

# FOMRHI Quarterly

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## FELLOWSHIP OF MAKERS AND RESEARCHERS OF HISTORICAL INSTRUMENTS

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FELLOWSHIP of MAKERS and RESEARCHERS of HISTORICAL INSTRUMENTS

Bulletin 49

October, 1987

Sorry, we're later than I'd hoped to be; overwhelmed with beginning of term work, setting up this term's Special Exhibition (*Shawms of East & West* - 4 page on one sheet catalogue, listing 36 shawms in some detail, available at 20p + postage) and so forth.

**SUBSCRIPTIONS:** Yet again it's time to renew and you'll find an INVOICE tucked in this Q. I head it INVOICE because some of you can hand it to your bank or to someone else who'll pay it for you; if you are one of those do please remember to hand it in (some of you who pay this way tend to be later than other people!). As I warned when I printed the Accounts last time, we have again had to put the rates up, and I do apologise for this miscalculation; we should not have had to increase the rates two years in succession, and it's probably my fault that we did not go up by enough last year. The new rates are:

Basic Subscription for UK and surface mail to anywhere £ 8.50

Supplement for AIRMAIL to EUROPE: £1.50, making a total of £10.00

Supplement for AIRMAIL OVERSEAS: £3.00, making a total of £11.50

Supplement for non-sterling cheques: £3.00 (about \$5.00 US); this was a very nasty shock to us as it will be to you; the bank and the GIRO whacked up their charges without giving us any warning. It's still not as bad as the charges American banks levy on foreign checks but it's bad enough. Please do remember to add this Supplement if you are sending your own check; otherwise you'll only have paid for just over half the year.

Please note, too, that we have a new Honorary Treasurer, Barbara Stanley (her address is 21 Broad Street, Clifton, Beds SG17 5RJ, UK), to whom your cheques, made out to FoMRHI or The Fellowship... in full, should be sent. Our GIRO Account number (we hope; they don't seem good at answering letters) is still the same: 27 316 4406. Again I'd ask you not to send your subscription by registered mail unless it's absolutely necessary; if you're worried about a cheque miscarrying, writing *A/C Payee Only* across it means that it can only go into the FoMRHI account (David Van Edwards suggested after last year that I tell you this).

Finally, if you can afford to add on a bit extra for those of our members who are not permitted to send money abroad, they and we will be grateful as always; FoMRHI is read avidly in those countries where foreign communication is difficult. Remember, too, that I'm always interested to hear of more people in any such countries, anywhere in the world, who would like to be helped in this way.

Before we leave this subject of subscriptions, I'd like to thank Maggie Lyndon-Jones for all the work that she did. She didn't stop being Treasurer because she got tired of it, but only because there was a new Lyndon-Jones to look after (on which we felicitate her and Graham).

**POSTAL PROBLEMS:** As has happened before, the Post Office has cheated us. Djilda has taken in a bundle of Qs marked for Airmail, paid the appropriate rate, and the Post Office has blandly stamped them '2' and sent them surface. We only found out because Cary Karp sent me back his envelope, with the date of receipt (18 days from Manchester to Stockholm). Because we only have that one bit of evidence, we can't get a refund (and thus can't give any of you credit for next year), and can't even get much of an apolo-

gy out of them. So Djilda has decided to give up the bulk postage method, for the airmail Qs (she can still use it for UK and surface mail) and she'll pay one of the girls who works part time for her a pound or so to stick ordinary stamps to the airmail rate on to the envelopes. This may give us a better chance. But would those of you who pay for airmail please help? Look at the postmark (if it's legible) on the envelope, and if it's taken more than three or four days (depending, of course, on the speed of your own postal services, which you should have an idea of), write the date of receipt on it and let me have it back; I only need the front of it, to save weight. Then if there are any problems, we have a bit more chance of doing something about it, because we have the evidence to show them.

**FURTHER TO: Comm.806:** Tony Baines points out that I was wrong in referring to the large Fornari instrument in *Il Flauto Dolce* as a baritone oboe.

