyone. This of course is utopic and it would end in a dramatic acceleration of the communication and would probably mean a collapse of research and the end of mankind or civilisation, because it would kill the notion of time. But by chance we are far from that and since 70 years post is becoming slower, not faster. So please keep Formrhi as it is, quaterly, too late, with articles written in every style and with the most various typefaces (but not so ugly please).

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[This draft is aimed at musicians just getting into baroque orchestral playing, or those non-keyboard players who haven't given the subject of early tuning much thought. Perhaps it will be of general interest to instrument makers; I would like to show it first to FoMRHI members for critical evaluation before making it public --- the more critical the better. I feel like an amateur in this field, and hope for feedback from some of you with more practical experience or longer thought on the subject. What's missing? What's mistaken? Etc.?]

"Temperamento per comune opinione perfettisimo": 18th-century tuning for singers and orchestral instruments.

"There are more things in heaven and earth than are dreamt of in your philosophy, Horatio"

No set of rules or abstractions from practice can possibly encompass the complexities of playing well in tune, or substitute for an alert ear and a willing spirit. But one cause of poor intonation may be a difference of opinion as to where notes should be placed. In early music, we cannot depend only on our ears to play in tune, since our ears were originally trained in a system that is anachronistic to the music we are playing. To know where notes "should" in theory be may help us at the moment of playing by eliminating random searching. Is there a consistent system of tuning non-keyboard instruments that is historically convincing?

It was the harpsichord that led the way into the early music revival and eventually to the rediscovery of original baroque orchestral instruments. Inevitably, the use of these instruments has brought a new awareness of the possibilities of tunings other than modern equal temperament (which has been in vogue roughly since the beginnings of the romantic period). But our thinking on the subject of 18th-century tuning has been dominated until now by the vast and confusing numbers of tuning systems that come with the harpsichord, while common sense and a number of early sources suggest that tuning for other kinds of instruments and for singers, whose notes are not fixed like those of keyboard instruments, was a relatively simple and universal system (albeit with occasional ad hoc adjustments).
The clearest difference between the tuning of modern instrumentalists and early music specialists seems to be in the placement of the major third. Pure thirds are by no means the sole domain of baroque musicians: many modern players (especially string players tuning intervals to open strings) use them in an ad hoc way, though usually without their concomitant low leading-tones. (A pure third is, after all, both easy and very satisfying to play.) But there are other major differences in convention between the tuning of modern and early players, involving fifths, leading tones, and distinctions between enharmonic pairs. To describe these, a brief review of some basic tuning theories and a survey of 18th-century indications of tuning for non-keyboard instruments will be useful.

Neither in theory or in practice is it possible to combine both pure fifths and pure major thirds in the same tuning system. A series of four pure fifths placed above each other (for instance, C-G, G-D, D-A, A-E) will produce a major third (C-E) considerably higher than pure. This is called Pythagorean tuning, and was common in the Middle Ages. The fifths are pure, which means that thirds are large --- larger even than in equal temperament.

Meantone, which became common by the middle of the 15th century, favors the thirds. This is accomplished at the expense of the fifths, which must be tuned small. This in turn has the effect of making sharps lower than equivalent flats [eg. A#/Bb or D#/Eb]. It is this latter tuning characteristic -- that enharmonic pairs of flats and sharps differ from each other --- that distinguishes and defines the 18th-century tuning of non-keyboard instruments.

In his *Opinioni de' cantori antichi e moderni* (1723), P.F. Tosi writes:

> Everyone knows that there is a Semitone Major and Minor, because the Difference cannot be known by an Organ or Harpsichord, if the Keys of the Instrument are not split. A Tone, that gradually passes to another, is divided into nine almost imperceptible Intervals, which are called Comma's, five of which constitute the Semitone Major, and four the Minor....If one were continually to sing only to those above-mention'd Instruments, this Knowledge might be unnecessary; but since the time that Composers introduced the Custom of crowding the

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2. Chapter I, par. 15. The translation used here is by the oboist J.E. Galliard, who published an English version of Tosi's book in 1743 entitled *Observations on the florid song*.
Opera's with a vast Number of Songs accompanied with Bow Instruments, it becomes so necessary, that if a Soprano was to sing D-sharp, like E-flat, a nice Ear will find he is out of Tune, because this last rises. Whoever is not satisfied in this, let him read those Authors who treat of it, and let him consult the best Performers on the Violin.

Quantz discussed the same tuning characteristic a number of times in his Essai, considering it axiomatic that flats were a comma higher than equivalent sharps. The second key that he added to the flute was in fact invented for just this reason (to distinguish low D# from Eb). Discussing violin playing, Quantz says:

If enharmonic flats and sharps appear together, i.e. if a note lowered by a flat becomes transformed into the note just below it, raised by a sharp [or vice-versa],...the note with a sharp is a comma lower than the one with a flat. For example, G# should be a comma lower than Ab.

If these two notes are tied to each other (as in Fig.6), one must draw back one's finger a little for the sharp following the flat; otherwise the major third will be too high against the fundamental note. But if, as in Fig.7, the flat follows the sharp, the finger must be advanced as much for the flat as it was drawn back in the preceding example... This same thing is done on all instruments except the harpsichord, where the enharmonics cannot be effected, causing it for this reason to have recourse to a good temperament which allows either to be endurable. On wind instruments, these changes are accomplished through embouchure corrections. On the flute, the pitch is raised by turning it outwards and lowered by turning it inwards. On the oboe

3. Quantz, J.J. Essai d'une méthode pour apprendre à jouer de la flûte traversière. Berlin, 1752. Translated into English from the German and French editions of 1752 by E.R. Reilly as On playing the flute. London, 1966. Chapter 3 par. 3, 5, 8; Ch. 16 par. 4, 7; Ch. 17 section vi par. 20; section vii par. 4, 8, 9. All translations from Quantz are the author's, based on the original French text and Reilly's translation. (The French version of the Essai is not, properly speaking, a translation. It appeared simultaneously with the German version and was prepared for the benefit of Quantz's patron, Frederick of Prussia, who had difficulty reading and speaking German.)
and bassoon, the pitch is raised when the reed is advanced in the mouth and the lips are pressed together. It is lowered by withdrawing the reed and relaxing the lips.

By definition, a tuning system that distinguishes between enharmonic pairs, with sharps being a comma lower than flats, cannot be either equal temperament or the Pythagorean system (in which sharps are higher than flats). It must be either just intonation or some form of meantone.

Just intonation is a tempting possibility, particularly for string players; it "has always had a kind of fatal fascination for musicians because of the purity within the basic scale of the tonic, subdominant, and dominant chords, and of certain melodic intervals..." that can be easily tuned to open strings. Some early violin fingering charts indicate the use of a kind of just intonation, flexibly applied in a limited way. But it is a system that cannot be applied continuously, nor does it appear to have ever been attempted. As Barbour put it, "The bulk of the violinists [in c1730] were probably still accustomed to the just thirds and greatly flattened fifths of meantone temperament..."

Since violinists were not and are not required to apply any one consistent tuning system, some players use a combination of just and meantone, beginning with open strings tuned to somewhat flat fifths, but tuning intervals purely to the open strings. Wind players, too, tend to adjust long notes purely. Of any consistent system, this tuning in fact resembles most 1/4-comma meantone ("meantone" in its strictest sense), in which thirds are pure (as in just intonation) and fifths are smaller than pure by 1/4 of the syntonic comma. As Boyden pointed out, however (215), the difference between enharmonic pairs in 1/4-comma meantone is much greater than that specified by original 18th-century sources (41 cents as opposed to 22). 1/4-comma is not, therefore, the meantone they describe.

6. See Boyden.  
8. See Lindley, "Mean-tone", 875.
By defining a comma as the ninth part of a whole tone, Tosi divides the octave into fifty-five equal parts. This is equivalent to a meantone known as 1/6-comma, so called because its fifths are smaller than pure by this amount (its thirds are larger by 1/3-comma). This system, as we shall see below, also fits the characteristics of all the other early descriptions of tuning for non-keyboard instruments, and provides us with a framework on which to base our tuning. As far as I am aware, no other tuning for non-keyboard instruments had a significant following during the century.

The 1/6-comma tuning appears to have been commonly used until somewhere near the end of the 18th century. Sauveur in France, c1700, described it as the one "most favored by musicians in general, as distinguished from keyboard musicians in particular..."

In Germany, this tuning was also described by Johann Adolf Scheibe (1739). He twice advocated a system that distinguishes sharps and flats by one comma. He says they are "blended together" on keyboard instruments, but on violin and traverso, "D# and Eb" are two different tones, played with different fingerings. Telemann also endorsed Quantz's addition of a second key to the traverso. Sorge (1748) attributed the 55-part octave to the organ builder Gottfried Silbermann, "explaining that in its complete state it could not be used on the clavier; but it might be applied to the violin and to certain wind instruments and was easi-

12. Sorge, G.A. "Anmerkungen Über Herr Quanzens...#D und bE-Klappe auf der Querflöte" in Historisch-Kritische Beyträger IV:1-17 [ed. F.W. Marpurg], 1758, 2-5, equates Quantz's tuning with that advocated by Scheibe and Telemann, and refers to the "Comma telemann" as the 25.05th part of an octave divided into 2000 parts, Eijken 6.
est for singers."14 In Leopold Mozart's violin method (1756)15 flats are higher than enharmonic sharps by a comma. "It can be shown that for whichever of the standard commas we choose, the perfect fifths in Leopold Mozart's system were theoretically flatted by about one-sixth of that comma".

J.B. Romieu in 1758 adopted the 55-part octave as his "tempérament anacratique."17 An article on Quantz's 2-keyed flute by F.D. Castilon appeared in the Supplement to Diderot and d'Alembert's Encyclopédie (1777).18 Castilon, like a number of other writers on the flute of this period (Petri and Tromlitz),19 recognized the validity of Quantz's invention as a means of differentiating the low D# and Eb. In supporting the use of Quantz's two-keyed flute, these writers were of course implicitly advocating the use of the tuning system that he described.20

14. Chesnut 259 and Barbour 1972, 126, citing Sorge, G.A. Gespräch zwischen einem musico theoretico und einem studioso musices, Lobenstein, 1748. See also Asselin, P.Y. Musique et tempérament. Paris, 1985, 148. Sorge's article of 1758 took exception to the tuning advocated in Quantz's book. "Sorge, an organist, ...simply demanded the opposite of what Quantz called for, insisting that non-keyboard players subjugate themselves to keyboard tuning instead of the other way around." (Chesnut 260). In any case, Sorge was by this time a believer in equal temperament for all instruments.
15. Chapter 1, section 3, par. 15 and Chapter 3, par. 6.
20. Castilon included an interesting comment on the over-small interval between the low IV/IV# on woodwinds of the period (F/F# on traverso and oboe, Bb/B on recorder and bassoon):

...M. Quantz's flutes differ from all others in their tuning. Usually the F on the transverse flute is not flat enough and the F# is correct; in his, on the contrary, the F is true and the F# a little flat....Rarely, if ever, is music written in the key of F#, either major or minor, but very often in F major and minor. The F# appears but seldom as a tonic, and it is much better to have the F in tune, since it is the keynote of a tonality not only much used, but one of the most beautiful on the flute. F#, when it appears, could easily be tempered by the embouchure; but as it stands, F natural remains a bad note. [Translation from Halfpenny, pp. 65-66.]
John Hind Chesnut has pointed out that from a close look at Thomas Attwood's notes on his studies with W.A. Mozart in 1785-87, it is clear that Mozart's normal concept of instrument tuning distinguishes the small and large half steps of a meantone tuning similar or identical to 1/6-comma. The usual discrepancy between keyboard and other instruments also exists, and there is convincing evidence that the keyboard tuning suggested by Mozart was some form of irregular temperament.\footnote{Chesnut 263-71.}

A tuning that was essentially 1/6-comma meantone was called the "temperamento per comune opinione perfettissimo" by Barca in 1786,\footnote{Barbour 1972, 43.} and in 1791 D.G. Türk in his Kurze Anweisung zum General-bassspielen also distinguished enharmonic pairs, sharps being lower than equivalent flats by a "comma".\footnote{Boyden 212.}

A large number of woodwind fingering charts from the end of the 17th to the end of the 18th century confirm the use of higher pitches for flats and lower for enharmonic sharps, the amount presumably approximating the syntonic comma.\footnote{See Eijken and Haynes, B. "Oboe fingering charts, 1695-1816" in The Galpin Society Journal XXXI, 1978, 68-93.}

Such a tuning obviously requires more than twelve notes to the octave, since it uses both D♯ and Eb, G♯ and Ab, etc. On instruments with tuning that is flexible to some degree, these enharmonics can be produced without difficulty (cf. Quantz above). But on a keyboard instrument, not only is tuning fixed, but there are only twelve keys in each octave. This is why keyboard instruments often resort to complicated systems of temperament, unlike the singer or violinist, who can adjust intonation while playing.

"Temperament" in this sense equals "compromise", an attempt to make the best of the fact that only one note can be played when two are needed. For most other instruments, then, "temperament" is unnecessary. "Meantone" is not an 18th-century term or concept, in fact. Musicians were so unconscious of alternatives to it that it had no name; what we now call "meantone temperament" was simply normal intonation.\footnote{Chesnut 258.}

The keyboard instrument is traditionally the tuning authority in our ensembles; it is novel to think of it instead as the questionable factor. And yet this is precisely the standpoint of Quantz:\footnote{Chapter 17, section 6, paragraph 20.}
Any keyboard player who understands the proportion of intervals will also know that enharmonic equivalents like D# and Eb differ by a comma, and therefore cause on this instrument (unless the keys are split) a certain inequality of intonation in relation to the other instruments that produce these notes in their correct proportions. This is especially noticeable when the harpsichord plays with one of these instruments in unison. Now, since these notes cannot always be avoided, especially in keys with many sharps or flats, the accompanist would do well to put them in the middle or lower part... It is true that this difference [in intonation] is not as clear when the harpsichord is played by itself, or when it accompanies a large ensemble. But when the notes are found in unison with another instrument, the difference is very audible, since the other instruments give them in their correct proportion, whereas on the harpsichord they are merely tempered. For this reason, it is better to omit them entirely, rather than offend the ear.

In any but the smallest settings, a keyboard will be considerably less audible than the treble instruments. The sound of the harpsichord also dies away more quickly. It is obvious, then, that singers (cf. Tosi) and other players should adjust towards the violins and oboes rather than the harpsichord. But unfortunately, one group is caught in the middle: the other bass instruments. Quantz' advice does not solve their problem, since they play in unison with the keyboard.

There is no theoretical solution to this problem. It is at this point that general principals must be abandoned in favor of musical instinct (guided by a basic understanding of the cause of the problem). As Asselin suggests (137), the players of instruments with variable tuning must adjust to the instruments with fixed tuning; at the same time, the keyboard players should do their best to find a temperament that corresponds as closely as possible to the tuning tendencies of the other instruments (when key changes are limited, the harpsichord can afford to use a temperament that

27. Quantz suggests something very similar to this in Chapter 16, par. 7. The problem is more acute with an organ, which is of course more audible. From Tosi's statement above, it is clear that he accepted the fact that keyboard instruments and violins used different systems of tuning.
matches the other instruments well). We must also keep a perspective on the subject: a violinist, for instance, plays about \( \frac{5}{12} \) higher when playing \textit{forte} than when playing \textit{piano}.

As players of 18th-century instruments, none of us has been trained in a tradition that has taught us to use meantone tuning. We must therefore in some way "raise ourselves by our own bootstraps", and find methods of retraining our ears to encourage the practice of such tuning. Fortunately, the ear is adaptable, and most of us have reasonable pitch memories.

Explaining meantone tuning to non-keyboard players in terms of interval relations is not sufficient by itself, especially for wind players, since they normally play only one note at a time. Melodic players who think of music in a linear fashion learn to play a tuning by being sensitive to degrees of a scale that tend low or high. Even when the same fingerings are used for enharmonic equivalents, a player can learn relatively quickly to place notes as flats or sharps, if it is clear where they should be.

For this reason, it is helpful in retraining the ear to use a consistent system that is simple to understand and easy to remember, such as 1/6-comma meantone, as a guide. In comparison to equal temperament, notes in such a system are tuned

28. "We should be less surprised by [different systems of tuning] when we remember that from the nineteenth century to the present day, keyboard and non-keyboard instruments have characteristically been tuned according to different systems of intonation, the keyboard instruments being in equal temperament and the non-keyboard instruments usually in some form of quasi-Pythagorean tuning." (Chesnut 257).

29. This is the conclusion reached by the author and the baroque violinist Michael Sand, in recent experiments using a Korg tuner.

30. "Eighteenth-century writers on keyboard intonation speak primarily about the tuning of fifths and thirds, but the authorities on non-keyboard instruments...deal primarily with the tuning of whole steps and half steps. The difference in emphasis no doubt results from the fact that non-keyboard performers, unlike keyboard players, are principally concerned with melody lines rather than with chords. Since all the intervals are interrelated in a complete tuning system, however, this difference in emphasis is of no consequence to our understanding of the systems being proposed." (Chesnut 257.)

more extremely in proportion to their distance from the home key of, for example, C:

<table>
<thead>
<tr>
<th>Note</th>
<th>Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0</td>
</tr>
<tr>
<td>C#</td>
<td>-13</td>
</tr>
<tr>
<td>Db</td>
<td>+9</td>
</tr>
<tr>
<td>D</td>
<td>-4</td>
</tr>
<tr>
<td>D#</td>
<td>-16</td>
</tr>
<tr>
<td>Eb</td>
<td>+5</td>
</tr>
<tr>
<td>E</td>
<td>-7</td>
</tr>
<tr>
<td>F</td>
<td>+2</td>
</tr>
<tr>
<td>F#</td>
<td>-11</td>
</tr>
<tr>
<td>Gb</td>
<td>+11</td>
</tr>
<tr>
<td>G</td>
<td>-2</td>
</tr>
<tr>
<td>G#</td>
<td>-15</td>
</tr>
<tr>
<td>Ab</td>
<td>+7</td>
</tr>
<tr>
<td>A</td>
<td>-5</td>
</tr>
<tr>
<td>A#</td>
<td>-18</td>
</tr>
<tr>
<td>Bb</td>
<td>+4</td>
</tr>
<tr>
<td>B</td>
<td>-9</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
</tr>
</tbody>
</table>

The note F is 2c higher than in equal temperament, Bb 4c, Eb 5c, Ab 7c, etc. Going in the other direction, F# is llc low, C# 13c, G# 15c, D# 16c, etc. Another regular aspect of this tuning is that each step is in the same relative place in every scale; the third and the seventh, for instance, are

32. Scales in the 18th century were traditionally tuned from C, not A. See Asselin 34, Chesnut 268, and Boyden 204.
33. Note that enharmonic sharps/flats are always 21 or 22c apart, i.e. approximately a syntonic comma.
always seven and nine cents below equal temperament. This makes the entire tuning easier to learn and remember.\footnote{An interesting aspect of regular tuning systems, in which degrees of the scale remain always in the same relation regardless of key, is the ease with which transpositions can be made. This would explain how J.S. Bach was able to function in meantone while using transposing instruments. The organ at Leipzig, tuned to A-460 (a tone above the orchestra at about A-410), played everything a tone lower to compensate. If it was tuned in something like 1/6-comma meantone, its notes would have been in an exact relation to the notes of the orchestra, but 4 cents higher (4 cents at A-410 is about 1 Hz., a negligible difference.) Even the difference of a minor third between the organ and wind instruments at Weimar would not have been problematic in this tuning, since notes retain the same relation in all scales. The difference of a minor third produces a pitch difference of about 5.5 cents, or about 1 1/2 Hz. Since transposing instruments were a part of life for German church musicians at this time, there is a strong possibility that regular (rather than irregular) meantone temperaments were normally used in this setting. Where organs without split keys were used, however, certain notes of enharmonic pairs (if not tuned ad hoc) would of course have been false. See Haynes, B. "Questions of tonality in Bach's cantatas: the woodwind perspective", Le Tic-Toc-Choc (Montreal), VI/3-4, (March and May, 1985).}

In this system, a player is theoretically expected to have alternate flats and sharps available for every note, but in practice, some of these are rarely used. This is because 18th-century music usually stays within the bounds of keys with four flats and sharps. One rarely has to play E#, Fb, Gb, B#, Cb, etc. There are, then, only three sets of enharmonics that are usually ambiguous: Ab/G#, Eb/D#, and Db/C#. Exercises should concentrate on differentiating between these six notes. The other notes (C, D, Esu- F, F#, G, A, Bb, B) are normally always in the same place.