*"As correctly stated in that article (p.34) 'from the fagottino is the extension of the lower register by keys for the left thumb'. The instrument is an extended cor anglais going down to written g (sounding c), though more in basset horn fashion. On the lower part of the instrument, three closed keys give (written) e<sup>b</sup>, c<sup>#</sup> and b<sup>b</sup>. The five open keys give when closed c', b, a, g<sup>#</sup> and g (this through the bell). I know of no other instrument of this description. You might call it a 'basset oboe'."*

**Comm.825:** Bruce Phillips says that it might be useful to mention that the book on *Guitars* by Tom and Mary Anne Evans is published in paperback by OUP at £15.00.

**PLANS IN THIS Q:** There are some miniature plans herewith, one from Bert van Leeuwen of a traverso by Milhouse, which you can order from him. Others are from Leningrad: part of the plan of the Hotteterre traverso and part of the plan of the Naust traverso, both by Felix Raudonikas, and a greater reduction (because it's on two sheets which I only put roughly together) of a plan of the Hotteterre by Alexander Batoff. These Leningrad plans, plus one also by Felix of the Poerschman traverso are available from me at £10 each (cheques made out to FOMRHI, please). What you will get for each £10 is:

**HOTTETERRE** by Batoff: 2 A3 sheets which overlap each other a bit (and I'll ink in some of the figures so they show better);

**HOTTETERRE** by Raudonikas: An A3 sheet of what you see here, plus an A4 sheet of the foot joint at the same scale, plus an A4 sheet of the head at a smaller scale, plus a sheet of bore measurements and frequencies;

**NAUST** by Raudonikas: An A3 sheet of what you see here, plus an A4 sheet of bore measurements and frequencies which includes a reconstruction of the bore measurements of the missing foot joint;

**POERSCHMAN** by Raudonikas: An A3 sheet (with the dimensions inked in by me; they're in light pencil on the plan) plus an A4 sheet of bore measurements and frequencies.

Both Felix and Sacha gave me the plans to benefit FOMRHI funds, and I hope that there is more to come from Felix; he sent some by a friend and pupil that haven't reached me yet. If sales are reasonable, I'll stop asking you for extra money for members who can't send money, and we'll look even more actively for more such members, using this money for that.

**BOSTON CHECKLIST:** Sam Quigley has sent me a Checklist of all the accessions at the Boston Fine Arts Museum since 1972, which you'll also find

here. He has sent me, too, a copy of their 1983 published *Checklist of Instruments on Exhibition*, which I imagine is available from the museum. It answers one of my queries: the Chinese instruments, which A.C.Moule illustrated from the Galpin Collection in 1908 did go to Boston with the rest of the Galpin Collection; it was all ignored by Bessaraboff in his otherwise beautiful catalogue of it.

ANOTHER COMM HEREWITH is one of mine on pitch. I sent draft copies to a few friends, and some of their responses will be found here also. To which I'd add one from Laurence Picken: *Aren't there any practical hints for tuners in any of the Baroque manuals or handbooks?* Further comments would be welcome; I couldn't send copies to all of you who are interested.

**MOSCOW & LENINGRAD:** The Galpin Society trip was, in part, very successful. 'In part' because Intourist, despite considerable correspondence from Pauline Holden, who'd done a superb job of organisation, quite obviously didn't believe that anybody could be mad enough to come to the USSR just to look at musical instruments, with the result that we only got into the Glinka Museum in Moscow on our last day there, and didn't see much there. We bullied them harder in Leningrad and were welcomed in that museum with open arms, in total contrast with the rather unwelcoming attitude of the Glinka. Not only open arms, but open cases, open drawers and open cupboards. Everything we wanted to see was brought out to be blown, hit, measured, and so forth. There will be a full report in the Galpin Journal (I'm still trying to find time to transcribe my notes, which are on tape) and I imagine a number of articles on various details in various periodicals. We have acquired two new FoMRHI members there: Volodya Koscheleff, who is the Curator of the Leningrad Museum; he is a bassoon maker and primarily a German speaker other than Russian. He does read English, but if you are writing for information and can write German, it'll help. The other is Sacha Batoff, who speaks good English. He is the assistant and the technician (I hope he may be coming over here before too long to study our museums). He is a lute maker and would be very glad of contact with other lute makers. Somebody made him a member for one year of the American Lute Society; he would very much like this to continue, and he would also like to be a member of the Lute Society here. I wonder whether any of our members would be willing to adopt him and pay a subscription for him? His name and address are in the Members List Supplement herewith.