The notion that we play now in equal temperament is of course a fiction, although we pay lip-service to the principal. String quartets and orchestras, in fact any groups that do not play regularly with keyboard instruments, develop individual tuning customs. Modern wind instruments still retain some of the natural tendency towards meantone found in their baroque ancestors. In the case of modern string playing, tuning is very far from meantone, however. Since the end of the 18th century, the movement has been strongly
backwards to Pythagorean-type tunings, with perfect fifths and very high thirds. 36

By contrast, Quantz advises that,

To tune the violin accurately, I believe one would not do badly to follow the same rule as for tuning the harpsichord, namely, that the fifths are a little small (and not entirely perfect, or a little sharp, as is usually the case), so that the open strings will agree with the harpsichord. If one tries to tune all the fifths truly, it follows naturally that only one of the four strings will be in tune with the harpsichord. But if the A is tuned precisely to the harpsichord, the E slightly small to the A, the D also small to the A, and the G likewise to the D, the two instruments will be in tune together. I do not give this as an absolute rule, but as a matter for further reflection. 37

The most efficient and musically satisfying "tuning machine" to work with is an intelligently (and recently) tuned keyboard instrument. But there is a "black box" on the market that can be a great help in individual tuning practice,

36. Podnos, T. Intonation for strings, winds, and singers. Metuchen, NJ and London, 1981, 9, Boyden 219, Barbour 1952:233, Chesnut 255 n.9, 256. "Modern intonation practice...is not appropriate if our goal is to play Mozart's music as he himself wanted it played. The quasi-Pythagorean "expressive" or "functional" intonation of nineteenth- and twentieth-century non-keyboard instruments is particularly foreign to the tradition in which Mozart stood." (Chesnut 271).

37. 17/vii/4. LeGuin, 27, reports that for cello, "The narrow fifths do indeed become less disturbing with time and perseverance. I found after a month or two that I had developed quite a taste for them, as for spice or food." A string player who tuned the open strings to a keyboard tuned to 1/6-comma meantone and then generated pure thirds above the open strings would, of course, be playing those thirds lower than in the tuning system (since the thirds are 1/3-comma higher than pure in this system). But this seeming conflict between theory and practice is illusory, since the purpose of any tuning system for string and woodwind players is merely to guide them in the right direction, after which alert ears take final responsibility.
since it is designed to play in any tuning the user wishes.

Equal temperament as a general principal admittedly has many practical advantages. 19th- and 20th-century music would certainly otherwise be unplayable. But when as a culture we began to move over to it at the end of the 18th century, we gave up a lot as well: major thirds that give "a glimpse into eternity", minor thirds that "bite back", flats that are audibly different from sharps. Tunings that are subtler than equal temperament are more appropriate for detailed listening in smaller rooms, and for finer affects than the vehemence and anguish brushed on so broadly in later symphonic works. Now that we are again playing appropriate instruments for the music of the 18th century, it would be a pity to deprive ourselves of one of its natural rewards: the pleasure of a more expressive and resonant intonation. 20th-century orchestras that take their inspiration from the 18th century would sound especially satisfying if they consciously adopted the richer colors and characters inherent in meantone tuning.

38. Available from Widener Engineering, 203 Westbrook Drive, Austin TX 78746, USA. Although this machine is an effective learning aid for developing an ear for meantone tuning, it is not without design deficiencies. The strobe is virtually unusable, and the pitch is not stable over periods longer than a few minutes. I have nevertheless found it useful, especially to play long tones against, and to set to a note against which I play something difficult, to catch myself at moments of inattention (ie. when tuning will most easily follow its natural inclination).
A MATTER OF TEMPERAMENT

It seems that anyone having the temerity to disagree with Mr Lindley (as in Comm. 628) runs the risk of being taken to task for their inconvenient attitudes: complaining of his methodology (the Unknown Scholar) brings scorn; preferring circles to ellipses (other analysts of lute shapes) results in an insult; and using 'empty rhetoric' (me) is now graceless. All this is a bit sad, since he can hardly expect to be right every time and ought to be willing to accept other views with rather more equanimity. Nevertheless, it is unfortunate that Mr Lindley is upset; if he would care to be more specific it is possible his problems can be resolved. However, I find difficulty in perceiving what actually troubles him: certainly there seems to be nothing in Comm. 628 to compare with the unpleasant phrase he has now disowned.

In fact, I have been a bit dismayed by the way in which Mr Lindley appears to disparage those who are not in total agreement with him. Perhaps it is his way of avoiding difficult questions: you disparage the critic and ignore the objections? Nevertheless, there remain substantial doubts about his work which, however phrased, cannot be ignored. These were described in detail in Comm. 556 and 628 and are outlined below:

- Mr Lindley is quite wrong in his understanding of the effect on pitch of depressing a gut string. This is not a matter of opinion, but of straightforward mathematics. The value he assumes for gut strings is far too large and the 18/17 method he advocates for equal temperament fretting will not give the true octave.

- The essential methodology adopted is subjective and it is clear that rather different conclusions may be drawn from much of the evidence.
- The omission of any reference to the new lute tunings is not only astonishing but, more importantly, suggests that Mr Lindley overlooked a substantial and very significant part of the instrument's repertoire, to the detriment of his conclusions.

- It is, perhaps, understandable that an author feels obliged to defend an Appendix written by someone else. However, I doubt whether this generosity should extend so far as to ignore the numerous problems in Mr Sonne's contribution. In short, these are: lack of an objective measure of fit and of data to support his views; a selection process that raises doubts as to the validity of his approach; a preoccupation with ellipses when the simpler circles might be successfully employed; discrepancies between Sonne's 'modules' and the actual dimensions of the instrument; etc.

Mr Lindley does comment on one matter which, I suppose, he could hardly have ignored: the G sharp in Milan (Comm. 684). If I understand him (here I must confess to experiencing a certain difficulty with the second paragraph of Comm. 684) he explains that by progressing far enough up the harmonic series for a particular interval, a unison will eventually be found that favours one temperament over another. Ingenious as this explanation is, it cannot be said to be wholly convincing: for, given enough harmonics, you can speculate as you will and the method is not appropriate to the vihuela. Indeed, the approach may, or may not, be satisfactory for some instruments (organs perhaps?) but with lute types the intensity of these higher harmonics and their extremely rapid decay is such that the question of sensing their beating does not really arise. In fact, I incline towards the first possibility suggested by Mr Lindley: it does indeed weaken his theory that Milan used a meantone fretting scheme. Disagreeable though this may be, I would not have thought it sufficient reason to discard the better explanation.
THE PROPORTIONAL COMPASS

A mathematical instrument at the disposal of the old instrument makers

Remy GUG

Transl. Anita EHLERS and Denzil WRAIGHT

This communication is a condensed version, for FOMRHI members, of my article published in Musique Ancienne, n°20, December 1985, Ed. CAEL, Bourg-la-Reine, France.

One often reads or hears that our ancestors employed nothing but the method of trial and error when they constructed their works. Thus, they knew only the path of empiricism, which, we would say (using our idea of progress) brought about "improvements" with the passage of time.

Set against this way of seeing things, which could bar all access to a useful approach to the History of Science and Technology, is another view: that which consists in relinquishing any attempt to understand how and why the old masters attained their goal. The almost magical reason that is usually invoked in such a case is that of "secrets".

Both these extreme opinions were indeed expressed by the writers of the time. The following excerpts, however, have the merit of showing that these are cases which the ancients often tried to avoid.

The author of the German translation of the six first books on Geometry of EUCLID, XYLANDER (1), explains in his introduction to the reader the merits of his enterprise.

"I will not elaborate on the arts of measuring and calculating. For those who are so uncivil and inexperienced that they do not realize how all arts (above all the most noble ones which are preferred to all others because of their ingenuity and subtle effect, as for example those of the painter, goldsmith, architect... ) have to work with compass, ruler, plumb line and numbers: for these it would be futile labour to praise these arts. Those I will let stay with flail and axe. Those however (who like all artists are not considered scholars but laymen) who understand and experience how necessary for their purpose the right use of compass and ruler can prove to be, how indeed nowhere, even in common manipulations, a thorough calculation can be dispensed with: Those (I hope) will eagerly read these books and comprehend their contents and what they report."

Thus XYLANDER complains that there still exist craftsmen who grope about to find their way:
"It is our daily experience that many a good German artist has the greatest problems in dividing a line or enlarging or reducing a figure or in measuring the area and other such problems of measuring. He opens and closes his pair of compasses endlessly measuring by eye. He could however accomplish his task without trouble and even with joy if he understood the basis and real foundation of measuring."

In conclusion, the author of this introduction of 1562 explains that only true mathematical instruction leading to a capacity for reasoning and allowing independance of thought could avoid the mechanical repetition of the Master's teaching. Faced with a new problem one must know how to tackle it:

"What might be the reason that often somebody has for a long time industriously learned his art from his Master, yet as soon as he encounters a problem of division or arithmetic which he did not encounter before cannot help himself? Answer: this happens and must happen since he does not learn his art from the beginning and does not understand how thing follows from another. He learned only step by step as he happened to need it. To encounter this weakness (which is quite common and evident, as can be witnessed daily) this art must be learned from a good and steady foundation by general rules, one involving from the other."

Thus a good understanding of geometry is indispensable for the master craftsman of the Renaissance.

Let us illustrate now the other opinion mentioned above. Being the trustee of a secret confers evidently the possibility of not passing it on. The secret of a trade was (and still is...) that of finding effective means to the end, the description of which would pass beyond the framework of this study. The examples are legion, of which we chose two.

The first is given by VOIGTEL in 1686 (2). It is particularly revealing of a mentality prevalent among the assayers of ores:

"This art is kept very secret by most, and even they promise to teach it, they do not do so completely, but always keep an advantage and some secrets. Thus the student must commit grave errors if he does not know enough geometry or has not enough judgement to help himself."

In addition of this kind of secret... there is that of the scholar as opposed to the workman. The 17th. Century gives us an example in the writing of one of his greatest minds: Constantin HUYGENS. His response to a letter from a certain Sr. PAYEN is, from this point of view, most interesting: (3)

"The Hague, March 25th. 1676

I am glad to see, Monsieur, from your letter of the 17th of this month that you believe your harpsichord completed to perfection and wish I could witness that on the spot. But as long as you have scruples of communicating it to any workman, which you yourself are not, the candle will expire under the bushel and won't be of more use to you than to anybody else. On the other hand, Monsieur, Professeur BÖCKELMANN told me that he offered you an address of an honest workman, a man of knowledge and integrity, whom you could employ to set your invention to work and who would oblige himself with an oath not to undertake anything against your will; if these conditions are not agreeable to you, I do not know..."
which other ones to propose and there will be nothing left but to
shroud yourself in your science and rejoice for yourself in the
grace which God gave to you without troubling any more whether its
pot is boiling little or less. I tell you the same thing about the
invention of the Carrosse...."

Let us stop here and classify the Secrets into two
categories:
- those passed on by members of the same guild out of sight of
  their contemporaries.
- those which were processes perfectly well known to every one at
  the time and have become secrets for us, because the changing times have
  consigned them to oblivion.

The builder of historical instruments in this second half of
the 20th Century has allowed himself to be inspired by those works which
have survived. He aims to approach or equal the ancients. The historian
takes a different position: his aim is not to "remake"... or to "work
like" somebody did centuries ago. (Judging from the completed instruments
build in several workshops all over the world this latter way has been
established and is always successful). One of the aim of the historian
is to describe, with the help of the available documents, the ancient
procedures, their genesis, their duration and their disappearance. He is
free to put this into practice or not.

The intention of the craftsman of today is certainly
different: he could attain his objective without never having held in
his hands a treatise on geometry of the 16th Century. He is allowed,
and it is often even indispensable for him to find his personal
solution, whether it is or seems to be historical or not.

The historian may only give licence to his creative imagi-
nation in order, as a critical investigator and conscientious archeo-
logist, to find the best path to clues and reliable documents.

While the craftsman is interested on getting a precise image
of the work he wants to carry out, it is better for the historian never
to visualize what he wants to find: imagining a personal solution to a
problem of the History of Science and Technology implies opening the
door to all possible "anthropomorphisms".

Finally it cannot be denied that the results obtained by the
historian can sometimes influence the craftsman's way of thinking and/or
doing, in the same way as latter's experience could be useful to the
researcher.

It is from this point of view that we ask the following
questions:

Which procedures did the ancients utilize at a time which
knew neither calculators nor computers in order to obtain and apply the
harmonic proportions to their instruments?

Did they use only the art of geometrical construction?

Did they turn to arithmetic only in order to find the
lengths of the strings or the right dimensions of their organ pipes?
This paper will try to answer some of these questions.

If we consider only the four centuries during which the "Makers of harpsichords and clavichords 1440-1840" (a well known title) were at work, we must with regard to our subject distinguish two periods:

- the period in which the art of the ruler and compass reigned as master with limited use of purely arithmetical operations.

- the period following the preceding one, which, from the middle of the 16th C. on, saw the spreading over all of Europe of the use of the "calculus with numbers" at the same time as the use of special compasses: the proportional compasses or sector.

This is to be the central subject of our paper. The sector or proportional compasses will also represent the connection between Arithmetic and Geometry on the one hand and between Science and Technology of the ancients on the other.

We propose:
1. to call to mind briefly the genesis and history of this mathematical instrument so popular at the time.
2. to give a short description and explain how it works.
3. to show that among the great number of possible operations there is one most important for us: the determination of the harmonic relations and their applications to instrument making.

1. A) GENESIS

The period preceding the appearance of the sector differs from medieval times, as far as mathematical instruments are concerned, by a vivid desire for an universal instrument that from a purely practical point of view would allow for a maximum of operations with a minimum of manipulations.

As a matter of fact, mathematical instruments conceived especially for a given well defined operation multiplied at the end of the Middle Ages and particularly at the early Renaissance. The growing importance of mathematics in the Arts was one of the reasons for this explosive diversification of mathematical instruments. Thus Roger BACON's remark in his "opus tertium" from about 1270 has prophetical value:

"without mathematical instruments one can not know anything and if they don't exist in great number they are of no use; they may have defects and conservation is difficult. Because of rust one cannot transport them from one place to another without fearing an accident. One cannot always and everywhere have new instruments but that would be necessary." (4)

It emerges from this remark that the great number of different instruments obviously caused some inconvenience because of their need of space and upkeep. This is opposed to the desired
"mechanisation" of as many mathematical operations as possible in the most efficient way. The path leading to the sector is an example of the way in which this dilemma could be resolved.

THE REDUCTIONAL COMPASSES

We will first consider another type of compass which had already a long history when the sector appeared on the scene: the reductional compasses. It had already been used in the Romanesque period and Fig.A shows a set of reductional compasses as used by the architect Daniel SPECKLE at the end of the 16th. Cent. Its mode of action is quite simple.

The following stage (6) brings us one step closer to a more versatile instrument: the reductional compass with mobile joint. This instrument represented on the title page of Levius HULSIUS's book (Fig.B) permits a whole series of operations. It suffices to place the joint successively in the proper place to be capable of performing with just one instrument all the operations for which the six former compasses were needed.

Another form of reductional compasses which foreshadows the sector is the one seen in the engraving by Jacques BES-SON (7) Fig.C. To utilize the "double ruler" with a mobile joint one has to be equipped with an ordinary pair of compasses. The double scale with 15 equal divisions, each of them subdivided into five, permits an enlargement of the
scope of such a "reductional compass". An example will show that this instrument also permits a gain in time: it requires less manipulation than the preceding two instruments while the mathematical possibilities are greater.

Let us imagine a master craftsman who, encountering a practical problem in the course of his work, has to find two segments of a straight line which are to a given segment — in the language used by the ancients — as 2 is to 3 and as 4 is to 5. If this craftsman has available only the compasses of HULSIUS, he must change the setting of the joint twice. To find the first segment he has to put the joint on the 3, adjust the upper compasses in such a way that their distance corresponds to the first segment and since the distance of the upper points is equal to 1/3, pivot once with the upper legs in order to get the desired length. Starting with the same segment as above, he must, in order to get 4/5, place the joint on the 5 and pivot 3 times with the points of the upper legs.

BESSON's compasses would get the same result with much less manipulation. To start with, a normal pair of compasses would be adjusted to the initial segment. The two points of this compasses are then placed on the large divisions n*9 (counting from the joint) of the lower legs. If the screw is then fixed to prevent any movement during the operation, it suffices to take with the normal compasses the distances of the points n*6 (large divisions) on the upper legs. The distance between these two latter points equals 2/3 of the original segment. Without modifying the position of the joint, this same procedure can be repeated by taking the initial section between the symmetrical points n*5 on the lower legs (large divisions of course). After fixing the screw, the normal compasses measure the distance between the points n*4 on the upper legs and its opening will give immediately 4/5 of the initial segment.

The difference between this latter instrument and the other forms lies in the fact that it demands on the part of the user some rather advanced knowledge of arithmetic.

THE SECTOR or PROPORTIONAL COMPASSES

The three reductional compasses which we have just described have one point in common: the joint, whether fixed or mobile, is always found between one of the extremities and the middle of the legs.

If we now start with BESSON's compasses and fix the joint once and for all at one of the extremities, then we have created the sector(8). The graduated lines of course continue to have the centre of the fixed joint as their origin. This joint obviously allows for the construction of any angles between 0 and 180°.

The step which we are now going to take was first made around 1560 and was made possible by the Euclidian "Bible". Indeed, the ancient works dealing with the sector seldom omit to mention that the theoretical principle is found in the fourth proposition of the 6th book of Euclid (9). Again we turn to the professor of Greek whom we mentioned in our introduction. XYLANDER was fully aware of the immense practical importance of this 4th proposition:

"There is, with the exception of the 4th proposition of the 1st Book, hardly any proposition dealing with triangles that is of greater practical importance for measuring heights, lengths, widths, depths, etc... as well as in all geometrical operations than this one; (.....) And if one applies this proposition to such
LE OPERAZIONI
DEL COMPASSO
GEOMETRICO
ET MILITARE.
DI
GALILEO GALILEI
NOBIL FIORENTINO
LETTOR DELLE MATEMATICHE
nello Studio di Padova.
Dedicato
AL SERENISS. PRINCIPE DI TOSCANA
D. COSIMO MEDICI.

IN PADOVA,
In Casa dell'autore, Per Pietro Marinelli. M D C V I.
Con licenza dei Superiori.

VS VS
ET FABRICA
CIRCINI
CIVIS DAM PROPORTIONIS,
Per quem omnia feris cum Euclidis,cli Mathematicorum
omnia problematica facile negroso refolventur.
Opera et studia BALTHESARIS CAPRAE
Nobilis Mediolanensis explicata.

DIFESA
DI GALILEO GALILEI
NOBILE FIORENTINO.
Lettore della Matematica nella Scuola di Padova.
Contro alle Calunnie & imposture.
DI BALDESSAR CAPRA
MILANESE.
Esprèggi nell' Accademia Naturale sopra la nuova Stella.
del M DC 1111. come ( & offi pri ) nel publicare
subito dopo che fu invenzione la fabbrica.
Gli scritti del Compiaggio Geometrico, &
Molare, fatto il dicembre di
Vita & Fabbrica Circoli ciascun proporizzioni, &c.
CVM PRIVILEGIO.

IN VENETIA. M D C V I L
Presso Tomaso Baglioni.
triangles of one of which the sides are known or can be measured, one finds also the length of the sides of the other, if that is what is wanted". (10)

Did XYLANDER know about the sector? That is hard to say. At any rate, the oldest representation we could discover in a book is the one found in the work of Petrus RAMUS, published in Basel in 1569. (11)

Fixing the joint at one extremity performs, theoretically speaking, the following transformation: we started with reductional compasses, which can be represented by two equilateral triangles touching at their vertex (scheme 1). The Euclidian proposition claims a certain proportion between the different sides of these two triangles. We will return later to this point. Let us remark here that the Euclidian laws stay valid in the case in which the upper triangle has been "folded" onto the lower one as indicated in scheme 2.

Scheme 1

Scheme 2

Behind this theoretical step are hidden some of the great names of History of Science. At a time in which the legislation for patent-laws was not yet what it is today, it often occurred that several people claimed the authorship of an invention.

The history of the sector offers an example. The law suit of interest to us caused a greater stir, since one of the plaintiffs was none other than the genius GALILEI. In 1606 he published the work of which Fig.D. shows the title page. His rival Balthasar CAPRA did the same in 1607 without mentioning GALILEI's name. Fig.E. This set fire to the powder and the battle came to a climax with the latter's publication of his "Difesa..." Fig.F. Today, with information (even from archives) circulating much more easily and faster than in the beginning of the 17th Cent., it is clear that the sector had been used for almost half a century before the publishing of GALILEI's book (cf. P.RAMUS). Let us, however, ascribe to GALILEI the merit of having considerably enlarged its possibilities, making this movable ruler a
May this historical evocation suffice. Before studying the sector's application to the making of historical instruments, we must give a short description.

2. A) DESCRIPTION

As we see in Fig. G., the sector resembles a normal compass of which the points have been removed and whose legs have been transformed into flat rulers which, in general, measure 1/2 or 1 foot in length and 1/2 or 1 inch in width. On the two faces of this rulers (which we continue to call "legs") there are graduated lines ordered into categories. They are always perfectly symmetrical with respect to the middle axis of the sector, and may number up to a dozen. Each of them has its own name: \textit{linea arithmetica}, \textit{linea geometrica}, \textit{linea rectae dividenda}, \textit{linea metallica}, \textit{linea musica}... Fig.G. indicates the placement and the division of these different lines. In the book in question they are depicted in actual size. (13)

We see that the \textit{linea musica} is placed at the outside of the collection of lines (at the right of Fig. G.). We will not review all the lines. The description and the explanation of the \textit{linea arithmetica} and \textit{linea rectae dividenda} will suffice to understand the \textit{linea musica}.

2. B) USE

The \textit{linea arithmetica} is nothing but a straight line divided into perfectly equal parts. Its graduation resembles the one in millimeters on our modern rulers. The \textit{linea arithmetica} usually shows values up to 200, but some large sectors may also show 1000 equal divisions. On the sector of Fig. G. (at the right) it occupies the middle axis of the instrument.

The \textit{linea rectae dividenda} shows far fewer divisions. They are limited to the first 10 integers. We see that this \textit{linea rectae dividenda} occupies the central place of the other face (at the left side of Fig. G.) of SCHWENTER's sector. The placement of the 2 on this \textit{linea rectae dividenda} indicates the middle of this line and corresponds to point 100 of the \textit{linea arithmetica}. The digit 5 indicates the 5th of this same \textit{linea rectae dividenda}, and corresponds to the point 40 of the \textit{linea arithmetica}... etc.

The \textit{linea musica} (to the right of Fig. G.) carries only the division of the monochord, and lists at each point the same name of the note corresponding to the division of the octave.

How can these lines be used? How did these first two engender the \textit{linea musica}?

The proposition 4 of EUCLID's sixth book proves the equality of the ratios in the case of two equilateral triangles as indicated by scheme 3 (already familiar to us).
Von der Musik oder Tonbindung.

Die XII. Frage.

Wie die Zusammenfassung mit breiten Hammerstäben möglichst geschickt zu tun ist?

Drei Flaschen von der Schmieröl-Behälter die Flute soll erhebt haben / so je helber belassen / und jede Artig zu tun.
Or equivalently

\[
\begin{align*}
\frac{AB}{BC} &= \frac{AD}{DE} \\
\frac{AB}{AD} &= \frac{BC}{DE}
\end{align*}
\]

This latter form is most valuable as it is the basis for the sector. In fact, the first member of this equation corresponds, on a mathematical instrument, to the values fixed once and for all on the different lines. The second represents the variables: BC gives the initial value and DE the desired solution. These two values are taken with the normal pair of compasses.

At a glance one can find segments which have a given relationship to one another. It suffices to mark the two terms of the relation in question on the *linea arithmetica*, and open or close the sector to the length of departure.

This theoretical example found its practical (and almost daily) application at the time in the domain of ancient metrology, for example. The extraordinary variety of measures forced the ancients to use constantly the rule of three (*regula de tri*). The sector proved a valuable aid. The old tables for the correspondence of measures usually indicated them in the following way: 100 feet of town A correspond to 108 feet of town B. It sufficed therefore to open the sector to the points 108 of the *linea arithmetica* of a known foot (e.g. that of town A). The distance between the points 100 of this *linea arithmetica* taken with the two points of a normal compass then gave the length of the foot of town B.

We will now consider the division of one segment into different ratios.

Let us listen to a mathematician and engineer from Nuremberg: Caspar UTTENHOFER, who passed on to us his knowledge in this field through George WENDLER, Master of Letters and Calculation. We translate the manuscript of 1646 which is preserved at the Bayerische Staatsbibliothek in Munich. (14) Fig. H.

"How a given line should be divided into different parts. Whoever wants to divide a line or cut it into equal parts must take its length and put it between 200 and 200. If you now want the half you will find it in the space between 100 and 100. If you want the fourth part you will get it between 50 and 50. If you want the fifth part between 40 and 40, and so on. But, since the number 180 contains more divisors than 200, put your line between 180 and 180. Then 90 will indicate the half, 60 the third, 45 the fourth, 36 the fifth, 20 the ninth, 18 the tenth, 15 the twelfth, 12 the fifteenth part. And you will easily find other remarkable things."

UTTENHOFER's procedure implies a certain facility in doing arithmetic. It seems that this was not the case for all users of the sector. For them the *lineae rectae dividenda* (literally: line for the division of straights) provided help. In fact, instead of doing arithmetic as before, they were given, once and for all, all the divisions by 2, 3, 4... up to 10, sometimes 12 on a special line. All that was left to do was to place the line to be divided between the points E (left of Fig. G.) and to take the distances between the (symmetrical) numbers of this *linea rectae dividenda* which corresponded to the denominator of the fraction in question.
3. APPLICATION TO INSTRUMENT MAKING

The examples indicated in some of the preceding paragraphs allow us to guess how the sector could be applied to divide the monochord, the very basis of all ancient instrument making.

Several old documents affirm that the sector was in fact used in the workshops of the musical instruments makers. Let us also add right away that certainly not all adopted it at once, although probably only a few stuck to the "good old methods" inherited from the Middle Ages.

We are thus interested in those who knew how to apply this mathematical instrument to their own trade.

In 1708 Michael SCHEFFELT (15) states in his introduction that the bell founders and organ builders take great interest in this mathematical instrument which provides the harmonic divisions and thus the wanted ratios in a way that could not be easier:

"Thus is shown for example how everyone seeking profit or pleasure from Geometry, Geodesy and Altimetry may make use of it (.....); it gives the bell founder the tone of one bell with respect to another, the organ builder that of one pipe to the other."

What were these ratios? Ought we recall, even briefly, that history traces the art of dividing the monochord back to the famous PYTHAGORAS? The legend of the "hammer" survived throughout the Middle Ages and Renaissance and appeared on the pages of the already mentioned work of SCHWENTER, in which he gives instructions on how to illustrate this legend with the help of a little machine (Fig. I.)

The description of the different mathematical solutions concerning the division of the monochord which have been thought up in the course of the centuries is beyond the scope of this publication. We will confine ourselves to the statement that for a long time ruler and compass were the only permitted means. To divide a segment in 3 or 5 required a geometrical construction. It was out of reach of some craftsmen to arrive at the same result using arithmetic. The sector, elegantly combining these two ways, offered a simple and practical solution.

**LINEA MUSICA**

Michael SCHEFFELT explains that the 12 chromatic steps can be obtained on this *linea musica* with only the help of the following *TABULA MUSICA*: (16)

<table>
<thead>
<tr>
<th>Clavis</th>
<th>Partes</th>
<th>Clavis</th>
<th>Partes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>2000</td>
<td>Bb</td>
<td>1417</td>
</tr>
<tr>
<td>F</td>
<td>1875</td>
<td>B</td>
<td>1333</td>
</tr>
<tr>
<td>F#</td>
<td>1770</td>
<td>C</td>
<td>1250</td>
</tr>
<tr>
<td>G</td>
<td>1667</td>
<td>C#</td>
<td>1178</td>
</tr>
<tr>
<td>G#</td>
<td>1583</td>
<td>D</td>
<td>1110</td>
</tr>
<tr>
<td>A</td>
<td>1500</td>
<td>D#</td>
<td>1057</td>
</tr>
</tbody>
</table>

By placing the length of the E-string between the points 200 of the *linea musica* it would be possible to find very quickly the length of the string sounding one of the other notes: the space between the points 1667 gives the length of a string which, on the same monochord, sounds the G, 1500 gives A etc.
These tables had been worked out by the scholars of the time. Passed on to the makers of the sector their great usefulness was demonstrated with the perfection of the *linea musica*. Let us pursue this affiliation in two documents from the 17th century.

In his *Livre premier des Instruments* MERSENNE, speaking about such a table, tells us clearly that

"the preceding numbers, which correspond to the second middle proportion, are nothing but what is usually done on the neck of the lute and violin. They are, however, useful for dividing the neck more securely and precisely and quickly than usual without need of testing them time and again, because when these numbers are marked on a sector made from brass or wood, and of which each leg is one foot long, one has with the greatest accuracy determined the place of frets on hundreds of necks in less time than the builders need to put them on a single instrument."

(17)

It is beyond doubt that the calculus of the scholars, in this case of MERSENNE, was taken into consideration by the makers of the sector. Nicolas GOLDMAN quotes him in his bilingual booklet published in Leyden in 1656 (18):

"The other little table contains the simple consonances... which Mr. DE CHAPTES and the famous Master of "Singing", MERSENNE, prefer to all others".

This method of using the *linea arithmetica* to find the harmonic ratios can be simplified. Here again we find the same approach as at the origin of the *linea rectae dividendae*. In fact it suffices here, too, to fix, once and for all, the divisions of the octave on a line especially conceived for this purpose. Thus the *linea musica* is born. The numbers of the preceding table are replaced by the names of the notes. The handling has become even simpler, and, as Nicolas GOLDMAN points out, the organ builders will swiftly find the lengths and diameters of their pipes, the makers of stringed instruments those of their strings, and the bell founder will be able to determine with great ease the relation between the height, lower diameter and thickness of the bells. This same author also states that in order to get the lower or upper octaves - the sector being only one foot long - it suffices to double or divide by two the dimensions found for the octave of departure.

**THE HARPSCORD**

We could not possibly illustrate the use of the sector in the construction of each type of old instrument with all the desired details. We shall limit ourselves to the building of harpsichords.

How could a harpsichord builder of the 17th or 18th century have used this mathematical instrument?

We know that the length of strings is determined by the distance between bridge and nut. How did the instrument builder go about finding the desired configuration of these two structures?

A German text from the second half of the 18th century helps one to visualize an instrument builder of this time at work.

Peter Nathanael SPRENGEL devotes a long chapter to the description of keyboards instruments (19). The section describing the construction of the bridge mentions a procedure not used by modern instrument makers: we have chosen a different way than the ancients. They did not "copy" - in the sense we habitually ascribe to this term - but they had inherited procedures developed and transmitted through the
centuries. Instead of our sometimes rather anxious search for the most precise or the most durable drawing, they relied on a turn of the hand and "tricks of the trade". SPRENGEL explains clearly that in the case of a clavichord the bridge is made only after each tangent has been put in its place, and in the case of a harpsichord after the nut has been glued onto the wrest plank.

The ancient instrument maker had in his workshop carefully chosen materials and implements and, along with a certain degree of geometrical or arithmetical knowledge, some mathematical instruments: rulers, compasses, and... sectors(20). His starting point and his way of approaching his work thus differed from ours. His question was "How is it done?" and not "How is it copied?"

How is it achieved, then, that an instrument, the pitch of which has been determined, has strings with those lengths which conform to the rules of the trade? Let us listen to SPRENGEL:

"Before stringing an instrument one must determine the lengths of each of the strings for the highest notes. This then gives the position of the bridge on the soundboard. The craftsman possesses to this effect a calibrated ruler, called "scale" ("Mensur"), on which are indicated the lengths of each of the treble strings".

SPRENGEL goes on to explain that for the middle of the instrument the octaves must be doubled and that the foreshortening which is necessary for the bass must be compensated for by an increase of the diameters of the strings. Then he goes on:

"All these string lengths (of the notes C) as well as the lengths of all the other tones belonging to the three octaves of the treble are indicated on this "ruler" and the craftsman uses it in the following manner:

He draws on the soundboard for each tone a line parallel to the treble string. Every one of these has as its origin the tangent of the corresponding note. He measures starting from the tangent, of e.g. the C of the fifth octave, along the parallel in question, 5 inches with help of his "ruler", takes then 10 inches for the C in the fourth octave, and 20 inches for the same note of the third octave. He obtains the lengths of the strings of all the other notes of these three octaves in the same way. Altogether these points at the end of the segments determine the position and the form of the bridge, which usually resembles an S. The resulting marks on the soundboard can help the craftsman to make the bridge with a fret saw."

SPRENGEL describes a similar procedure for the harpsichord which we only summarize here.

The origin of the different segments is in this case evidently not the tangent but the nut, fixed in a preliminary way according to rules which we do not know yet. In transferring the different lengths as indicated on the "ruler" as before onto a set of parallels passing through the mortises of the registers, the builder obtains here, too, the position and the form of the bridge.

Let us return to our initial question: Where does the sector come into the picture?

This "ruler" showed the divisions of the monochord. We can realize these with the sector. That is already the first application.

We know today – and this has been proven brilliantly by G. O'BRIEN (21) – that the RUCKERS constructed instruments in different sizes. We do not know whether they used this "ruler". We can only guess – the dates mentioned in this paper give us the right to do so – that they made use of the sector. In this case it would have been extremely
easy for them to trace in an instant the "scale" corresponding to any
given size. In effect, and this is a point which the research on the
sector enabled us to discover, we see here that the length of reference
in the 17th c. was not the C, but the E (cf. SCHEFFELT and GOLDMAN). Or
is it only chance that the length of the E of RUCKERS harpsichords and
virginals of type R (the reference pitch used by G. O'BRIEN) equals
exactly one Antwerp foot?
Starting with this reference it suffices to put between the
points 200 of the linea arithmetica or the E of the linea musica one
Antwerp foot. One can easily find the lengths of the other notes. One
can also find the "scale" of other instruments. To determine for example
the measures of the strings of the harpsichord R + 5 one must begin by
marking the points 200 of the linea arithmetica or the points E of the
linea musica in such a way that their space corresponds to 2/3 of an
Antwerp foot. The other points then give respectively the lengths of the
other notes.

CONCLUSION

The sector, this "royal road of Mathematics" applied to a
multitude of crafts, thus proves to be of triple interest to the maker
of musical instruments in past times.
- It allowed him to determine with great ease and speed the
divisions of the monochord. The tedious tracing with ruler and compasses
was replaced by simple procedures.
- It permitted speedy fixing of these divisions for different
pitches, or, in other words, the determination of the scaling with
respect to the different lengths of the foot used by the craftsman.
- It was even more useful in the construction of the instrument
as a whole: the linea arithmetica or the linea rectae dividendae allowed
the values within the given proportions to be found with extraordinary
facility. Enlarging or reducing the dimensions of the different pieces
of an instrument in very exact proportion thus was just child's play.

The sector thus contradicts the point of view described in the
beginning on this paper. The pure empiricism was not the way of the good
craftsmen of old times. How could the Masters building instruments in
the service of music, an art which at this time was integrated in the
mathematical sciences, have ignored the great lessons given by
PYTHAGORAS and EUCLID? These instrument makers took their place among
all these artists of which Fig. J. gives a picturesque list. They all
bathed in the Fountain of Numbers. The sector offered them, by its
simplicity and universality and its different scales, a reliable path:
the path connecting Science and Technology, one of the prime conditions
for each epoch to enhance its work to the "ultimate degree" of what it
judges to be perfection.

Fig. J.
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3. JONCKBLOET, W.J.A. & LAND, J.P.N., Musiques et Musiciens au XVIIe siecle - Correspondance et oeuvres musicales de Constantin HUYGENS, Leyde, 1882, p.72
4. BACON, Roger, Opus Tertium, Ed. BREVER, 1659, p.36-37
5. SPECKLE, Daniel, Architectura, Strassburg, 1599
6. This way of dividing the genesis of the sector in different stages has no chronological meaning. We choose it solely for didactical reasons. It is clear that the different reductional compasses and the sector coexisted during the period in question.
7. BESSON, Jacques, (Jacobus BESSONUS), Theatrum instrumentorum et machinarum, Lyon, 1578.
8. There existed at that time a whole list of synonyms: Euclidian compass, Ebenpasser, Proportionatorius, Polygraphometrum, Proportionalzirkel, Pantometre, Proportionalpasser, Compasso geometrico etc...
9. These Elements by EUCLID are the work with the greatest number of editions, second only to the Bible, since the invention of printing. The 13 Books of EUCLID's Elements, transl. Sir Thomas HEATH, reprint, Chicago, 1963.
10. XYLANDER, see note 1.
11. RAMUS, Petrus, (Pierre de la Ramee), Arithmeticae libri duo, Geometricae libri septem et viginti, Basel, 1569, p.2
13. We are dealing here with a large sheet of paper bound into Daniel SCHWENTER's book of which we reproduce the title page at the end of this paper. We ask our reader to excuse the distortion at the upper rim of the representation of the two faces of a sector. It was quite obviously impermissible to damage a book binding from the 17th. Cent, according to the needs of modern photographic techniques and the book is of a rather great format. These sheets were sold as such at the time and it suffices to cut them out and glue them to a blank frame, made from wood or cardboard. This was the most economical method of obtaining such a mathematical instrument.
15. SCHEFFELT, Michael, Unterricht vom Proportional-Zirkel, Ulm, 2* Ed., 1708
16. ibid, p.21
18. GOLDMAN, Nicolaus, Tractatu de Usu Proportionante, Eine Anleitung vom Gebrauch des Ebenpassers, Leiden, 1656, p.23. This work is a perfect example of "directions for use" of the sector sold with it.
20. Cp. the inventories of Francois Etienne BLANCHET, 1766; of Jean-Jacques MALADE etc... published by F. HUBBARD, Three Centuries of Harpsichord Making, p.293 & 303. The authors of these inventories did not give a very detailed description of the compasses in question, It can not be excluded that one or other of the makers was indeed in the possession of a sector.
21. G. O'BRIEN, The stringing and pitches of Ruckers instruments, Colloquium, Antwerpen, 30 September-2 October 1977, p. 48-70
A simple and cheap hygrometer.

Every maker of wooden instruments knows the problems related to variable humidity in the workshop atmosphere. With a psychrometer one can measure the relative humidity very well, but the following device has some advantages: 1) It will not react immediately on sudden changes of humidity and will thus show an average taken over some time; your wood and your more or less finished instruments are reacting in the same delayed manner. 2) It shows the movement of the wood directly and gives you an idea of the tensions of wood glued together or within rings on woodwind instruments. 3) It is cheap.

I took a piece of pearwood and dried it in my oven (110 ° for more than one hour). The shrinkage/expansion of the wood is biggest in the direction parallel to the annual rings, so I cut the dried wood into rectangular pieces so that one of the sides were as parallel as possible to the annual rings; my dimensions were ca. 300 x 25 x 20 mm. The pieces were glued together to a bar with a length of 1 m, the length-direction of the bar thus being virtually the same as the tangential direction of the wood. I fixed one end of the bar to a wall and fastened the rest of the bar loosely so that it could move freely. I noted the length at 0% humidity (1000 mm) and the length at my favorite humidity 55% (1022 mm). The length was stable after about 3 hours.

It is possible to calibrate a scale with the help of a psychrometer, but what I really want to know is if the humidity is above or below the desired average. Without intervention the minimum length is reached in the winter (when the workshop is heated) and the maximum length in the late summer, just before the heating season. The difference may be more than 10 mm (2°). To keep the same length winter and summer I use a dehumidifier (?) in the summer, and I pour water over my heated concrete floor in the winter, accepting a variation of 42 mm from my average. A variation in wood dimensions of 1° is so big that tuning changes of recorders can be noticed; the pitch is lower when the wood is expanded and vice versa. Also, without humidity control, brass rings fitted in the summer are very loose in the winter, and rings fitted in the winter will compress the wood in the summer; this is especially a problem at bigger diameters (f.ex. great bass recorders).