**MATERIALS AND TOOLS AVAILABLE:** Jon Swayne writes:

An alternative to Vigopas, the ivory substitute, has come to my attention. It is available from GPS Agencies, tel. 01.373.3249. Ask for Mr. Stevens. The material is cast polyester with added pigments. It is claimed to be superior to Vigopas both in appearance and workability. It is manufactured in a range of standard diameters starting at 25mm, but non-standard sizes can be made to special order. Ivory can be ordered either 'plain' or 'figured'. Other colours are available, as well as various simulated horns. The material is claimed to be non-toxic. Prices are currently about £7 per kilo.

Alec Loretto writes:

It is now possible to buy an efficient RECORDER WINDWAY CUTTER at a reasonable price! This easy to use, precision made hand operated machine gives complete control over cutting recorder windways.

It will control accurately all the many variables in windway construction - the length and longitudinal curvature of the under labium; the lateral and longitudinal curvature of the windway roof; the size of the step; the width of the windway; the taper of the windway, etc.

Send US \$25-00 or equivalent currency (to The Loretto Workshop, Box 67-114, Mount Eden, Auckland 3, New Zealand) to receive by airmail a sample recorder head with the windway cut entirely by this machine, and a descriptive pamphlet giving details.

**OFFERS:** TOOLMAIL (GMC) LTD of 170 High Street, Lewes, East Sussex BN7 1YE have sent me a copy of their new 160 page catalogue saying *Although being sold for £2.45 through most major newsagents in the UK, it is available free of charge to your members upon request. Provided that they clearly indicate that they are members of your Association, we will be pleased to despatch a catalogue to them at the earliest possible opportunity.* They don't say whether this offer is confined to the UK or not.

The GUILD OF MASTER CRAFTSMEN of all-but the same address (the difference is 166 instead of 170) have issued a new *Guide to Restoration Experts*. They say *Members of your organisation may obtain entry forms for future editions from the address above. They may also obtain a copy of the Guidebook at the reduced price of £5.10 - a saving of 40% on the published price of £9.50.*

**CONSERVATION:** The Museums & Galleries Commission has set up a Conservation Unit. They are wondering whether to assist with some cash musical instrument conservation training in this country. One problem has been suggesting where anyone might train in this subject (as distinct from restoration or making) in this country. I'll be happy to pass on any suggestions. They are also building up a register of conservators and restorers; if you were on the old Crafts Council register, they should have you, but if not you can write to them at 7 St.James's Square, London SW1Y 4JU.

They are reprinting the three Crafts Council books on Science for Conservators: *An Introduction to Materials; Cleaning; Adhesives and Coatings*. They cost £6.95 each (£7.75 with p&p inland, plus another £1.00 for abroad) or £19.50 the set (£21.50 with p&p but still only plus £1 abroad). The books are very good, clearly written and authoritative.

**COURSES:** As you should know, we have a Baroque and Classical Oboe Weekend here on November 7th and 8th, with Dick Earle, Paul Goodwin, and Lorraine Wood. We too have had to put up our prices, and they are now £20 for the Weekend, £10 for either day, and £15 for the Weekend for students. We shall have a Tuning and Temperament Weekend next May, with Lewis Jones and his archicembalo and Patrick Newsom and Peter Bavington. Unfortunately I've made a mess-up over the dates, and unless I can get hold of Lewis between now and when I finish this, I can't be more precise on date. I've also made rather a hash of things for next term, and there's nothing fixed. If enough of you write and say you'd be interested in an Early Percussion Weekend, I'll run one myself in, say, February; if you are interested, please let me know as soon as possible so I can publicise it before the end of the year.

**EXHIBITIONS:** By the time you get this, I'm likely to have seen a good many of you at the Horticultural Hall.

Marco Tiella writes that there will be the 5th INTERNATIONAL TRIENNIAL EXHIBITION OF STRINGED INSTRUMENTS in Cremona from 1st to 9th October 1988, in association with the Antonio Stradivarius International Violin-Making

Competition. If you're interested, write to Marco at Via Gioconda 3, 26100 Cremona, Italy.