You may of course make your humidity bar of other dimensions. If you make the cross section bigger, it will of course react more sluggishly. Also, it is not necessary to dry the wood in the oven. To be sure you should control your calibration regularly. It is said, that the variations in the wood dimensions will diminish with the age of the piece of wood. Also it is said, that the wood will generally shrink after many variations of humidity. How you have a possibility to check these theories at your bar; I have not, after the first two years, seen any confirmation of the theories.
Mitutoyo is an important manufacturer of measuring tools such as telescopic gauges (bore measurement) and calipers. They also make digital calipers. The resolution of these "digimatic" calipers is 0.01 mm and the accuracy is 0.03 mm. The readout can be set to zero at any position of the jaws.

There are two models:
1) No 500-210 range 0-150 mm with 40 mm jaws which costs hfl 285,- (c. £65);
2) No 500-211 range 0-200 mm with 50 mm jaws which costs hfl 355,- (c. £80).

(prices excl. btw or VAT)

At the expense of hfl 90,- extra these two models also are available with digital output (I'm afraid the interface is probably known only to Mitutoyo, because they also sell the matching calculators —the cheapest costs hfl 751,- so you probably can forget about connecting these calipers to your personal computer).

Though digital calipers are easy to handle, I prefer the cheaper 652 series vernier calipers with fine adjustment and parallax free readout (which provides 0.02 mm resolution). A model with 40 mm jaws, range 0-130 mm costs hfl 86,- (c. £20). Because of fine adjustment these calipers can be operated very carefully; therefore I consider them much safer than other calipers. The calipers are also convenient when using Mitutoyo telescopic gauges for bore measurement (see comm. 639): because of fine adjustment the gauges are easily preset to the diameter required.
MODIFICATION & SHARPENING OF TWIST DRILLS

a few remarks on comm. 676

Comm. 676 describes how a standard twist drill can be modified to a twist drill with centre point for drilling in wood. Drills like these also can be bought ready-made, up to lengths of 10 cm. Longer drills probably will be difficult to obtain, but they still can be made by modifying a standard twist drill on a bench grinder. When doing this, an extra support might come in useful to keep the centre point centred. The one represented below is being sold in hardware shops for sharpening twist drills, but can also be used to perform the modification as intended.

Support for sharpening and modification of twist drills.

Dehumidifiers.

The April issue of FOMRHI included a list of small dehumidifiers which I thought may be of interest to members. Each of these was in the price range £250–£350. I can now report on a model produced by L.E.C. which retails for just under £200. The only difference between the L.E.C. dehumidifier and more expensive versions is that it lacks the refinement of an automatic humidity control. In practice, all that is necessary is to keep an eye on one's humidity gauge and turn the machine on and off as required. During the winter 'wet' months a humidity level of around 55%–60% can easily be maintained with the machine running almost continuously. In the summer months it is rarely necessary to use the machine; the problem is more one of achieving that level of humidity. During the first 48 hours after installation, the dehumidifier extracted something like two gallons of moisture condensed from the atmosphere. It now condenses between one and two pints a day. The L.E.C. dehumidifier has two motor speeds. The slower is intended to reduce operational noise at night, but the noise level is hardly more than a whisper at either speed. I can highly recommend this machine to anyone who has been considering buying a small domestic dehumidifier. It is widely available but if any FOMRHI member does experience any difficulty in locating one, I should be pleased to pass their order to the L.E.C. company.

As Jeremy Montagu points out, the most important characteristic to distinguish the Chitarra Battente from the ordinary guitar of the period is the use of metal strings. The strings pass over the bridge and are fastened to the lower bout of the instrument, usually by looping them over ivory/bone/metal 'hitch-pins'. As the strings were of metal, it is generally assumed that a plectrum would have been employed. However, not one of the early Chitarra Battenti that I have examined show any score marks across the table that one would expect to find on an instrument played with a plectrum in the strumming style. Therefore either (i) the plectra were of felt or leather, (ii) the performers took an extraordinary amount of care when they played, or (iii) the fingers were employed.

Members of FoMRHI who are not also members of the Galpin Society may like to know of the excellent study by Roberta Tucci and Antonella Ricci published in the Galpin Society Journal April 1985, in which they discuss the few contemporary makers in the Calabria region of Italy who still build Chitarra Battenti. The article also discusses the traditional way of stringing and playing the instrument. The players do not use a plectrum, but strike the strings - and sometimes the soundboard as well. According to the same article, the Chitarra Battente is built in three sizes and can have either the familiar vaulted back or a flat back. It is suggested that the latter style is due to the influence of the modern classical guitar. One final point of particular interest. Players often drill a tiny hole in each side of the guitar at the waist. They claim that these 'ears' (orecchie) "give vent" to the sound. Similar holes are to be found on early examples of the Chitarra Battente.

FoMRHI Comm 710

Vihuela

I understand that the classical guitar luthier Jose Romanillos has been digging into the early Spanish archives. In a recent interview published in the February issue of 'Classical Guitar' magazine, he comments on the 'vihuela' in the Jacquemart-Andre Musee, Paris, remarking "I know the head and neck are not originals and the instrument as such does not conform to the way that Spanish vihuelas were made in those days". Even more of interest, he goes on to say that "I have information, not to suggest, but to definitely prove that the vihuela in the 16th and early 17th centuries had a vaulted back very similar to the Italian guitarra(?) battente". I have written to 'Classical Guitar' to observe that this evidence may prove to be a significant contribution to our knowledge of the vihuela and is of such importance that it should be published without delay. I shall pass on further information as it appears.
The Problem: A violin arrived in my workshop and the belly had to be removed for the repair. The bass bar looked a little unusual and on examination I found it had been carved from the belly, not shaped and glued in place as is customary. Others might be more familiar with this construction but I am not, and started wondering how to find out what effect it has on the sound. It was no good just building a copy: it would be unreasonable to expect them to sound the same. Some means of comparison or control was needed.

The Method Two sets of timber, A and B, were chosen to make two instruments: the experiment and the control. As most people know no two pieces of wood are identical so to even out the differences, each set was divided in two, i and ii. A1 and B1 were put together as were Aii and Bi. Because the A's and B's were literally sawn in half to make i and ii, mixing them in this manner made two instruments with as near possible identical timbers although obviously not bookmatched.

The first instrument was built in the usual way, using tap tones etc to thickness the plates. Before assembling detailed measurements of all the thicknesses were recorded and then the second experimental instrument was built copying the measurements from the first. It was tempting to use tap tones to thickness the experimental instrument, but if the differences in the construction were to be highlighted and if the timber was as near as possible the same, then using the same measurements on the second instrument would highlight the effects of the changes.

Results Predictably the instruments did sound different. The experimental instrument had more 'top' and was less well balanced tonally than the orthodox one. But the method should be usable for any instruments normally jointed down the centre line.

The method could be improved by making two pairs instead of one. The first pair would be matched as above; the second pair built with the experimental one 'tuned' during construction and the orthodox one being a measured copy. Unfortunately, there is a limit to the quantity of unsolicited unbookmatched instruments I can hope to sell, and I shall stick to just two. Has anyone else any experience of controlled construction experiments?
On Extended Lutes

I was recently recommending Comm 337 ("English Nomenclature of Extended Lutes" by Robert Spencer) to a correspondent when I re-read it and remembered that I had a few objections that never got written down.

1. ARCHLUTE

I don't like SOLO and CONTINUO for the two types. It is most unlikely that players were either purely soloists or purely continuo players, and it is unlikely that the same player had both types for the different functions. Who ever heard of a soloist that wouldn't accompany a singer? The terms SMALL and LARGE are unsatisfactory since body and overall size varied within each type, and it is not obvious that the terms refer to what we want to distinguish, namely the relative length of the long strings to the short. The only satisfactory single-word adjectives I can think of are EARLY and LATE.

Spencer's rejection of 'theorboed-lute' (because the theorbo relationship would be confused with the two-headed lute) depends on people not being able to tell the difference between the stopped strings being tuned from a bent-back pegbox or from a straight-out pegbox that supports a nut on the other end. Be that as it may, there is another more powerful objection, namely possible confusion with 'theorboe-lute', which has reentrant tuning and so is not equivalent to an archlute.

2. CHITARRONE

I don't think that Spencer is fully aware of the unsoundness of the analysis by D. A. Smith in his article "On the Origin of the Chitarrone" (JAMS XXXII No 3 (1979), 440-462). Smith interpreted the historical information on the origins of the chitarrone with the assumption that Piccinini was unreliable and wrong. If one accepts this assumption, Smith's story is self-consistent and reasonably convincing. But in historical scholarship, one has no right to make such an assumption about a primary early source without good supporting evidence. Smith's evidence against Piccinini's story is easily dismissed. This is done in Appendix 1. From the evidence available, any objective historian would accept Piccinini's story and reject those aspects of Smith's story that are inconsistent with Piccinini's. Consequently, Spencer should strike out the Malvezzi (1591) reference with respect to the extended-lute type of chitarrone.

I can't find where Praetorius mentioned three roses as a distinguishing feature of the chitarrone. If early sources consider the chitarrone and theorboe as equivalent terms, we should do the same and not make unhistorical distinctions without good reason. I can see no reason for distinguishing between instruments on the basis of rose design.

Incidentally, Piccinini wrote that what other people called 'liuto attiorbaba' existed before the long second neck was applied to the chitarrone. When the latter happened, the obvious name for the instrument would be 'chitarrone attiorbata'. The equivalence of the names 'tiorba' and 'chitarrone' can then be explained as contractions of this term, just as later in England 'theorboe-lute' was usually contracted to 'theorboe' or 'lute'.

3. THEORBOE

As before, I am uncomfortable about the designations SOLO and CONTINUO for the same reason as for the archlutes. Here, the main distinction is in size, and I would prefer to use just SMALL and LARGE. But one may argue that Spencer's distinction corresponds with early terminology, eg 'lesser French theorboe for lessons', 'Theorbe pour les pieces', and 'Theorbe d'accompagnement'. These names probably related to whether or not the tuning was consistent with the pitch standards of contemporary ensemble
instruments, and implied no restriction as to vocal accompaniment. With the proviso that this is understood, I withdraw my objection here.

As for the ENGLISH THEORBOE, Spencer compounds the problems that Talbot created in his notes. The measurements Spencer quotes are for an instrument called by Talbot 'English Theorboe' not, as Spencer states, 'English Single Theorbo'. The instrument had doubled stopped courses, not single ones, and it had eleven single basses, not seven. Talbot never used the term 'English Double Theorbo'. What Talbot actually wrote is summarized in Appendix 2. Spencer is remiss in not mentioning the theorboe-lute. A discussion of Mace's writings on this instrument is in Appendix 3.

Concerning the name 'tiorba', Smith (op cit) convincingly identifies its origin as the hurdy gurdy. Smith makes no guess as to what the connection was between the hurdy gurdy and the long second neck on a lute. I have one. Mary Burwell mentioned that the French masters rejected the two-headed lute because the longer basses rang for too long. Mersenne and Mace remarked on how long the sound of the long strings on extended lutes lasted. When the long bass strings first appeared in Italian lutes, listeners would have been immediately impressed by this characteristic. The sound went on and on and on - like the drones on a hurdy gurdy. The liuto attiorbata was a lute which had acquired hurdy-gurdy characteristics.

In summary, the linguistic development suggested here is as follows: 'Chitarrone' meant large guitar because of a strumming technique used on it then. Piccinini's archlute with the long second neck was called by the others 'liuto attiorbata', which meant a lute given hurdy-gurdy characteristics. This longish name was often maintained because one still had to occasionally distinguish between the archlute and the ordinary Renaissance lute which was still in use (where this distinction was not necessary 'liuto' would do). When the long second neck was applied to the chitarrone, it would have been called 'chitarrone attiorbata', but since all chitarrones were so converted, this long name was not necessary, and it was contracted to 'chitarrone' by some and 'tiorba' by others. Hurdy gurdies called 'tiorba' were still around, but the instruments and playing circumstances were so different that anyone who couldn't tell the difference from the context deserved to be confused.

5. ANGEL LUTE

My comment on this instrument in Comm 621 is relevant to the period when it was played. It is not clear here whether Mersenne in 1636 was reporting what people were doing or whether he was suggesting that someone should invent this instrument.

Appendix 1

Smith's Objections to Piccinini's Story

Piccinini (1623) wrote that originally the chitarrone was just a bass lute tuned higher, with one or two reentrant courses. After a false start with a long-bodied lute in 1595, he claimed to have invented the long second neck for the lute, making it into the archlute. This modification was then applied to the chitarrone. Following are the points raised by Smith to discredit Piccinini's story. Each numbered item starts with the historical evidence cited by Smith, followed by my demonstration of how Piccinini's reputation remains unsullied.

(1) A 1592 letter by Cavalieri mentioned that Duke Alfonso "was very satisfied with his chitarrone and the mode of tuning, of which his highness wanted the drawing". Smith ignores the obvious interpretation that the Duke wanted a diagram of the tuning and writes "the letter reveals that the tuning or stringing (cordatura) made the chitarrone
very distinct from the lute in appearance, otherwise Duke Alfonso would not have desired a drawing of it."

(2) There are inconsistencies in two details between the story that Piccinini published in 1623 and other available information. In 1623 he said he went to Padua to order long-bodied lutes in 1594, while a surviving letter he wrote in January 1595 indicates that he was there earlier in that month. The other is that he wrote that the maker of the long-bodied lutes was Christofano Heberle. One of these surviving in Vienna has the maker Wendelio Venere on the label. These discrepancies can be argued about, but they are much too trivial to discredit Piccinini’s veracity.

(3) Large lutes were not new, and thicker strings on the first two courses are not enough of a difference to require a new name for the instrument. One can argue that Piccinini wrote that chitarrones had thinner strings and were tuned higher than the original large lutes, so playing at a higher tessitura would give a different kind of sound. But a difference of name in the Renaissance was usually associated with a difference in technique. The fact that the highest-pitch course is not the first will clearly effect technique when one is not simply playing full chords. Caccini praised Naldi for inventing the best inner voices of accompaniment on the chitarrone. The technique for doing this cannot have been the same as on the lute because of the mixup of octaves.

There is another difference of technique that could be implied by the name. In spite of the context of Greek mythology for the first uses of the chitarrone, which led Spencer to suggest (and Smith to agree) that the name ‘chitarrone’ derived from the kithara, any Italian at the time would have understood the name as meaning ‘large guitar’. The five-course Spanish guitar had just recently been developed (apparently by Espinel). It was also used in the 1589 Intermedii which inaugurated the chitarrone. A characteristic aspect of five-course guitar style at the time was strumming. It therefore seems reasonable to speculate that the chitarrone acquired its name because of a strong strumming component in its playing style at the time.

There is an important parallel in acoustics between the 5-course guitar and the chitarrone. Because of the relatively large volume of enclosed air in the body, both have good resonance at pitches that are exceptionally low compared to the tuning of the strings. This gives a characteristically hollow sound to strumming.

(4) Mersenne and Doni identified Naldi, not Piccinini, as the inventor of the theorboe. The instrument that they knew had a second neck for basses and reentrant tuning; Piccinini claimed to have invented the second neck for basses, applying it to the lute to make the archlute. He did not claim to be the first to apply this to the chitarrone. We do not know whether Mersenne and Doni were aware of Piccinini’s role, but this knowledge would not have stopped them from crediting Naldi as the inventor, since Piccinini only contributed indirectly to the instrument’s subsequent development. The long second neck is not more distinctive a feature of the theorboe than the reentrant tuning.

(5) There is no evidence from other sources crediting Piccinini with the invention of the long second neck. Neither is there any evidence for anyone disputing his claim. But his personal role is much less interesting than his history of what happened, and when, in the development of extended lutes. His book was published less than 30 years after the relevant events, and there must have been quite a few people of considerable influence still alive who would remember whether long second necks existed before the late 1590’s. If he wanted to lie about the sequence of events, how could he have expected to get away with it? What would have been the point? This is independent of whether he was the person who first thought about the extended neck.

(6) An instrument with a long second neck survives in Boston with the label "Magno Diffobruchar a Venetia 1589" and there is no evidence for major alteration. It seems to
be of very early design with seven doubled courses at 72 cm stop on the fingerboard and six single basses at 111 cm. Smith called it a chitarrone but I would consider it as probably a bass early archlute (because of the stringing and stop ratio). If we accept Piccinini's story one must postulate an alteration to accommodate a long second neck, perhaps c 1600. There is no evidence for this, but if the alteration were made by a craftsman in the same class as the maker (if not the maker himself) we would not expect to find such evidence. So this instrument, or any other surviving instrument, cannot be a test of Piccinini's sequence of events.

Appendix 2

Talbot on the English Theorboe

Almost all of Talbot's information on plucked instruments with fingerboards was published by Prynne (GSJ XIV (1961) 59, 60). I'll just add a few details and offer a different organisation of the information. That information is scattered around in three of the five notebooks Talbot left.

The notebook which contains most of the detailed measurements on the various instruments has measurements on p 18 of an 'English Theorboe' provided by Mr Agutter. Spencer reports a few of these dimensions. The instrument had 22 strings with 11 in 6 stopped courses plus 11 single bass strings on 5 nuts. On p 11 of that notebook, after measurements on the French Lute, is information on the 'English Theorbo' provided by Mr Lewis. It describes a 23-string instrument with 13 strings in 7 stopped courses plus 10 bass strings in 5 octave pairs, usually on 5 nuts but sometimes on 3.

The notebook that shows tunings of instruments has two relevant entries: 'English Theorboe with double ranks' on p 10 and 'Double Theorboe' on p 14. The tunings given in mensural notation, are identical. There are 27 strings with 11 in 6 stopped courses (the 6th being an octave pair) plus 16 bass strings in 3 octave pairs. The first two courses are reentrant with the first tuned to a. The basses are diatonic with no sharps or flats, going down to G.

From p 21 to 24 of a notebook containing general observations are notes mostly taken from Mersenne. Included are crossed-out notes on the lesser theorbo and double theorbo which duplicate such notes on p 8 (see below). On page 25 are notes taken from Mace's book under the title 'Lute Theorbo'. There is no indication that Talbot realized that Mace's theorboe had only one reentrant course. On page 7 of that book are notes on the lute and theorbo taken from Mersenne. On the second column is written "the present theorboe has 7 basses, 6 trebles, all single, sometimes double." Following is 'The tuning of present Theorboe' given in mensural notation. The first string is the only reentrant one and it is tuned to a. The basses are diatonic with no sharps or flats, the lowest being A. Alternatives are then given, with B♭ and E♭ in the 'Flat tuning' and C♯ and F♯ in the 'Sharp Tuning'. There are crossing-out lines through all of these tunings, indicating that Talbot later did not trust this information. This might be related to what follows on that page, which is a note about the archlute, which is included "the archlute's 2nd rises a 4th above the 3rd whereas in the Theorboe it falls a 5th below it". In this comparison the theorboe has two reentrant courses while the tuning given for the 'present theorboe' has only one. Was it really a theorboe? I am far from sure that Talbot's second thoughts are more reliable than his first.

Another example of this problem is overleaf on page 8 of this notebook. At the head of the column is 'Theorboe', followed by 'Single' in a more hurried hand at a slightly different angle, looking to me like a later addition. Then follows a description provided by Agutter of the nuts of a theorboe. These are identical to those on the measured instrument information also provided by Agutter. In this description, the instrument
was originally called 'Double theorboe' but the 'Double' is crossed out with 'Single written above it. After the description is a question "Whether this be true for single theorbo?" with the answer "no". This answered question is consistent with the original text but not with the text amended from 'Double' to 'Single'. The trouble here is most probably not in our ability to understand Talbot, but in Talbot's changing in his understanding of the situation (not necessarily towards a clearer picture).