**THE BAGPIPE SOCIETY:** Jon Swayne, who is their President, has sent me details of who does what and their subscription rates (I've reviewed several issues of their journal *Chanter* here). Basic subscription is £7, plus £2 'joining fee' (£9 family membership, £12 Institutional membership, plus £2 surface mail abroad or £5 airmail) and the Secretary is David VanDoorn, 49 Osborne Road, Hornchurch, Essex RM11 1EX.

**DEADLINE FOR NEXT Q:** I'd like to say January 1st, but it may be more realistic to say the 4th, since there isn't likely to be much post delivered here between Christmas and that date. You might like to bear in mind that it'll be our 50th Q (that's a daunting thought) and produce something special for it.

Do please get your renewals in before then if you possibly can. The more they spread out between when you get this and the beginning of January, the easier it is for Barbara, Djilda and me to cope with all the work involved, so early renewal is a great help to us. Those of you who don't renew till after the January Q has been posted cost us (and you) money - every reminder we send out costs us printing, an envelope, and postage; each one equals the cost of several pages in the Q, and this is one of the reasons we have to put the rates up, so do please try to get your renewal in before the end of the first week in January at the latest; that's when we decide how many reminders to print.

Have a good autumn and Merry Christmas.

Jeremy Montagu  
Hon. Sec. FoMRHI

## BULLETIN SUPPLEMENT

E. Segerman

I received a letter from Jacques Blockx of S.P.R.L. J. Blockx Fils, B 5291 Terwagne, Belgique, a firm that makes artists colours. Most of it follows:

Our company has the secret of dissolving natural Amber according to the formulation of the past, and as far as we know, we are presently the only ones having this know-how over the world.

We use dissolved Amber for the production of varnish and painting solution, but we know that Amber is also a perfect material for varnishing musical stringinstruments.

Mrs. Awauters, from the Museum of Musical Instruments in Brussels, to whom we showed our Amber varnish, confirmed that it has been used very successfully in the past, and that there should still be a great interest today for this traditional product, among most of the instrument makers; but she recommended us to ask for the advice of a competent authority and kindly gave us your name.

A glass vial sample of his Amber varnish was enclosed for evaluation, but it was broken on receipt, with the contents flowed out and dried. It has an attractive golden brown colour of not great intensity. We may have our doubts about the exclusivity of his know-how, or of Mrs Awauters's certainty about the historical use of Amber varnish, but the varnish may still be of interest to readers who might like to try it.

As I said in the Bulletin, time has been difficult. Reviews of some of these will follow next time, but meanwhile you'll at least know what is available.

**Berlin Musikinstrumenten Museum:**

*museum*, published in association with Westermann's at 10,-DM. A glossy pocket size handbook with many excellent photographs of their most famous instruments, some of them showing their extensive new galleries in the Tiergartenstraße.

*Magie der Flöte*, a handbook, again well illustrated, accompanying their 1986 special exhibition to celebrate the bicentenary of the death of Frederick the Great. No price stated.

*Sophie Charlotte und die Musik in Lietzenburg*. Another special exhibition handbook, for the 1987 celebrations of the 750th anniversary of Berlin. Includes detailed notes on the Marius *clavecin brisé* and a treble viol among other instruments.

*Tasteninstrumente des Museums*, 1981. A handbook, rather than a catalogue, with articles on harpsichords etc by Dieter Krickeberg, and clavichords and pianos by Gesine Haase. Lots of colour photos. Stiff bound

*Handwerk im Dienste der Musik - 300 Jahre Berliner Musikinstrumentenbau*, 1987. Articles by Martin Elste (violins etc, clocks with little organs, gramophone records) and Gesine Haase (wind instruments, piano) and again well illustrated.

*Wege zur Musik*. Celebrating the opening of the new museum in Tiergartenstraße in 1984. A little on the instruments, but mostly a history of the museum and its various homes.

**Edinburgh University Collection of Historic Musical Instruments: Guide to the Collection**, 75p + 25p postage. A short history of instruments as seen in the Collection, written case by case for visitors to have in their hands as they go round. A well-designed cover is a mosaic of photos of instruments in the Collection.

**Luis Artur Esteves Pereira**, *Tratado 2º de Geometrica Practica (Manuscrito nº 194 da Biblioteca Geral da Universidade de Coimbra)*. Fundação Calouste Gulbenkian, 1984. Transcription, with notes and commentary in the back, of a late 18th century text on organ building. In Portuguese. If any of our organ-builder members reads Portuguese and would like to borrow it (Luis has inscribed it to me) to review it, let me know.