The trouble here seems to be about what 'single' and 'double' meant. Talbot was informed by Crevecoeur that both the French single theorboe and the double theorboe had 14 courses of strings (8 basses and 6 trebles) with two reentrant and the first tuned to a. The only difference was whether all of the courses (other than the first) were single or double. This is apparently the distinction made by Crevecoeur. He seems to have been the only informant who had used 'single' and 'double', and Talbot latched on to the terms (if Agutter had clearly called his instrument a 'double', Talbot probably would not have felt free to change it). The instrument measured by Agutter seems rather intermediate, with single basses and doubled trebles, thus giving Talbot trouble. It is confusing terminology, inconsistent with the contemporary meaning of 'double' in 'double bass viol' and 'double virginals', and I suggest that we avoid it.

Any instrument with two reentrant courses would have unquestionably been called a theorboe. If it had at least three nuts for the basses, it was an English type, and if it had only one nut for the basses, it was a French type. The information given on the 'double theorboe' and 'present theorboe' is ambiguous in this respect. Talbot seems not to have known what to make of instruments with one reentrant course, and I suggest that 'theorbo-lute' is a good name, following Mace.

Concerning the 88.6 cm fingered string stop of the measured English theorboe, with a normal highest string stress condition (i.e. pitch-length product) of about 210 Hz·m, the highest string would have a fundamental frequency no higher than 240 Hz. The two major pitch standards in England then were Talbot's 'Chappell Pitch' at about \( a' = 430 \) Hz (which was also a fiddle-band pitch), and 'Consort Pitch' about a tone lower, used by viols and harpsichords. The pitch of 240 Hz is a b at Chappell Pitch, which fits the tuning in a of Talbot's theorboes providing that two courses were reentrant. The lowest string of the 11 single basses, assuming fully diatonic tuning, would be D. This pitch can be reached at the given 135.9 cm string stop without even the need for a roped-gut string construction (see Comm 632). This theorboe can probably be tuned down to consort pitch with no ill effects.

A summary of Talbot's stringing information on theorboes is given in the following table:

<table>
<thead>
<tr>
<th>Name given for type of theorbo</th>
<th>Informant</th>
<th>Number of reentrant courses</th>
<th>Stringing with octave of courses</th>
<th>Strings on nuts</th>
<th>Tuning of first stop string (cm)</th>
<th>Fingered Longest bass (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Agutter</td>
<td>2</td>
<td>11x1/5x2+2+1x1</td>
<td>3+4x2+11</td>
<td>?</td>
<td>88.6</td>
</tr>
<tr>
<td>English</td>
<td>Lewis</td>
<td>?</td>
<td>8-13</td>
<td>5x2/6+2+1x1</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>English</td>
<td>probably Crevecoeur</td>
<td>2</td>
<td>6-14</td>
<td>8x2/5x2+2x1</td>
<td>a</td>
<td>?</td>
</tr>
<tr>
<td>'present'</td>
<td>?</td>
<td>1</td>
<td>none</td>
<td>7x1/6x1 sometimes double</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>lesser French</td>
<td>Crevecoeur</td>
<td>2</td>
<td>none</td>
<td>8x1/6x1</td>
<td>b'</td>
<td>75.9</td>
</tr>
<tr>
<td>French</td>
<td>Crevecoeur</td>
<td>2</td>
<td>none</td>
<td>8x1/6x1</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Mace wrote that "the theorboe-lute [which he more often just called 'theorboe' or 'lute'] is Principally used in Playing to the Voice, or in Consort." In his plan for a music room he included "a Pair of Lusty Full-Seized Theorboes, always to strike with your Consorts, or Vocal Musick." When discussing his Dyphone, the newly invented theorboe half was "much more easy than Most True-Consort-Pitch'd Theorboes." So Mace's theorboe-lute was most probably at the consort pitch standard.

Mace's theorboe had 26 strings in 13 courses, with only the first reentrant, tuned to g. When he designed a shortened theorboe to combine with the French lute to form the Dyphone, reentrant tuning was dropped and the instrument became an archlute. He wrote "The Length of the Strings of Both, from Bridge to Nut, are exactly Consort-Pitch: The Treble Strings of Both to be Pitch'd to G-sol-re-ut [g']." The inscription around the Dyphone roses states "Long have we been Divided; now made One, He Sang in 7th's, Now in Full Unison." Since the first course of the original and transformed theorboes were an octave apart, both at the same pitch standard, we can then conclude that the French Lute first string was normally tuned to one or two semitones lower than g' at consort pitch.

Mace's French lute can be identified with Talbot's two-headed lute, which had a fingered string stop of 23.5 inches or 60 cm. Let us assume that the two instruments were the same size. Consort pitch was about a tone lower than a' = 430 Hz, so one or two semitones lower than g' at consort pitch would be about 322 or 304 Hz. This leads to a string stress condition (called 'pitch length product' in Comm 632) of 193 or 182 Hz-m on the French lute. These can be compared with the stress conditions of the highest strings on the various gut-strung instruments depicted by Praetorius (eg the chitarrone with a stress condition of 191 Hz-m) in Table I of Comm 632. The grouping of the various stress conditions in that Table can be displayed if we round off the stress conditions to the nearest 5 Hz-m and then plot the number of instruments with the highest stress conditions within 5 Hz of each stress condition vs that stress condition. This is shown in the following graph:

The highest peak is at 210 Hz-m, and I interpret this as the highest stress condition one would design an instrument for to get the lowest bass string to sound acceptably. A good highest string would last perhaps about five weeks at pitch before breaking, and to
preserve it, one would normally tune down a tone when not playing. The peak at 235 Hz-m is the highest stress condition one can push an instrument to when one has to because of extreme pitch demands. A good highest string would last perhaps about one week at pitch before breaking, and to preserve it, one would normally tune down two tones when not playing. The peak at about 190 Hz-m represents a comfortably high stress condition to have when there is no problem about the sound of the lowest string. No tuning down is necessary when not playing and a good highest string would last perhaps about 25 weeks. (These estimates of lasting time are based on information published by Baron (1727) and Beedle White (LSA Newsletter May 1932); they can be reduced considerably by wet fingers or very vigorous playing.)

It is clear that Mace's French lute falls in the last category. Mace never wrote that one tunes the highest string as high as it could comfortably go (that would be the 210 Hz-m category). Mace didn't say this for the theorbo-lute either. Because of the extended lengths of the bass strings, neither instrument presents problems with bass-string sonority. It is therefore reasonable to assume that its stress condition was about the same, about 190 Hz-m. The theorbo-lute's highest string was d' at consort pitch, which would be 256 Hz. We can then estimate the string stop, which is 190/256 = .74 m or 74 cm.

Mace did not describe the construction of the head (second neck/pegbox) of his theorbo-lute, but he implied that the one on the theorbo half of the Dyphone, which he provided a drawing of, was a miniature version of his full-sized instrument. In that drawing there are 24 strings and 26 pegs. The number of pegs corresponds to the number of strings he mentioned, so the disposition of these pegs is to be considered more reliable than the apparent disposition of the strings. The lower straight part of the head has 20 pegs and 3 nuts with a pair of strings on each. The curved pegbox on top with the highest nut has 6 pegs. The stringing of courses (from bass to treble) is then 6x2/7x2 and the disposition of strings on nuts is 6+2+2+2+14. Mace wrote that he added an extra course in the bass, and the normal theorbo-lute had 24 strings. So the normal theorbo-lute had 5x2/7x2 stringing and either 4+2+2+2+14 or 6+2+2+14 strings on the nuts. If we compare Mace's theorbo-lute with Talbot's theorboes, and make allowance for Mace's instruments having double first courses and Talbot's having single ones, we see that the usual theorbo-lute mentioned by Mace corresponds with the 'English Theorboe' information provided by Lewis (with 7 stopped courses and 5 longer courses, and 6+2+2+13 strings on the nuts).

This makes it highly probable that Lewis's instrument had a single reentrant course. Lewis reported that the long courses were octave pairs but didn't mention anything about octave pairs on the stopped strings. Mace didn't discuss this either. Whether the 6th and 7th courses were in octaves probably depended on the amount of projection that was needed in the instrument's use.

Finally, since the Agutter measurements in Talbot and the theorboe part of Mace's Dyphone both show the length ratio of the longest bass to the stopped strings to be about 1.5, this ratio was perhaps standard on the English theorboe and theorboe-lute, as it was on the early archlute.
Neapolitan mandolins, wire strengths and violin stringing in late 18th c. France

Fouchetti (1770-80, writing in France) wrote that the strings for the mandolin 1st course (mi or e") were gut chantrelles (first strings) for the pardessus de viole, those for the second course (la or a') were guage 5 brass, those for the 3rd course (re or d') were two guage 6 brass wires twisted together, the bourdon (low octave) string of the 4th course (sol or g) was wound on gut or silk (one can use a very fine violin 4th), and the octave string for the 4th course was the same as a string for the second course. Bakeman (GSJ XXVII (1974), 98) determined that the diameter of the French guage 6 string was .297 mm from Cryseul's (1780) measurements. Bakeman postulated an 18th century French guaging system based on Cryseul's information and measurements of wire found on an 1733 Blanchet harpsichord with guage markings. In this system, a guage 5 wire had a diameter of .34 mm.

All of the information on French stringing practices on non-keyboard stringed instruments before the middle of the 19th century that I know of indicates a preference for equal tension across the strings. Assuming equal tension, tuning in fifths and .34 mm brass wire for the second course, the other courses would have the diameters e" .57 mm gut, d' .51 mm equivalent (i.e., the diameter of a brass wire with the same weight as the twisted wire), and g' 1.92 mm equivalent (i.e., the diameter of a gut string with the same weight as the overspun gut string).

To estimate how reasonable these figures are, let us assume that this mandolin has been brought to France from Italy without any change in stringing. From Comm 528 we learn that in Neapolitan string-making practice of 1765, a mandolin first used 2 guts while a violin first used 3 guts. Therefore the diameter ratio was \(\sqrt{2/3} = .8165\). From GSJ XXXVIII (1935), 26, we learn that Riccati measured a violin first string in 1767 and the diameters were .69 mm. The mandolin first string would then have a diameter of .69 x .8165 = .56 mm. This provides strong support for the calculation above for Fouchetti's mandolin first.

In our experience with making twisted brass strings, the equivalent diameter of the twisted string is about 50% greater than the diameter of the wire that went into it. So a twisted guage 6 wire of .30 mm would have an equivalent diameter of .45 mm. This is 23% lower than the calculated equal-tension figure. Twisted brass strings are used where plain brass strings of the same weight would go unacceptably sharp on fretting. But they have a duller sound than plain brass strings or overspun gut strings. Thinner twisted brass strings have a brighter sound than thicker ones. Achieving better balance in brightness of tone seems to be a reasonable motivation for the stringing to have deviated here from equal tension.

One should worry about the pitches that the strings can sustain. A gut e" string is in an identical stress condition as on a violin. Comm 632 deals with this matter adequately. All I would like to add is the name 'stress condition' to the quantity defined as the fundamental frequency in Hz multiplied by the vibrating string length in meters.

The measured tensile strengths of early brass, as summarized in Karp's booklet "The Pitches of 18th Century Strung Keyboard Instruments" (1984), range from 356 to 834 MPa. The median of the 14 figures listed (the median is the number with half the other numbers less and half more) is 765 MPa. The strings which provided the low measurements could well have suffered from the ravages of time, so if we throw away the lowest 5, we have a median of 779 MPa. This tensile strength is 6.6% lower than the maximum measured. If we do the same with Karp's list of 14 measurements on iron, which range from 687 to 1177 MPa, we get a figure of 1087 MPa, 7.6% lower than the maximum. This approach seems to give reasonable estimates of the tensile strengths that could have been expected from good quality wire. Some such estimate needs to be
taken into account when designing instruments.

Typical stringing with brass is to have the highest pitch a tone below breaking pitch, and with iron, a semitone below. These safety factors take into consideration the stretching of the wire after being brought up to pitch. So a typical highest string stress on an instrument design would be 618 MPa for brass and 968 MPa for iron. This leads to a typical highest stress condition of 135 Hz-m for brass and 176 Hz-m for iron.

Though we know that tensile strength increases with the amount of drawing of a metal string, and so we would expect the tensile strength to depend on diameter, this tendency is not clearly indicated in the measurements summarized by Karp. It can be argued that this tendency is obscured by the considerable variability in the quality of the wire available. We shall therefore here ignore this tendency.

It should be noted that this estimate for the working pitches of iron strings leads to higher harpsichord pitches than the estimate given by Karp. Using Ruckers (or Swedish) scaling, the estimate here leads to a highest pitch of a semitone below modern.

We may now ask why iron strings were not used for the e" strings of the Neapolitan mandolin. At a typical string stop of 32.5 cm, a maximum stress condition of 176 Hz-m leads to a highest pitch of 176/\(325\) = 542 Hz. This is well over 3 semitones lower than modern e", lower than any known 13th century pitch standard. Iron was clearly not strong enough.

Let us now determine the highest pitch for the brass a' string on the Neapolitan mandolin. It is 135/\(325\) = 415 Hz. Relevant French pitch standards active at that time (see Comm 442) were about one semitone above modern and one semitone below modern (Ton de Chappelle). The mandolin must have played at the latter lower standard. If the mandolin were required to play at the higher standard, an iron a' string would be required. This option is taken in the alternative stringing scheme for the instrument as reported by Baines in "European and American Musical Instruments" (1966). Since string stress is the tension divided by the cross-sectional area, the tension on the a' brass string is 55.1 Newtons or 5.6 kg. The total string tension is about 42 kg, about 2/3 that of the modern Neapolitan mandolin.

Fouchetti's information on the g string can tell us something about violin stringing practices in France at the time. Players can clearly distinguish about 6% difference (a 'semitone step') in string diameter and normal stringing practice is to append the label 'thick' or 'fine' to strings differing from the normal by this amount. A label 'very thick' or 'very fine' usually means from 2 to 3 semitone steps (12 to 19%) different from normal. From this, we can estimate that a normal French violin 4th string would have a gut equivalent diameter of from 1.12 to 1.19 mm, or from 2.15 to 2.28 mm. At equal tension, the first string would have a diameter of from 1.64 to 1.68 mm. The second string at a' would have a diameter of 1.96 to 2.01 mm. At a' = 415 Hz and a typical string stop of 32.5 cm, the string stress would be 98 MPa. The tension would then be 70.9 to 78.5 Newtons or 7.2 to 8.0 kg. Total tension would be 29 to 32 kg.

Heron Allen (1895) reported that L'Abbe Sibire in "La Chelonomie, ou le parfait Luthier" (1806) estimated the total tension of the strings of a violin to be 64 lb. If Heron Allen did a proper conversion of units, this would be 29 kg, but it is possible that he just used 1 kg = 2 lbs, in which case it would be 32 kg. Whichever is the case (I have not as yet been able to see the original), this indicates that French violin string tension did not change significantly in the last quarter of the 18th century.

I would like to thank Donald Gill for providing me with the information by Fouchetti. He would like to express his regrets that his mention of it in the 'Mandolin' entry in New Grove DoMI was garbled.
ROUND BRIDGES: THE GEOMETRY OF CLEARANCE ANGLES

There are many areas of bowed-instrument making where time and effort can be saved if one has quantitative knowledge of what to expect from a particular combination of bridge curvature, fingerboard action, string tension, bow-hair tension, and the relationship between bridge height and width with soundboard width and arching height. This knowledge can also let us discuss the playing characteristics of instruments not yet made. The geometric relations given here are reasonably good approximations to the more detailed theory given in Comm 253.

I Geometry of string tops along an arc on the bridge, nut or at the bowing position assuming uniform curvature and uniformly spaced strings along the curve

If we let:
- \( c \) = distance between end strings; it is a chord of the circle of the curvature
- \( r \) = radius of the circle
- \( \theta \) = half of the angle subtended by the end strings
- \( a \) = maximum distance between the line of \( c \) and the top of the curvature
- \( \varnothing \) = clearance angle per string
- \( n \) = number of strings

Then:

\[
(n - 1)\varnothing = 2\theta
\]

\[
r = \frac{a}{2} + \frac{c^2}{8a}
\]

\[
c = 2r \sin \theta
\]

\[
a = r(1 - \cos \theta)
\]

Subscripts \( b, n, p \) will refer to the bridge, nut and bowing position respectively.

II Geometry of the strings in the bowing position

If we let:
- \( L_0 \) = string stop (open string length or nut-to-bridge distance)
- \( p \) = distance between the bridge and bowing position

Then:

\[
c_p = c_b - \left( \frac{p}{L_0} \right)(c_b - c_n)
\]

\[
r_p = r_b - \left( \frac{p}{L_0} \right)(r_b - r_n)
\]

\[
\sin \varnothing_p = \frac{c_p}{2r_p}
\]

\[
\varnothing_p = \frac{2\theta_p}{n - 1}
\]

The strings lie on a cone the geometry of which allows this linear interpolation.
III String depression by fingering
If we let:
\( f = \text{string depression by the finger} \)
\( d_f = \text{string depression at the bow resulting from fingering} \)
\( L = \text{vibrating string length} \)
Then:
\[ d_f = \frac{pf}{L} = \left(\frac{p}{L}\right)\frac{L_o}{L}f \]

IV String depression by bow pressure
If we let:
\( F = \text{bowing pressure} \)
\( T_s = \text{string tension} \)
\( d_p = \text{string depression at the bow resulting from bowing pressure} \)
Then for the usual case where \( F \) is much less than \( T_s \):
\[ d_p = \frac{p\left(|L - p|/L\right)F}{T_s} \]

V The true clearance angle for the bow
If we let:
\( e = \frac{1}{2} \text{ the distance between the neighbouring strings on either side} \) - can be approximated by the distance between strings in the bowing position
\( \theta_t = \text{the true clearance angle at the bowing position taking string depression into account} \)
Then:
\[ e = r \sin \theta_p \]
\[ \tan(\theta_t/2) = \tan(\theta_p/2) - (d_f + d_p)/e \]
The minimum total clearance angle needed is \( n\theta_t \).

VI Geometry of the relationship between the end strings and the soundboard edges in the bowing position
If we let:
\( h = \text{perpendicular distances (assumed equal) between the end strings and the line between the two soundboard edges; this is usually a bit less than the bridge height plus the arching height} \)
\( w = \text{distance between the two soundboard edges} \)
\( J = \text{angle between the lines between soundboard edges and between each soundboard edge and the end string on that side} \)
Then:
\[ \tan J = \frac{2h}{(w - c_p)} \]
Maximum total clearance angle available = \( 20^\circ \).
VII Requirement for clearance angle by hair depression of the bow

If we let:

\[ T_h = \text{bow hair tension} \]
\[ \alpha = \text{the acute angle between the hair on either side of the string} \]

Then (when the string is at the centre of the hair (where \( \alpha \) is largest, the value that needs catering for in the geometry):

\[ \sin \left( \frac{\alpha}{2} \right) = \frac{F}{2T_h} \]

\( \alpha \) is less than \( \theta_t \) by the amount of angular freedom the player has in positioning the bow to play that string alone.

Example: Simpson’s Division Viol

On p 2 of Simpson’s "The Division Violist" (1669) are printed arching curves for the bridge, nut and end of the fingerboard. We shall use the bridge and nut curves to calculate the clearance angle at the bow position. The strings are not shown, and we shall assume that the total arc shown is 6 times the angle between strings (6 times \( \theta_b \)).

This leaves half a string spacing on each end, which is approximately what we see in the drawings of viols facing page 1. Measurement of the p 2 drawing gives: \( r_b = 81 \text{ mm} \), \( \theta_b = 76.1^\circ \) (so \( \theta_b = 12.7^\circ \)), \( r_n = 69 \text{ mm} \), and \( \theta_n = 47.0^\circ \) (so \( \theta_n = 7.8^\circ \)). Simpson indicated that one bows 2 to 3 inches from the bridge and that the string stop is 30 inches, so \( p/L_o = \frac{2}{3} \) to \( \frac{3}{2} \) or \( \frac{1}{31.30} \) or 0.067 to 0.10. (In the following where a range is given, the first figure is for 2 inches and the second for 3 inches). The formulas of II give \( c = 82.5 \) to 81.2 mm, \( r_p = 80.2 \) to 79.3 mm, leading to \( \theta_p = 12.4^\circ \) to 12.2°, a drop of .3° to .5° from \( \theta_b \).