**Ringve Museum**, *Ieve langedleiken!*, 1987. An interesting booklet on the langedleik (a long box cithar), its makers and players. With, too, a fair amount of information on other plucked cithars with a melody course.

**Cassa di Risparmio, Verona**, *La Bottega del Suono*. Handbook to accompany an exhibition earlier this year of wind instruments. Articles by Marco Tiella and others. Lots of nice pictures.

**Harpichord and Fortepiano Magazine, October 1987.** (see bull.48, p.5). An interview with Melvin Tan, an article on Americus Backers, and an up-to-date checklist of the Russell Collection in Edinburgh, which has grown considerably since they published their catalogue in 1968, are probably the most important articles.

Two major books:

**Herbert Heyde, *Das Ventilblasinstrument*, Deutscher Verlag für Musik, Leipzig, 1987.** Tremendous detail, as you'd expect from Herbert Heyde, on all types of brass valves and instruments. Essential reading for anyone concerned with that subject.

**Kunitachi College of Music Research Institute, *The Collection of Musical Instruments*, 1986.** With a small photograph (many about 35mm contact size) of every instrument in the collection.

As I said above, reviews of some of these will follow next time, as will the usual New Grove DoMI.

Museum of Fine Arts, Boston  
Collection of Musical Instruments  
Acquisitions from 1972-1987

- 1972.852 square piano, John Tallman, New York, NY, about 1835.  
 1972.854 grand piano, Chickering, Boston, MA, about 1890.  
 1972.1173 alto recorder (reproduction), Friedrich von Huene, Boston, MA, 1972.  
 1972.1175 violin, Walter Solon Goss, Boston, MA, 1908.  
 1972.1176 violoncello, Herbert F. Conant, Taunton, MA, 1901.  
 1973.157 clarinet in C, 5 keys, Klemm, Philadelphia, PA, about 1825.  
 1973.734 upright piano, G. Weidig, Jena, Germany, about 1900.  
 1974.30 violin bow, Forster, England, 18th century.  
 1974.31 double bass bow, England, 18th century.  
 1974.56 buccin, Italian or French, 19th century.  
 1974.57 harp, Jean-Henri Naderman, Paris, 1788.  
 1975.27 shawm, Tibet, 20th century.  
 1975.28 clarinet in C, 6 keys, Klemm, Philadelphia, PA, about 1825-35.  
 1975.318 bagana, Ethiopia, about 1925.  
 1975.319 cunbus, Zeynel Abidin, Istanbul, Turkey, about 1930.  
 1975.320 sehtar, Persia, 1850-1880.  
 1975.325 Music Tutor for the Violin by Francesco Geminiani, published by Smart, London, about 1792.  
 1975.345 piccolo in D, 6 keys, Germany, about 1860-1880.  
 1975.346 flute in C, 13 keys, Germany, about 1860-1880.  
 1975.348 clarinet in C, 6 keys, Herman Wrede, London, about 1813-1820.  
 1975.367 flute in C, 4 keys, John Ashton, Boston, MA, about 1830.  
 1975.368 fife in B-flat, Klemm, Philadelphia, PA, about 1820.  
 1975.391 semi-toned accordion, United States or England, about 1860.  
 1975.392 cornet in B-flat, Gilmore, Graves & Co., Boston, MA, 1864 or 1865.  
 1975.393 cornet mouthpiece, Gilmore, Graves & Co., Boston, MA.  
 1976.132 chamber pipe organ, Hilborne L. Roosevelt, New York, NY, about 1880.  
 1976.136 The Flute Preceptor by Muzio Clementi, music book for flute, partially in manuscript, partially engraved, compiled by Briard of Portsmouth, NH, and bound Nov. 19, 1821.  
 1976.137 violin, United States, about 1800.  
 1976.147 American bass viol, Benjamin Crehore, Dorchester, MA, 1788.  
 1976.156 American bass viol, Benjamin Crehore, Milton, MA, about 1785.  
 1976.745 orchesterhorn, Charles Kretzschmann, Strasbourg, about 1830.  
 1976.767 cymbal, Zildjian Co., Norwell, MA, 1976.  
 1976.768 sarinda, Nepal, about 1975.  
 1976.845 fife in D-sharp, Jonathon A. Landell, Boston, MA, 1976.  
 1977.8 flute in C, Meacham and Co., Albany, NY, about 1820.  
 1977.9 hurdy-gurdy, northern Maine or French Canada, early 19th century.