Let us now explore the effect of fingering an inner string at the 7th fret. At this fret \( L/L_o = 2/3 \) and \( p/L = (3/2)p/L_o = .1 \) to .15. We have observed that on viols that we consider have good actions, the clearance between the string and the 7th fret is one two-hundredth of the string stop. Then \( f = L_o/200 = 3.8 \text{ mm} \). The formula in III then gives \( d_f = .4 \) to .6 mm. If we ignore the string depression resulting from bow pressure and consider only this fingering factor, using the formulas of V, we get \( \theta_p = 9.9^\circ \) to 8.4°, a drop of 2.5° to 3.8° from \( \theta_p \).

From information in the Talbot ms (discussed in FoMRHI Comm 438) we estimate that the string tension per string of a late 17th century division viol was about 8 kg. In robust playing one can easily generate up to 200 gm of bow pressure. Using the formula of IV this bow pressure leads to \( d_p = 1.1 \) to 1.6 mm. On an open string (so \( d_f = 0 \)) the formulas of V give \( \theta_t = 4.3^\circ \) to 1.3°. My bass bow (with a clip-in frog) has a hair tension of about 8 kg, so according to the formula of VII, \( \alpha = 1.4^\circ \). It is clear that if one is playing loudly or fingering an inner string on a high fret, one plays closer to the bridge to limit
the deterioration in clearance angle.

The Talbot ms gives measurements on the division viol (see FoMRHI Comm 382). The width of the middle bouts is 10 inches, which will serve as \( w \) in the formula of VI. We will neglect the differences between the bridge and bowing position for this fairly rough calculation. The value of \( h \) is the arching height (1 inch) plus the bridge height (3.25 inches) minus the drop in height from the top of the bridge to the end string for Simpson's bridge clearance angles and Talbot's width of the bridge top (3.625 inches). Using the formulas of I, assuming the total bridge width accommodates \( 60_0 = 76.2^\circ \), we find the drop in height is .44 inches. Then \( h = 3.81 \) inches, \( c_p = 3.09 \) inches and \( \theta \) is \( 47.8^\circ \). The total clearance angle available is \( 2\theta = 95.6^\circ \). The total clearance angle needed if the end strings had the same clearance angle as the others is \( 60_p = 76.2^\circ \). The difference indicates that the end strings have an extra clearance angle of about \( 12^\circ \) each. This takes care of the facts that the bow doesn't always play at the narrowest point in the middle bout, that accidentally bowing the edge of the viol is more disconcerting than bowing an adjacent string, that the lowest all-gut string needs harder bowing for balance in projection, and that the first string is fingered very high on the fingerboard.

One point that this exercise in geometry should illustrate is that in late viols, all of the clearance angle is used in loud playing. If one is considering single-string playing in earlier bowed instruments, where available clearance angles are much less, one must be prepared to accept much less projection.
Flat Bridges I: Focus on the Lira da Braccio

The issue of flat bridges on early bowed instruments has continually bewildered modern scholars. Within the last year it erupted as a controversy on the pages of the Musical Times. The issue was raised in Collette Harris’s review of Woodfield’s “The Early History of the Viol”, with a rejoinder by Peter Holman, followed by a response by Harris. There is much that is deficient and questionable in Woodfield’s book, and Harris has rightfully attacked the statement “It is difficult to avoid the conclusion that the Valencian viol really was a most impractical instrument even for the relatively simple task of playing drones, and that its demise was fully deserved.” Woodfield admits that his conclusion is based on experience trying to bow a modern guitar. He unfortunately suffers from a delusion common amongst instrument makers and players but indefensible for an historian. It is that if he can’t make it work it can’t be done. More effort (like having a Valencian viol made for him and using gut strings) and more imagination are required, because historically, it must have worked.

Harris goes on to claim that “Once the viol had more than two strings it would have needed a curved bridge and there is no reason to suppose that instrument makers could not work that out.” By ‘curved bridge’, Harris means curved enough to play each string individually, as evidenced by her comment on the lirone: “Its flat bridge renders melody playing impossible.” Harris’s faith in instrument makers is gratifying, but unfortunately we cannot defy the geometry and physics of the situation to do the impossible.

Holman counters by claiming that before the 1480’s “all bowed instruments seem to have been used to accompany or perform monophonic music with the strings sounding together in a drone, a technique that was carried into the 16th century with the lira da braccio, the last descendant of the medieval vielle.”

The retort by Harris points out that Jerome of Moravia’s instructions for medieval fiddle specify the fingering of individual notes throughout the range of the strings and indicate that the bordunus (the off-fingerboard last string) should not sound when not in harmony with the tune. This is an effective argument only if one assumes that the term ‘drones’ means strings constantly sounding at constant pitch. This is a superior definition (see Comm 58) but clearly is not Holman’s meaning since the surviving music for lira da braccio that he refers to conforms to Jerome’s specifications. That music, in the Pesaro ms, consists of some simple divisions on popular grounds appropriately punctuated by chords. (It is reproduced in Brown’s 1973 “Sixteenth Century Instrumentation: The Music for the Florentine Intermedii”.) The Italian tablature indicates finger number in diatonic fingering. As with all tablatures, it tells when notes start but not when they stop. It is therefore quite appropriate to interpret the tablatures so that the chords continue to be bowed throughout the divisions. This appears to be essentially what Holman had in mind for the 15th century vihuela (called ‘Valencian viol’ by Woodfield) and the medieval fiddle. One should expect that bowed chords on the lira da braccio would sound continuously, rather than being arpeggiated as on the baroque violin and viol, because of Ganassi’s statement indicating that if one wanted to play the viol in a chordal style imitating the lira da braccio, a bow with slacker hair tension is required.

Holman’s interpretation of the music from the Pesaro ms, which assumes continually bowed chords, is supported by an illustration of a lira da braccio in an intarsia now in the Louvre dating from about 1515 attributed to Fra Vincenzo da Verona (reproduced on p 45 of Pincherle’s “Histoire Illustree de la Musique”). This careful representation shows the bridge with a curvature such that the clearance angle for each string is 3°.
(clearance angle is the angle over which one can rotate a stick resting on the string and perpendicular to it, as limited by other strings or the edges of the soundboard).

Instruments from the Renaissance and later which are played with each string sounding individually have a clearance angle per string at the bridge of over 8° (Simpson's bridge diagram for the division viol gives an angle of 13°; the smallest clearance angles at the bridge that I've found on pictures of such instruments are 8° on Mersenne's viol bridge in Fig 37 of Harmonii Universelle Book IV and 9° on the Renaissance viol shown as Fig 81 in Woodfield's book.)

The Pesaro ms lira music is obviously for a beginner. The tuning instructions indicate 7 strings, but in the music the first string is not used, probably removed to simplify the stopping while bowing gets sorted out. On the remaining strings, the chords notated cover the highest 3, 4 and 6 (ie all) strings, and the 3 strings below the highest. It seems reasonable to interpret this so that normal bow pressure leads to 3 strings bowed together, with chords using more strings played either by using more bow pressure, using arpeggiation or bowing further from the bridge. This last possibility would work because the string depresses more when bowed further from the bridge for the same bow pressure, and this depression reduces clearance angle per string, thus allowing more strings to be bowed. Three strings at 3° clearance angle each is equivalent to 9° on one string as far as the bow is concerned, so the conditions of bowing (other than clearance angle) seem to differ little between liras and contemporary instruments which were primarily melodic.

It would be quite understandable if a painter did not bother to reproduce the very shallow curvature of a lira bridge with 3° clearance angle per string, and painted the bridge top as straight. This could have been the case in the Jan Bruegel 'Allegory of Hearing' painting in the Prado (reproduced as Plate 37a in Winternitz's 1967 "Musical Instruments and Their Symbolism in Western Art" and on the cover of Munroe's 1976 "Instruments of the Middle Ages and Renaissance"). Alternative possibilities are that the shallow curvature could have been achieved by varying depths of string notches in a flat bridge (for a 3° clearance angle, the difference between end-string and middle notches would be 1/25 the distance between end strings, or 2 mm on a 50 mm bridge), or that the tops of the strings were truly intended to lie on a flat plane. With the latter alternative, the only playing possibilities would be bowing all of the strings together (with the end strings loudest) or playing the end strings individually. If this alternative has any historical validity, it could be associated with first strings traditionally having been called 'singing strings' in French and Italian.

There are many pictures of lyras which show the slight bridge curvature which could represent approximately 3° of clearance for each string, but for which the angle of viewing is bad for measurement. Well-painted examples are given as plates 33a and 33b in Winternitz's "Musical Instruments and their Symbolism ...". But plate 32a on the previous page shows an obviously late lira with a very curved bridge. The fingerboard seems not to be similarly curved, so it is possible that the instrument was being pressed into service as a kind of extended violin.

Winternitz's plate 52a is a 15th century Urbino intarsia showing a 9-string 5-course lute and a 5-string instrument that looks like either a late medieval fiddle or an early lira. It has one off-fingerboard string, a flat soundboard, wedge fingerboard and a remarkably high bridge. The string clearance angle at the bridge is 1.5°. With this clearance angle, one probably could not play on the inner strings while avoiding the outer strings on both sides, as one could do with a 3° angle. The effect of a 1.5° clearance angle differs from a truly flat bridge in that, while bowing near the bridge, the sound output if the inner strings would be closer to that of the end strings.

Before we get into serious arguments about medieval fiddles and the 15th century vihuela, it may be worth while to first argue out the lira da braccio. The lira has several advantages over the other instruments: It has been depicted by an exceptionally
accurate school of artists, some instruments have survived, and it has a bit of surviving
music. We need to examine carefully the surviving liras and paintings of liras to make
sure that the bridges of liras in the first half of the 16th century usually had very small
clearance angles of only a few degrees. If this is established, we should build a few of
these and try to get the players interested. This is worth doing in itself, but a useful
consequence would be that we could then approach bowed instruments from earlier
periods with much greater understanding.

For the following Comm


Ten of the More Popular Tunings for Viol Tablatures
(higher strings are to the right, lower to the left)

<table>
<thead>
<tr>
<th>Name of Tuning</th>
<th>Intervals by Tablature</th>
<th>Tune Semitones from Lute Way</th>
<th>Sample Nominal Tunings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lute Way</td>
<td>f fe f</td>
<td>0 0 0 0 0 0</td>
<td>D G c e a d'</td>
</tr>
<tr>
<td>Violl</td>
<td>h f e f</td>
<td>-2 0 0 0 0 0</td>
<td>C G c e a d'</td>
</tr>
<tr>
<td>Lyra</td>
<td>f h f e f</td>
<td>-2 -2 0 +1 0 0</td>
<td>C F c f a d'</td>
</tr>
<tr>
<td>Harp Sharp</td>
<td>f h f e d</td>
<td>-2 -2 0 +1 0 -2</td>
<td>C F c f a c'</td>
</tr>
<tr>
<td>Harp Flat</td>
<td>f h f d e</td>
<td>-2 -2 0 +1 -1 -2</td>
<td>C F c f a c'</td>
</tr>
<tr>
<td>High Harp Sharp</td>
<td>h f e d f</td>
<td>-2 0 0 0 -2 -2</td>
<td>C G c e g c'</td>
</tr>
<tr>
<td>High Harp flat</td>
<td>h f d e f</td>
<td>0 +2 +2 +2 0 0</td>
<td>D A d f a d'</td>
</tr>
<tr>
<td>Eights</td>
<td>f h f h f</td>
<td>-5 -5 -3 -2 0 0</td>
<td>A D A d a d'</td>
</tr>
<tr>
<td>Allisonoe</td>
<td>h f h f f</td>
<td>-5 -3 -3 0 0 0</td>
<td>A E A e a d'</td>
</tr>
</tbody>
</table>

Lancashire Pipes: - n h f (To use this last tuning, cross the 4th and 6th strings at the bridge and nut)
FoMRHI Comm 7/6  E Segerman

Lyra and Other Viols that Played from Tablature, and Free Resonance

When one plays a viol in its usual melodic role in an ensemble, the sound produced while bowing is all-important and the free resonance of the string and instrument after the bowing stops is rarely of interest. By contrast, this free resonance is all the sound one has in lute playing. When tablature music for viol is played, the situation has some similarities to that of the lute. More than one note on non-adjacent strings is expected to sound at any one time for a large fraction of each composition. Free resonance is an essential characteristic of viol playing from tablature.

Those aspects of a viol's stringing and construction which contribute to longer-lasting free resonance would therefore be preferred for viols that play from tablature. Free resonance is greater if the instrument is larger. It is enhanced by sympathetic vibration of other strings, or by adding other unbowed strings that can vibrate sympathetically, or by not having a soundpost in the instrument. Most and perhaps all of these factors have contributed to the use of general-purpose viols and the development of special-purpose viols for playing tablature.

There are a few instances of tablature music specifying treble viols and tenor viols, but the vast majority of tablature music that indicates a size name specifies bass. The preference for a large size for purposes of free resonance is opposed by the preference for a smaller size to allow more complex fingerings (which allows more compositional freedom) and still be playable with a human hand stretch. The resolution of this opposition seems to have been different at different times. Later in the 17th century, fingerings was less complex than early in the century, so we can expect that larger viols were used. For instance, the biggest stretch in Mace's music (1676) is between the tablature letters d and n which is 17.3% of the string stop, while in Corkine's music (1610), the biggest necessary stretch is between b and f which is 19.5% of the string stop. If both of these represent the same maximum hand stretch, the late 17th century viols for tablature were about 12% bigger than early 17th century tablature viols. If we assume that Mace's instrument and the lyra viol Talbot measured (with string stop of 28 1/8 inches or 71.4 cm) were typical of late 17th century instruments, then the maximum stretch in Mace's music is 12.4 cm. I can believe this figure because it is just about what I can do. The string stop for Corkine's Lyra Viol then calculates to be about 64 cm. This is no more than a very rough estimate, but around 65 cm is quite reasonable.

For comparison, the sizes of viols in a chest seem not to have changed in England during the 17th century. The string stops were 16, 24 and 32 inches (about 40, 60 and 80 cm) for the treble, tenor and bass respectively, as indicated by Talbot. We must remember that bass viols other than those for the chest were extensively used throughout the 17th century. Those specifically intended for tablature playing were usually called lyra viols and tended to be amongst the smallest. There were also other small bass viols primarily used for accompaniment, where the size was chosen for convenience of the hand and pitch of the voice. When "viol" or "bass viol" or "viol da gamba" was specified in a tablature source (which was more often than "lyra viol"), it is likely that these smaller instruments were usually the ones involved. These terms were generic ones though, and lyra viols and large basses of chests (called Consort Basses late in the 17th century) can not strictly be excluded.

It is also possible, as some illustrations imply, that the bass viols in a chest were not all of the same size. In much of the music there is a bass part which covers a pitch range lower than all of the other viols. Then any other basses would not need the fullness of sound in the bottom register that the lowest would. So a higher bass could be smaller and thus more convenient to play. It should be noted that the whole situation of bass viol sizes changed drastically around 1690 when sixth strings overspun with metal began to be used extensively (as indicated in the Talbot ms). The small bass viols
of Barak Norman and his contemporaries were probably designed to use these strings for the functions previously performed by larger viols.

Viols specifically made for playing tablature were called variants of the name Lyra Viol throughout most of the 17th century. As stated above, the apparent left-hand stretches required in the early period are greater than in the later period, implying smaller instruments earlier. The requirements for free resonance should not have differed, so we are led to search for additional sources of free resonance in the smaller instruments of the early period. We can easily find one that started at about 1609 but probably lasted no more than a few decades. It was the addition of metal sympathetic strings to the viol. In footnote 59 of an article on the Bassano family by Lasocki (GSJ XXVIII (1985) 130-1) we learn that in March 1609, Edney and Gill applied for a Court privilege for "the sole making of viols, violins and lutes with the addition of wire strings beside the ordinary strings for the bettering of the sound, being an invention of theirs not formerly practised or known." Praetorius (1619) mentioned an English type of viola bastarda with eight sympathetic strings of steel and brass. Playford (1661), writing about the history of the lyra viol, confirms that Praetorius's English viola bastarda was the lyra viol. Playford attributed the invention of metal sympathetic strings to Daniel Farrant (but Kircher (1650) gave the Duke of Somerset the credit). According to Playford, the wire strings were tuned in unison with the bowed strings. This tuning would have had to be modified by about 1620 when steel strings that could be tuned as high as gut stopped being available, and this may have started the loss of favour of this type of lyra viol. Bacon (1626) argued against the sympathetic strings but he gave no hint of his opinion being widespread. By the second half of the century, Playford wrote "Of this sort of Viols, I have seen many, but Time and Disuse has set them aside." They seem to have been replaced by lyra viols that got their added free resonance from being larger. These were then distinguished from other viols perhaps solely by being the smallest size of bass.

In the period of popularity of the lyra viol with metal sympathetic strings, we do not know whether this was the only type of lyra viol in use. Nevertheless we do have evidence that a lyra viol differed from a bass viol in enough more than just stringing and tuning to make it a separate article of commerce. In Woodfill we read that in 1614 the Earl of Cumberland bought both a bass viol (from Mr. Sperley) and a lyre viol (from Mr. Coprario).

The situation before 1609 is fascinating. Whenever the name "Leero" was used, either for a type of viol (eg "Leero Viole" in Hume's 1605 book) or for a way of tuning a bass viol (eg "two Basse-Viols, the Liera way" in Ford's 1607 book) the same tuning is always involved. Hume called this tuning "the bandora set" (because it is relatively the same as a seven-course bandora with its fifth course eliminated), but others used the leero name (eg "Leerow way" in Barley). Sources such as Barley include tablature music in other tunings (Alfonsoe way, eights, lute way) but these had no apparent connection with the Leero viol.

If the term "Leero Viole" meant any bass viol using this particular tuning, it then seems odd that writers went to the trouble of writing "Basse-Viols, the Liera Way" when they could have written just "Liera Viols". The more probable alternative is that in this earliest period the Leero Viole was a distinctive instrument with a distinctive tuning which was much used (amongst other tunings) by other types of bass viol. It seems that this instrument was largely displaced by the new version of the lyra viol with metal sympathetic strings around 1609. This new lyra viol was much more versatile than the old one in that it used much the same variety of tunings used for tablature playing as other viols.

It is possible that the earliest leero viols had no soundposts, as was the case with all viols till near the end of the 16th century. The open-string range of the leero tuning is two octaves and a tone, about the same as the earlier viols. By contrast, the new
Allfonsoe and Eights tunings have an open string range of two octaves and a fourth, which uses to the full the increased range and power in the bass provided by the newly available roped-gut bass strings (catlines) and the soundpost. The earliest evidence for the soundpost is the word used for the name of one of the musicians in Shakespeare's Romeo and Juliet (1595). The audience at the Globe Theatre was expected to recognize the term "soundpost" as a musical one. A member of the general public today probably wouldn't, but he would know quite a few technical terms of space flight, since that is the new technology in the news. If the earliest lyra viol retained the old structure without a soundpost, it would have the free resonance of a larger viol on a smaller one.

Ferrabosco's printed book of 1609 is the earliest source to indicate that a lyra viol would play in any other than lyra tuning. It may be significant that Ferrabosco titled the solo music "Lessons for the Lyra Violl" while his music for 2 or 3 viols (using the same three tunings) was just titled "For two Viols" and "for three Viols". This would make sense if lyra viols were few and far between and it would be unlikely for more than one to be available. A single lyra viol would be rather more likely, and it would have been preferable to other types of bass viol.

Finally, a particular characteristic of the vast majority of lyra viol tunings throughout the 17th century is that most open strings fall on one chord, the fifth of which is (of course) the root of the dominant chord. So bowed notes in either of these chords will usually cause sympathetic vibration in the harmonics of unplayed open strings. When the bowing stops the sympathetic vibration continues, adding to the free resonance of the note. If the bowed note was fingered and the finger is needed elsewhere, the sympathetic vibration provides the only free resonance for continuation of the note. So Salmon (1672) could write: "I would therefore play ... upon some pleasant Lyra Tuning, that the most frequent Notes be always struck open, that their Concord be their nearest neighbours, and at last the whole Viol, with an unstop'd freedom, may echo forth a full Consort-stroke, usually in the key of the Lesson." This amply shows the aesthetic purpose served by the free resonance provided by the lyra tunings.

In summary, throughout the 17th century, tablature music was mostly played by small bass viols that were neither lyra viols nor consort viols. The lyra viol was a particular type of small bass viol devoted exclusively to tablature playing. Being the smallest of the bass viols, it was the easiest to finger. It sometimes had special adaptations to enhance free resonance, some of which was lost by being small. The adaptation in the first decade of the century could well have been omission of the soundpost. In much of the rest of the first half of the century, the adaptation was the inclusion of a set of metal sympathetic strings. In the rest of the century, it was larger than previously, with no special adaptation we know of. In the earliest period there was only one lyra tuning. Afterwards, any tuning that was not a normal viol tuning could have been called a lyra tuning. The modern habit of calling any instrument that uses a lyra tuning a 'lyra viol' is historically unfounded.
## VIOL SIZES AND NAMES

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<th>Typical String Stop</th>
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<th>late 17th c.</th>
<th>18th c.</th>
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<td>20</td>
<td>22</td>
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The keyboard instruments that we know today, are, basically, divided in three kinds, according the present method of classification in use, being: chordophones, aerophones and electrophones.

Among the chordophones, we include the clavichords, harpsichords, spinets and pianos. Among the aerophones, we have the organ and the harmonium and, at last, among the electrophones we can include all the synthesizers either electro-mechanical or electronic, at present being manufactured by the thousands by the electronic industry.

It is not our intention to present definitive doctrine about a subject that has been debated by so many scholars. But, we understand that a bit of systematization will not be so bad, anyway and that we can advance some ideas for a more rationalized classification of the keyboard instruments. This matter has been calling our attention for some time because it has something to do with our professional work.

It is within the scope of this paper to introduce a study, even very superficial, about the electrophones that a very sophisticated electronic industry is producing. Also, the keyboard aerophones do not put any doubt on us - the organ, known for more than two thousand years and the harmonium, known for a little more than a century, either in its portable version (usually called accordion or concertina) or in its movable version, the harmonium used in some churches and residences.

Among the chordophones acting through a keyboard, there are two instruments with struck strings which are very well defined and classified without any margin for doubts: they are the piano and the manichord (also known as clavichord, by influence of French and German languages).

But the keyboard chordophones with plucked strings have been classified using several nomenclatures which doesn't have in mind certain and very important building details. Authors from England, Italy, France, etc., have used so different criteria for classification, as the form of the case, position of the keyboard, etc.

With these several methods of classification if we can call them as such, three main designations are used - Harpsichords, Spinets and Virginals.

We follow, now, presenting some of our own ideas about the criteria that, in our opinion, must be used as a basis for classification of plucked string keyboard instruments.

All authors are in agreement to call harpsichord to an instrument with the shape of the present days grand piano with one or two keyboards. The main characteristics of the harpsichord are as follows:
- Keyboard(s) in a right angle with the strings.
- Strings laying down on two bridges, one being deaf because it is glued to the wrest plank (between the wrest pins and the rows of jacks) and a second being vibrating or transmitting, because it is glued to the soundboard. This second bridge is, in a great extent, responsible for the transmission of the vibrating power from the string to the soundboard. Now let us see the typical configuration of the harpsichord, seen from above (Russell, photo 33).

Also, there is no great divergence between scholars and organologists as far as the designation of the spinet is concerned. The main characteristics of this instrument are as follows:

- Keyboard (one only) parallel or forming a very acute angle with the strings.
- Stringing laying down on two bridges, both vibrating, because both are glued to the soundboard that occupies almost the total area of the case.
- The case may be rectangular or polygonal with 5 or 6 sides, not regular, according the design of the builder.
- Generally, the aspect of the spinet is very similar with that of the manichord.
- In opposition to the harpsichord, the set of jacks (as much as the number of keys) cross the soundboard, from below, to be able to pluck the strings. Some builders use a kind of register (a light strip of wood, glued to the soundboard acting as a guide for the jacks. Some builders, more purists in relation to the vibrating freedom of the soundboard, use a strip of thin leather with rectangular perforations, acting as a guide for the jacks, without direct contact between these and soundboard, to prevent parasitic vibrations or sound energy damping. Let us see the aspect of a spinet, also seen from above (Russell, photo 25).

These considerations, illustrated with the two photos already projected, show the two main differences that, in our mind, separate, definitively, the harpsichord and the spinet: in the harpsichord one only vibrating bridge, in the spinet two vibrating bridges. This difference goes on informing the nomenclature of other instruments that we will present in the continuation of this paper.

Among the spinets, there are some where the plucking point is not the same as we saw in the previous photo which we project again. As you can see, the row of the jacks is put very close to the bridge at the side of the hitchpins, at the left of the player. The plucking point goes a little far away in the treble side, due to the small length of the strings. Thus, in the instrument built by Hans Huyckers in 1598, the plucking point is somewhere between 10% of the string length at the low C and about 40% at the top C. Because of this and to avoid a very difficult configuration of the tails of the keys, the keyboard was installed at the left of the case as we can see in the photo (Russell, photo 25 as before). This instrument belonged to the collection of the late Contesse de Chambure, in Paris. But in other instrument, by the same builder, built in 1604 and belonging to the collection of the
Musée du Conservatoire de Musique de Bruxelles, the plucking point is far more away from the left bridge, as far as about 35% of the string length at the low C and going to about 40%, again, at the treble C. Let us see another photo that shows this instrument (Russell, photo 26).

In this instrument, to avoid identical difficulties in the form of the tails of the keys, the keyboard was displaced to the right of the case. And, as all of us know the effect that the plucking point has in the production of harmonics generated by the string, we can realise the difference in tone between the spinet of 1598 and the muscelar of 1604. And because the muscelar has two vibrating bridges glued to the soundboard it goes being classified as a spinet, according our criterium. And the same are the virginals, name that does not get consensus among the specialists, because it has not a valid base, some arguments being concerned with a vrgin queen ... As a curiosity, we can say that documents of that date speak about spinets and/or virginals depending of the writers and from which country they belong, having nothing to do with building details. And the argument relating with the configuration of the case is also without value for the classification of the instrument. To refer another curiosity it seems that Hans Ruckers (or his clients) had more marked interest in the muscelars as Hans built far more of this last model than of the traditional spinet!

Now, to finish this paper, we want to contest, from tally, the denomination as a spinet of the instrument we go to show (Russell, photo 76). This is what the english use to call a wing spinet. If we analyse closely and following the classification already explained, we have to agree that this instrument is no more than a harpsichord, where, for the sake of smaller space to be occupied, the strings were installed at an angle of about 30° to the keys. But remark that all the characteritics of the harpsichord are there— one deaf deaf bridge and a vibrating one. As well as in the usual harpsichord, the jacks are installed between the wrest plank and the soundboard. And the same is found in the next instrument we will show (Elite photo 26), built and on show in Italy and to which we must apply all the previous considerations. Therefore, we have no other chance than to classify these instruments as harpsichords to which we could join the adjectif "oblique" or "angular". And the same applies to two octave harpsichords in existance at the Instrumental Museum of Lisbon, being one by Castanis Giannini (1628) which has a lot of possibilities of not being a Francio lini and another, by unknown builder, bought by the Instituto Português do Patrimônio Cultural and restored in 1982. At last we go to see another harpsichord which may be named "vertical": the so called "clavicytherium" built by Albert de Lin bu the middle of the XVIIIth century (Elite photo 20).

English version of a paper presented to the Annual Meeting of Musicology organised by the Portuguese Association for Musical Education (member of the I.S.M.E.), March 1986.
In his discussion of the Ruckers' doubles, Nicholas Meeus proposes (Comm. 680) that
"...one should first consider a priori what can be done on them, leaving for later to
wonder which of the instrument's potentialities actually were used"
In the very next sentence this admirable unprejudiced approach to the question is blown
to smithereens!
"The important and most puzzling feature of the Ruckers doubles is that their
keyboards were a fourth apart in pitch", he says. He could as easily have declared that
the most important feature is that their keyboards have different tone-colours, but this
a priori fact fails to surface in seven paragraphs discussing possible implications of the
keyboard arrangement.

I claim that the arrangement of the keyboards is the natural one: if you are fitting
a tenor and a bass instrument into one box then of course the keyboards will be
displaced relative to one another, how else would the keys reach the correct strings?
I do not propose, as Nicholas suggested I did, that the purpose of the misalignment
was to permit the playing on the lower keyboard of pieces that would have involved a
D-sharp at the pitch of the upper keyboard. It is true that if one were accompanying a
singer on the upper manual in a piece in D-major and the singer found it a trifle low then
one might want to go up a tone in pitch. If so, one would be embarrassed by the
C-sharps, which in E-major have become D-sharps. It would be possible in this
circumstance to drop straight down onto the lower manual whereupon the fingering is
A-major. You have achieved the pitch that the singer wanted to sing at, but you are
playing a tonally different sounding instrument, which may or may not please you.
Whether such a circumstance arose is a matter of conjecture — I don't believe the
Ruckers designed their double with this in mind, though such tricks may have
perpetuated its popularity. In any case such arguments do not rely, as Nicholas
asserted, on the existence of pieces of music with written D-sharps.

From the point of view of the listener, you cannot tell whether the keyboards are
aligned or not — it only affects the fingering used by the performer. You will of course
hear the tonal difference. When Nicholas unearthed evidence that the 1646 Couchet had
been aligned without having an extra 8' he treated this as an absurdity (1), yet such a
procedure was quite common in the second half of the 17th century (2). Whether you find
it more or less convenient to have your keyboards aligned does not alter the
instrument's musical resources.

So, yes the keyboard alignment is unimportant as far as the music that can be made,
and no, it is no more puzzling than an aligned keyboard would be on such an instrument.

In his summary, Nicholas omits all mention of what I take to be the real purpose of
the instrument (ie to make a piece of music sound different by switching keyboards).
Instead he describes a number of transposition tricks that could have been performed.
These he describes as 'so obviously useful'; in fact (1) The vast majority of pieces ca
1600 can be happily transposed without exceeding the limits of the meantone system, (2)
We have good reason to suppose that the performers were sufficiently versed in
transposition at the time that 'saving one accidental' would not have been considered
sufficient reason to be forced off the keyboard of choice.

Finally Nicholas expresses a suspicion that I didn't find his ('sixth') hypothesis
convincing. Were that the case I would happily have summarized it; in fact my attempt at
a comprehensive survey of the hypotheses was scuppered at this point by my inability to
get the gist of Nicholas's arguments. (Mea Culpa!). I'm very pleased that Nicholas has
filled in this gap. Moreover it seems that his arguments lend weight to the idea that the alignment of the keyboards was as natural for them as a unison alignment, 'transpositions of a fourth or a fifth... were not considered as true transpositions." as he says.

(1) Nicholas Meeus: "Le clavecin de Johannes Couchet.." in The Brussels Museum Bulletin
(2) see GSJ '84

Marc Champollion

I have some enquiries:

I want to buy jacks made in the historical way. I know only Swainson, Groom and Minns. But perhaps there are other makers ? "My " jacks would be of service wood (Alisier)(Elzbeere), planed (not sanded), edges bevelled, holly tongue not too noisy but without "silenting pads"; "boar" bristle; cotton wire behind the tongue; slot in the tongue for thin delrin plectra .4 x 1.9mm; slots for dampers 1.5 x 5 mm, the bottom of that slot being ca 1mm lower than the plectra slot because I cut the damper at an ca 45°-angle in the historical way.

I wish to have delrin in thinner strips than the ones commercially available (.5 or .6mm). Better: bevelled, so that the strips, say 10mm wide, taper from .45 to .30 mm. How could they been made ? With a scraper it is not very easy to have a constant thickness. Until now I have my delrin thinned but not tapered.

Has someone experience in making mouldings in thin walnut planks either by hand or with a machine ? Today's circular saws rotate very fast ( 4500 , 5000 or even 6000-6300 Rpm) and carbide moulding devices are available for them at a reasonable price: the tool costs about 200-300 DM ( 55 to 80 pounds) and the blades about 12 quids. The cutting velocity is
as high as in a router because the diameter of the tool is much bigger, 140 to 180 mm instead of 100mm. At the tool's fair at Cologne last month I saw such a machine making mouldings at only 2850 Rpm in softwood. The mouldings were very good. Of course it is still possible to make moulding planes by hands but I must confess I can't. (If somebody wants to help me please...)

I'm too looking for some electric machines, if possible 380 volts:
- band saw not too heavy but made of cast iron, two wheels, two guides;
- planing/Thicknessing machine with a width of about 11-12" (270-290mm)
- circular saw of cast iron, sawblade inclinable at 45°, 3000 and 6000 Rpm, sliding chariot, not too noisy, not too heavy.
- hoover.

I could be in London at 22-26 May.

Some more theoretical enquiries now:
As I'm researching especially the early French harpsichord I would be glad if everybody who knows more than that is available in the literature would let me know. I would then publicize a survey first in Fomrhi. Before all I'm interested in constructional details of the inside of following instruments:
French double Rubin sold to the Stuttgart museum; Both Lebrèche 1699; three Tibaut
(Brussels, Guillou's and Paris Conservatoire) Richard 1688; Jacquet; Denis; DesRuisseaux; and other thin-cased walnut instruments, even anonymous like the little harpsichord Bingham has had last year. The Vaudry is the only one which is well known, the VAM having issued plans.

Does anyone have experiences with soft iron like Röslau "weich"; or that american wire (available in two strongnesses) sold by "the harpsichord workshop", is that the same (tinned) wire than Zuckermann's? The difficulty is that wire manufacturers change their product or the name under which the same product is being sold without warning.

Another "theoretical" query: It is probable that Bach's Mietke (in any case his Compenius 1675) had a range of GG.AA-c". It was the range of the harpsichords of the period, even of the Italians and the French until the coming of these big GG-e" and FF-e" in the thirties and forties (which Bach had probably not had). Anyway, the original range of both instruments in Berlin which are thought to be of Mietke was GG.AA-c" when they were built. Why did Bach exceed that range some five or six times in the treble? E.g. the Well-tempered clavier, the chromatic fantasy & fuge, the 5. Partita, in which one
has to play c"", c"" sharp and d"". Did he not care? Did he not see? Did he know of the first early french "grand ravalement"? Perhaps this kind of problem seems to be beyond the scope of Fomrhi, but it is of no small importance for the maker who is often confronted with the wish of a customer wanting a big five-octaves-harpsichord (of course with two manuals, buff, lute etc.), even with an atypical range of FF-g"" to play everything including that famous Scarlatti sonata requiring a g"" (or some Soler pieces I'm told). The same problem occurs with Rameau & François Couperin. When they composed their first books (1706–1713) they surely used those widely spread french instruments with GG/BB-c"" (or even new chromatic GG.AA-c"" (none of which seems to have survived)), and their music quite never exceeds this range, but most players today want a Taskin, a Hensch or another fully-fashioned name, forgetting that they build their huge harpsichords fifty years later. So the research today should go in the direction of these End-of-the-17°-century little french harpsichords which fullfills so admirably the tonal needs of the composers of the early 18°century, up to 1740. It's only a pity nobody cares.

Marc CHAMPOLLION, STEGEN
I wonder if Mr Vojnić couldn't simply ask Michael Heale; as he is the maker of the copy of this little French harpsichord he surely has plans. Possibly he is Fomrhi member, but, as I haven't the list, I don't know. But I know Mr Heale and I'm sure he would like to help a fellow maker, especially one of Yugoslavia. His address is in the mentioned (Early Music, July 83, p. 368). The original is (or was) in the possession of Tony Bingham, London, who has offered it for sale about one year ago (§§3§8 $5edaaifer^karibyr-g). He would surely send photographs. It's a very little harpsichord indeed, ca 5' (152 cm), original compass GG/BB-c "", double curved bass side, black naturals. Doubtless an early French and one of the three known single manual French harpsichords of the 17th cent. The scale is fairly short, as reported to me by Denzil Wraight and it would be possible to string it in yellow copper (brass) like the Vater or the single Mietke. For more details ask Miles Hellon, I was told he restored it.
Whether it "could be the right instrument for" Mr Vojnić, as he states, (probably because it's so small) I don't know, but I expect the tone of the bottom octave to be very poor because the strings there have to be very short, even shorter as in a spinet of the same length. Perhaps the instrument was a transposing one, e.g. a fourth or a fifth higher than ca 390 (the "standard tuning" then) and was strung in iron. Although many French 17th century harpsichords were fairly short, this one is at least 1' (30 cm) shorter.

Marc CHAMPOLLION, GRUBENWIESE 8,  D 5900 SIEGEN, WEST GERMANY
Eph made the comment in his New Grove DOMI review in the last Q that 'This entry is very frustrating, suppressing all speculations that do not have very strong support. I prefer a speculation with some shred of support to silence.'

The reason that I was asked to write these entries, the one under this head and those under each instrument's name, was that the person who had written the equivalent article in the main New Grove (Grove 6) had done just what Eph asks for - he had speculated. His speculations had so annoyed some scholars that I was asked to write to new, non-speculative, articles. There has, in this area, been far too much speculation in the past, most of it quite unjustified, starting with the first translations of the original text, the Targumim, which are translations by various authors into Aramaic, the common tongue of that area, and the Septuagint, a translation by seventy scholars into the Greek spoken by the Jewish community in Egypt, and the Vulgate, a translation by St. Jerome into lateish Latin for the early Christian church, and followed by all later translations into more modern languages and into many commentaries, both written and pictorial (including sculptural). The point being that even by the time of the earliest of these translations, the precise identification of a number of instrument names was already guesswork; it was clear from the context that a musical instrument was under discussion, but nobody knew exactly what that instrument was. Therefore, they took the name of an instrument of their own time which might, they hoped, be somewhere close to that originally meant, and perhaps was not too far away in spelling. Hence the Authorised Version's sackbuts and cornetts for Nebuchadnezzar's orchestra (and for that matter, hence Nebuchadnezzar's name, which is only an approximation to the Aramaic in which that book was written). Even the original text suffers in the same way. One of Nebuchadnezzar's instruments is given as kaiithros, which we presume to be an Aramaic attempt at the Greek kithara; in other words, the chap who wrote down the book of Daniel was already so far away in time and place from when and where it happened that he didn't know what the instruments were.

The point which I tried to make in this DOMI entry is that there is very little solid evidence at all. I cited one instrument, the metal trumpets described in Numbers X, vv.3ff, as one which allows us, from its description in the original text, to work out what it was by logical deduction. I cited others, in the entries under their names, which can be deduced etymologically or in other ways. King David did not play the harp; kinnor was not a harp, and still less was it a violin; the modern meaning of that word in Hebrew today; however we do have some idea of what it was, and that I have provided in the appropriate entry. I did not hesitate to say 'we do not know' in other cases (something which often terrifies scholars - they are reluctant to admit ignorance - and even more often
terrifies editors - all praise to Stanley Sadie for allowing me to do so). In other entries I declined to speculate, and I believe that I was right to do so. I am sorry, Eph - quite simply we do not know what some of the instruments were, and we never will. Speculation is not merely useless, it is positively misleading. It is no business of DOMI to add to misinformation currently or anciently available, and only too often when one does speculate, even with strong warnings that one is only speculating, readers ignore all such warnings and take speculations as facts.

However, I owe all the readers of DOMI (and Stanley Sadie) an apology for one major omission. As you may know, I am Jewish and, with sheer stupidity and the slight excuse of some haste, I forgot that there is, as one might say, a Vol. II of the Bible: The New Testament. There is only one significant mention of musical instruments in that part of the Bible, St Paul's reference in I Corinthians 13, v.1 to γολκός Hχwv (forgive, please, the partial availability of a Greek face on this machine), in the Authorised Version the sounding brass. This is, in fact, almost certainly a reference to a gong (see my article 'What is a Gong' in MAN, 1965:5) and, as I pointed out in the Bate Collection Catalogue for last summer's Special Exhibition Instruments of the Bible, this is a deliberate reference back to the last two instruments of Psalm 150, the two (whether contrasted or not, or a double description of one instrument, we shall never know) pairs of cymbals. St Paul replaces the first pair of cymbals, loud cymbals in King James, betzilz'lé-shama in the original, with chalkos echon, resounding bronze in English probably more accurately than King James's brass, though it could be any copper alloy, keeping the other instrument the same as it is in the Septuagint (St Paul was also writing in Greek) text of that Psalm. So he was deliberately evoking his readers' memory of that Psalm.