**The Edwin M. Ripin Collection (#'s 1977.54 to 1977.599)**

- 1977.54 double manual harpsichord, Pieter Jan? Couchet, Antwerp, 1680, with enlargement and keyboards by François Etienne Blanchet, Paris, 1758, and genouillères added by Pascal Taskin, Paris, 1781.  
 1977.55 double manual harpsichord, France, 1667, enlarged by Colless, Lyon, 1739.  
 1977.56 single manual harpsichord, Jacob Kirkman, London, 1758, with piano attachment by John Joseph Merlin, London, 1779.  
 1977.57 double manual harpsichord, Shudi and Broadwood, London, 1772.  
 1977.58 spinet, England, 1770.  
 1977.59 double manual harpsichord, William Hyman, Hoboken, NJ, 1969.  
 1977.60 clavichord, Johann Christoff Georg Schiedmayer, Neustadt, Germany, 1796.  
 1977.61 chekker (reconstruction), Edwin M. Ripin, Forest Hills, NY, 1974.  
 1977.62 square piano, Vienna, about 1780.

- 1977.63 grand piano, Johann Andreas Stein, Augsburg, 1783.  
 1977.64 violin, Augustin Chappuy, Paris, France, 1778.  
 1977.65 tenor violin, United States, late 18th century.  
 1977.66 hurdy gurdy, France, second half 18th century.  
 1977.67 flute in C, 1 key, John A. and William Geib, New York, NY, about 1820.  
 1977.68 flute in C, 2 keys, England, about 1800.  
 1977.69 clarinet in C, 5 keys, Harley Hosford, Albany, NY, 1813.  
 1977.70 double flageolet in C, 7 keys, William Bainbridge, London, about 1805.  
 1977.71 oboe in C, 2 keys, Astor & Co., London, about 1800.  
 1977.72 post horn, Longman & Broderip, London, 1780.  
 1977.73 natural trumpet, Willy Hopf & Co., Taunus, Germany, late 19th century.  
 1977.74 natural horn, England, early 19th century.  
 1977.75 natural horn, Gautrot Brevetè, Paris, after 1889.  
 1977.76 tuning hammer, Europe, 18th century.  
 1977.77 side-blown horn, Pokot Tribe, Kenya, about 1970.  
 1977.78 häverlur, Mora, Sweden, 1971.  
 1977.79 trumpet mouthpiece.  
 1977.80 clarinet mouthpiece.  
 1977.81 mishwuz, Egypt, about 1965.  
 1977.82 chalumeau in F (reproduction), Cary Karp?, United States, about 1970.  
 1977.83 viola da gamba, division size, German, about 1960.  
 1977.84 "Ariette, e Canozonette per Piano Forte," Celestine Bartolini, copied in 19th century Naples.  
 1977.85 selected manuscripts from Handel, copied by Smith and others, London, about 1717; after 1729; 1730-32; after 1765.  
 1977.86 "Sonate da Cimbalo," Galuppi, Pescetti, Iozzi, Francesco Alberti and Casali, unknown copiest.  
 1977.87 essay on musical expression, Avison, printed for C. Davis, London, 1753.  
 1977.88 "God Save the King Variations," J. C. Bach, printed for G. Shade, London.  
 1977.89 Musique Mathématique, by Euler, Paris, 1865.  
 1977.90 42 Suits of Lessons For The Harpsichord, Vol. I by Domenico Scarlatti, printed for Johnson, London, 1748.  
 1977.91 A Musical Dictionary... by Grassineau, printed for Wilcox, London, 1740.  
 1977.92 "Harmonica," Encyclopedia Britannica, first edition, 1796.  
 1977.93 "Music," Encyclopedia Britannica, fourth edition, 1810.  
 1977.94 Die Lehre von den Tonempfindungen als Physiologische Grundlage für die Theorie der Musik, fifth edition by Helmholtz, Braunschweig, Germany, 1896.  
 1977.95 L'Arrivée du Piano Forte a Mr. Le Comte D'Affry..., Oeuvre II by Albanese, Paris, 1771.  
 1977.96a&b La Scuola Della Musica, 2 volumes by Gervasoni, Piacenza, Italy, 1800.  
 1977.97 Music Made Easy To Every Capacity..., Ayre & Moore, London, 1778.  
 1977.98 Neue Bibliothek der Schönen Wissenschaften und der Freien Künste, XIII Bd, Leipzig, 1772.  
 1977.99 The New Musical and Vocal Cabinet by Kelly, London, 1820.  
 1977.100 "Principj di Musica," Panerai, Florence.  
 1977.101 "Pianos, Harpes, et. orgues" by Erard et Cie, Les Grandes Usines, Revue Periodique, Juin 1887.  
 1977.102 Historische-Technische Beschreibung der Musicalischen Instrumente by Schneider, Leipzig, 1834.  
 1977.103 Harmonics, or the Philosophy of Musical Sounds, second edition by Smith, for T. & J. Merrill, London, 1759.  
 1977.104 A Musical Grammar and Dictionary by Tans'or, Stokesley, England, 1819.  
 1977.105 Traite des Languettes Imperiales Pour La Perfection du Clavecin by Rousseliere, Paris, 1679.  
 1977.162 grand piano, Joachim Ehlers, Vienna, about 1810.  
 1977.599 cornetto curvo (reconstruction), James Crossman, New York, NY, about 1967