I have been kicking myself ever since I remembered this one New Testament reference because this was a subject that I had wanted to come back to ever since I first wrote the article in MAN. There is a good deal of evidence for the use of gongs both in the biblical area and in ancient Greece and Rome, and one of these days I will come back to it. I am, of course, not the first to point this out; Jaap Kunst put me on the track and so did various others. So here is one reference that should have been in DOMI but isn't, and for that I apologise to Eph and to you all. For the other entries, I make no apologies. What I have said in DOMI is what we know, and for me that is the purpose of a Dictionary, to say what we know, not to perpetuate errors and unfounded guesswork. Read the Biblical Instrument entry for yourselves, and the entries to which it refers (cited at the end of that entry in capital letters) and see what you think.
On the Skill of the Nürnberg Brass Instrument Makers — A Tribute

When I wrote the catalogue entries for the instruments in the recent Hallelujah Handel exhibition at the National Portrait Gallery (see Comm. 670 for a review of the Catalogue), there were a few instruments which I had to describe without having seen them because they were not accessible. Among them were the two Leichamschneider horns (no.81), which had been sold from the Tredegar Collection at Christie’s in Switzerland in 1976 and which were lent to the Exhibition by the present owner, whose identity I still do not know.

After the exhibition closed, I was permitted by the kindness of Jacob Simon of the National Portrait Gallery, who had been responsible for arranging the exhibition, to have a look at these horns, and to blow them, and there are some details which are worth recording here.

Both are exactly in modern E (ie in twelve-foot F at A=415) and both play superbly, though one has a small hole in the tubing where a seam may have blown out, which has to be covered with a thumb; it is NOT a harmonic finger hole. From the written middle C upwards:

- 4th harmonic: exactly E (modern pitch)
- 5th harmonic: G sharp minus 14 cents (ie exactly in tune as a natural major third)
- 6th harmonic: B
- 7th harmonic: D minus 40 cents
- 8th harmonic: E
- 9th harmonic: F sharp
- 10th harmonic: G sharp (ie slightly sharp)
- 11th harmonic: A sharp minus 30 cents (ie also slightly sharp from the natural 11th harmonic)
- 12th harmonic: B

Any differences between the pair are more likely to be me than the instruments, and it is possible that the slightly sharp 10th and 11th harmonics were due to my mouthpiece; their own mouthpieces do not survive.

As is noted in the Catalogue, both are solid silver, though one can add that the bells are silver-gilt. What astonished me, and this is the reason for writing this Comm., is the way in which they were made. There is a lead-pipe 23.7cm long, and the rest of the instrument, some four metres of tubing, is in two conical joints, and only two. I have no equipment which will measure the internal diameter of such tubing, but the outside diameter of the narrow end of the first body tube is 8.35mm; the outside diameter of the wider end, some two metres away, is 10.28mm (stupidly I had not taken a long non-metallic tape with me, and therefore I have no linear measurements of these instruments). As far as a one could judge in the time
available, the cone is reasonably even; certainly there were no
sudden jumps in conicity nor in diameter. This implies the use
of a steel mandrel two or more metres long which is conical,
expanding from between 6 and 7mm to between 8 and 9mm over that
distance -- a knitting needle some six or seven feet long.

There was then a ferrule which covered the joint with the bell-
yard, which is 11.4mm in outside diameter, expanding to the
bell at 248mm, again over a length of some two metres. Again a
tour de force, though somewhat less so in view of the greater
diameter and the bell throat and flare.

This skill in manufacture, not only of the horns but of the
mandrels on which they must have been made, contrasts with the
normal English and French technique at this period of taking
fairly short lengths of cylindrical tubing, each of a slightly
larger diameter than the one before, and setting one into the
next, so producing a stepped cone with between four and six
cylindrical sections.

Of the early horns in the Bate Collection, the Carlin trompe de
chasse has a short lead-pipe, then a conical section expanding
from 7.4mm OD to 10.00mm, followed by five cylindrical
sections, each set into the next, followed by the conical bell
section. The two early English horns, the Bennett and the
Winkings, appear to be made in the same fashion, but since both
are leather covered it is not possible to count the cylindrical
sections. Certainly on none of the three are there any visible
ferrules covering joints; each is simply telescopic and
presumably soldered internally.

We have only one Nürnberg horn, a brass instrument marked
Johann Wilhelm Haas but presumed to be by Ernst Johann Conrad
Haas from the attitude of the hare, the common rebus for all
the instruments made by the Haas family. This is not in
original condition, for it now has a removable lead-pipe, a
straight shank which fits into a socket. The rest of the
tubing, however, is again in two and only two sections. The
first section is 2.68m long and expands from 7.9mm to 12.7mm
OD. The second section is 1.11m long and expands from 13.8mm
to the bell diameter of 230mm. The joint is covered by a
ferrule, as on the Leichamschneiders. Thus the method of
construction is very similar, though there is a considerable
difference in the quality.

The pitches, using the same mouthpiece as on the
Leichamschneiders, are as follows:

<table>
<thead>
<tr>
<th>Harmonic</th>
<th>Pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>E minus 10 cents (ie 12-foot F at 415)</td>
</tr>
<tr>
<td>5th</td>
<td>G sharp minus 10 cents (ie 14 cents sharp)</td>
</tr>
<tr>
<td>6th</td>
<td>B plus 10 cents (ie 18 cents sharp)</td>
</tr>
<tr>
<td>7th</td>
<td>D minus 15 cents (again sharp)</td>
</tr>
<tr>
<td>8th</td>
<td>E plus 40 cents (wildly sharp)</td>
</tr>
<tr>
<td>9th</td>
<td>F sharp plus 20 cents</td>
</tr>
<tr>
<td>10th</td>
<td>G sharp plus 10 cents</td>
</tr>
<tr>
<td>11th</td>
<td>A sharp minus 20 cents</td>
</tr>
<tr>
<td>12th</td>
<td>B plus 35 cents</td>
</tr>
</tbody>
</table>
These pitches were obtained by trying to keep the embouchure the same all the way; it would have been possible to lip all the notes into tune, but that was not the purpose of the exercise; the Leichamschneiders didn't need any pulling with the lip. The comparatively poor intonation is almost certainly due to the non-original lead-pipe, with perhaps some help from the various dents in the tubing. This instrument is in the same tradition as the Leichamschneiders and was made with similar skill. It is noteworthy that not until John Christopher Hofmaster (whom I presume to have started life as Johann Christoph) arrived in London, did the English instruments begin to show a comparable skill; one of our two Hofmasters is made in a single piece from the crook socket to the bell; the other has a short first section, followed by a single piece. The skill required is not so great, since the crook socket is of much wider diameter than the lead-pipe of the Nürnberg instruments, and the instruments are much shorter because of the use of crooks and couplers, but it does show a considerable advance over the older English tradition.

If anyone can produce measurements of other one-piece horns of similar date, I should be very interested to compare them with the figures given here, but on what I know at present, the Nürnberg makers seem to show skills undreamed of by all their contemporaries in other horn-making centres.

(The Pitches of Flutes)

Baroque musicians have embraced A415 as the standard pitch to play music of the eighteenth century. It is a semitone below the modern pitch of A440. If you are in the baroque camp, you will be aware of how hot under the collar we get in our rejection of modern pitch as being inappropriate. Looking at many hundreds of original flutes from the eighteenth century, it is apparent that very few of them played at A415. It is also apparent that the pitch started low in the early part of the century, and increased towards the 1800’s, ranging from about A388 to A435, approximately. I would agree that a pitch of about A412-A415 is a good characteristic pitch for flutes played around 1750, with a further complication that pitch varied also with region. These comments should be taken as being of a general nature, and reflect no scholarly background on my part. I will stand corrected, if necessary, by the much more detailed studies on the subject of pitch by Bruce Haynes and others.

I think that my flutemaking colleagues would agree with the following observations: a) Although traversos often had seven interchangeable middle joints to alter pitch by a total of about one semitone, it was almost always the case that no more than three of the joints worked well, the others having quite severe problems. b) These three joints were mostly in the middle of the seven, allowing us to guess at the working pitch of the instrument. c) A flute which plays at A400 when
fitted with a shorter middle joint to play at A415 will sound with a totally different sonority, and feel like a different flute.

So what is the point of saying all of this? It is this. I assert that if we wish to be faithful to the sonorities of eighteenth century music for flute, it will not work to play everything at A415. Yes, I know that it is a bother, and it means problems for the harpsichord tuning, etc. Yet if we are going to stick to A415, we should at least be willing to concede that, by choice, the important parameter of sonority is left unexplored. Remember, that unexplored difference might be at least as great as the difference between A415 and A440!

This is unabashedly a move to loosen up our attitude to pitch, mainly in the first half of the eighteenth century, since there is a growing willingness to play the classical period at pitches ranging between A425-A435 (with A430 being favored in Europe, and A425 on the East Coast of the US).

What might be the characteristics of a flute suitable for playing the J.S. Bach sonatas? These were written around 1717-1723. The French style three-piece flute, so rich in sound and appropriate for Couperin and Hotteterre, is not really nimble enough, nor does it cross-finger with strength. The lively GA Rottenburghs and CA Grenuers certainly can handle the music, but they came along later, in 1750 and 1760. It is when we look at certain transition flutes, the picture looks clearer. By transition I mean the very first four-piece flutes which might have appeared in the period 1715-1725. The unusually long headjoints and short middle joints of these transition flutes look out of scale, compared with later four-piece flutes. Bart Kuijken has pointed out that when an early four-piece flute, such as the Brussels IH Rottenburgh (No. 2001), is placed side by side with a French style three piece flute, such as an Hotteterre, it will be noticed that the scaling is very similar. Headjoints are about the same length, and the combined length of the middle and lower joints of the Rottenburgh are about the same length as the single middle joint of the French flute. It is as if the middle joint of three piece flute were simply cut into two, to make a four-piece instrument with the headjoint now looking long and out of proportion. These flutes are more nimble than the French flutes, have a good high register, full low register and cross finger with more strength. They are at about the same pitch as the French flutes, sometimes lower in fact.

Let me put forward a scenario for the evolution of these flutes for which there is no historical evidence, yet it could have happened. We know that Bressan was making three-piece flutes in London in the early 1700’s. We know that he made an unusual four-piece flute which may have been one of the earliest. It was not in any way like a sawn-up French flute. The length of each joint is in a nice balance with the whole. The bore of the flute is very wide, and unlike any other baroque flute (there are some intonation problems). This flute is covered with delicate inlaid silver wire in scroll patterns on the ebony body, and the sockets have heavy silver rings giving the flute a very beautiful look. It is probable that the flute was well known and talked about by musicians of the day. I have tested its sound, which remains very lovely. It is a possibility that some players who knew of this flute would have travelled home and asked local makers to make them a four-piece flute, since it was a new design coming into fashion.

A maker with good designs worked out for a three-piece French flute might simply keep the same acoustical design, but divide the flute into four joints to satisfy a player wanting to have the new look flute. This could have accounted for many of the early four-piece flutes have headjoints as long as the French flutes, until new acoustical patterns were worked out. The nimble action and stronger cross-fingerings could have been worked out still keeping the same linear scaling.

We have a late eighteenth century viewpoint from Tromlitz who writes that the three piece flute was changed to a four-piece design so that the shorter middle-joints could be re-reamed. Tromlitz did not have much good to say of his contemporary flutemakers. It seemed that the flutes they made warped quite often, and had to be re-reamed. Tromlitz pointed out correctly that the long middle joint of the French flute could not be accurately re-reamed if it had warped into a bend. He felt that the change to the shorter joints of the four piece flute was made so that the joints could be more successly re-reamed. This makes some sense, what do you think?
Building and Playing a Narh
at the Freies Musikzentrum in Munich

I spent a fascinating weekend recently at the Freies Musikzentrum in Munich (Ismaninger Str. 29.) This organization aims to specialise in areas of music not generally catered for by the more traditional musical establishments. Their activities include concerts, a wide range of music lessons, and courses on musical instrument construction in their own workshop.

Their latest prospectus includes 16 courses involving the building of musical instruments ranging from quite ambitious projects such as building clavicords and harps to less demanding projects like the one I took part in.

I attended a beginners course on the construction and playing of a Narh. This is an end-blown flute also known by a variety of other names according to its origin including Ney or Nay in Persia and Woissa in North Africa. The flute in its various forms has been used by the Sufi and Dervish sects since the 11th century, and is thought to have been played in ancient Egypt. It is still used extensively throughout the Islamic world.

The course, attended by ten people, was run by Dieter Trüstedt, a physicist with a special interest in music. He has made a detailed study of this type of flute including research in the musical instrument collection of the Munich Stadtmuseum which has a number of these instruments.

The course began with a brief explanation and demonstration of how to obtain a sound by blowing against the rim of a tube open at both ends. Lengths of water pipe, as well as an assortment of finished flutes (copies of instruments in the Stadtmuseum) were provided. The position in which the flute is held can be seen in figures 1 and 2. One end of the tube is placed against the mouth so that it hangs slightly away from the body and at an angle of about 30 degrees to the side. With the end pressed against the lips on one side of the mouth and the lips cusped almost in a whistling or kissing position the player breathes very gently on to the opposite edge of the tube. One side of the tube must be kept closed by the edge of the lips and the other side approximately crosses the centre of the opening between the lips. The inside of the mouth must be made open and round and the air-stream very gentle. It is said that this type of flute should not so much be "blown" but that the player "awakens the sound that lies deep in the flute itself."

Within a few minutes most people had achieved some degree of success in obtaining a sound and were encouraged to experiment, see how gently one can blow, still maintaining the sound and how low a note one can obtain and the effect of changing the shape of the inside of the mouth. The fundamental frequency can be quite difficult to produce. Dieter demonstrated the playing of a finished instrument very competently. He also demonstrated a different blowing technique from Persia, in which the tube is held vertically and one side of the open end is rested between the top two front teeth. A windway is formed between the players tongue, which is laid on the front edge of the tube, and the roof of the player's mouth. Using the Persian technique the fundamental frequency is much stronger although accompanied by a strong rushing noise which is controllable by the player and is used as part of the musical effect. With the Persian blowing technique however the overtones are not so easily produced.
It was then time to start work to produce our own instruments. The traditional instrument is generally made of reed (Ney in Persian). We however used the dried stem of a weed that grows prolifically on waste land in Bavaria (Polygonum Cuspidatum or Japanese knotgrass, I think). I have also seen it in England. The stem used were about 10-25 mm in diameter and 75 cm long. The first job was to burn out the divisions between the hollow sections of the stem. For this we used a simple tool consisting of a long shaft (4mm threaded bar) with a tip of 9mm brass tapering to a point. We heated the tip to redness in a blow lamp. The next job was to shape the sound-producing edge at one end of the tube. Figure 3 shows the finished edge in section. This was done by alternate charring and filing, as the uncharred material was too soft to file properly. When the edge was right, it was possible to blow the fundamental tone on the flute plus a series of harmonics up to about the 6th.

We then took a break from our flute construction to practice the blowing technique and to listen to some recordings: Flutes du Rajasthan from Le Chant du Mond LDX 74645; Musik der Hamar from South Ethiopia, Museum Collection Berlin MC6; Music of the Mevlevi, Unesco Collection BM 30 L 2019; Flutes & Trumpets, Tangent TGS 134; Meditation on the Ney, Kudsi Erguner, Philips 6586 039; and Turquie Musique Soufi, Nezih Uzel and Kudsi Erguner, Ocora MV 218 Y 558 522. A striking characteristic of this flute is the very wide range of sound that can be produced on the instrument, from a clear tone to a very windy sound.

The agenda for the second day started with the cutting of the tone holes and the tuning of the instrument. Figure 4 gives the measurements. Our instruments had only four tone holes, although the traditional instruments often have more. The number of tone holes apparently depends on the origin and age of the instrument. We cut the holes by pushing the hot tip of the tapered burning tool into the side of the flute. When the tip had penetrated the tool was moved in a circle at an angle of about 45 degrees so as to undercut the hole slightly. The holes were cut small at first, and gradually increased in size to obtain the desired tuning, working from the bottom of the flute upwards. This was essentially a trial-and-error process. The bottom end of the flute was trimmed to give a bottom note "G-sharp".

The tone holes were cut to enable a pentatonic scale corresponding to a section of a harmonic series normalised to lie within one octave. Figure 5 is a fingering table giving the frequency ratios. This tuning is believed to be generally in line with the historic instruments. The scale enables one to obtain the interval of a natural fifth between any pair of notes that are separated by two others. Also available are two intervals of a fourth and one whole tone. As the tuning is based on harmonics both the "B" and the "F-sharp" are approximately a third of a semitone lower than in the well-tempered scale. Once the instruments were finished we practiced the playing technique again including of course fingering, now that we had tone holes. We also tried maintaining a vocal drone and various percussion effects with the fingers. We also attempted improvisation to the accompaniment of a recording of an aeolean harp. (recorded & published by Dieter Trüstedt).

The weekend was enjoyable as well as educational and illustrated above all the tremendous scope available using simple materials.

It occurs to me that something on these lines may make an interesting and worthwhile project for school children combining early music, science and handicraft.
In my project of researching on Italian woodwind makers, I have spent lots of efforts on a Venetian master, because of the quality and originality of his work. Result of this work will be a biographic and technical article on Fornari to be published in "Il Musico Italiano" at the end of this year.

One of the most peculiar characteristics of Fornari is his specialization in oboes and english horns (I am aware of respectively 17 and 21 of them, against only one piccolo, one clarinet, one bass-clarinet and one fagottino). This might sound quite normal today, but it was not in the 18th Century. Fornari distinguished himself also for several original ideas and solutions which he applied on his earlier instruments; curious to notice that this originality would slowly diminish, and that actually the latest of Fornari's instruments are the most "ordinary". Being many of his instruments non-dated, this development between them helps to date the few which are not.

The most original of his oboes known to me, is the one mentioned by Jeremy Fontagu in 1757 in Venice, Fondazione Querini Stampalia n.400-2, dated 1791.

First evident peculiarity is the keywork: 3 keys in ivory, of which an usual Eb, a low C to be used by the left little finger, and a low C# between them, for the right one. A logical solution, to avoid troubles to the player who needs to pass quickly from Eb to C (and other passages). Other oboes by Fornari (Leipzig, 2 in Venice FQS) and english horns (Venice FQS) adopt a long key for the (fingered)C, for the left little finger. No other one has a C# as this. Fornari apparently did not use this solution after 1793, possibly because of the trouble given to the player for a new (and innatural) technique.

The original shape of the key is the typical mentioned by Phillip Young in his "2000".

Typical of Fornari, to be seen in this oboe, is also the unusual vase-shaped upper joint; only other maker who adopted it seems to have been J.M. Anciuti (see ob. in Victoria and Albert Museum, London). Charming is the very fine use of the combination dark-african wood (rosewood ?), ivory and horn (see drawing).

This oboe is the lowest-pitched of all Fornari to my knowledge. Rather than talking in pitch terms, so subjective from player to player, I will mention here the overall lengths, which are 574/567/560, depending on the 3 different upper joints. Most of Fornari oboes are long between 550 and 560 mm, excepted the two in the FQS, and that in Boston (565mm).

Some notes on the other woodwinds in the Fondazione Querini Stampalia: the boxwood oboe by Fornari n.400-3, appears to be a "cheap" brother of the above mentioned one: no corps de recharge, no african wood, no ivory and horn rings, no C# key, no date! (perhaps for second oboist?). Overall length 568mm. The Fornari english horn seems to belong to the same set of instruments. It is one of the earliest dated instruments by the Venetian maker: 1791. I am sorry not to have measurements of it, nor of the Jeremias Schlegel flute, excepted its oval mouthhole (9.55 - 8.0mm). Notice that this flute has a Fornari-shaped ivory key: probably a restoration or an adaptation by the Venetian maker, to make it belong to the set of winds (he did not make flutes himself, excepted a piccolo in München: excess of too short boxwood pieces...).
Fornari Oboe
Venice 1793

Fondazione Querini Stampalia, Venice, n.400-2

3 upper joints

Overall length: 574/567/560

- Vase-shaped upper joint

- Dark wood (rose?)
- Horn
- Ivory
- Brass

E♭ key for left little finger (open)

C# Key for right little finger (closed)