- 1977.808 violoncello, attributed to Domenic Busan, Venice, 1776.  
 1977.809 bow, Knopf, New York, NY, 1900.  
 1977.814 masengo, Ethiopia, 20th century.  
 1977.815 bow for masengo, Ethiopia, 20th century.  
 1977.816 table model overture music box, Jacot, Switzerland, about 1895.  
 1978.27 grand piano (model M), Steinway and Sons, New York, NY, 1894.  
 1978.28 decorative box for sheet music.  
 1978.29-34 six volumes of 19th century sheet music.  
 1978.199 spinet, Thomas Haxby, York, England, 1764.  
 1978.488 dital harp, J. Pfeiffer, Paris, about 1830.  
 1978.489 melodeon, Prescott Brothers, Concord, NH, about 1860.  
 1978.490 flute, 7 keys, Jacob David Helwert, Stuttgart, Germany, about 1840.  
 1979.122 cocked-hat grand piano, Chickering, Boston, MA, about 1858.  
 1979.143 lyra and bow, Greece, early 20th century.  
 1979.144 lyra bow, Greece, early 20th century.  
 1979.536 clarinet in C, 12 keys, Henry Prentiss, Boston, MA, mid-19th century.  
 1979.550a&b flute in C, 1 key, with cheater, Clementi & Co., London.  
 1979.551 square piano, Longman and Lukey Co., London, 1770.  
 1979.549 piccolo in D-flat, 1 key, Dresden, early 19th century.  
 1980.234 flageolet, England, about 1800.  
 1980.247a-d string quartet music part books, including works by Haydn, J. C. Bach, Boccherini and others, 18th century.  
 1980.248a phonoharp, The Phonoharp Co., Boston, MA, 1891.  
 1980.248b Selection for Phonoharp by Batchelder, pub. by Oliver Green & Co., 1892.  
 1980.268 piccolo in A-flat, 6 keys, about 1850.  
 1980.269 organized square piano, Timothy Gilbert & Co., Boston, MA, about 1854.  
 1980.646 watercolor by James Penniman, Boston, MA, about 1830, of a piano in the shape of a bentside spinet.  
 1980.647 flute in C, 1 key, Gerock, London, about 1810.  
 1980.663 ride cymbal, Paiste AG, Nottwil, Switzerland, 1980.  
 1980.664 dark ride cymbal, Paiste AG, Nottwil, Switzerland, 1980.  
 1980.665a-d symphony gong, Paiste AG, Nottwil, Switzerland, 1980.  
 1981.137 bass ophicleide in C, 9 keys, Halari, Paris, about 1821-1830.  
 1981.287 polygonal spinetta, Joseph Salodiensis, Venice?, Italy, 1574.  
 1981.316 fife in A, with cheater, United States, about 1800.  
 1981.391 flute in C, 9 keys, H.F. Meyer, Hanover, Germany, about 1864.  
 1981.392 fife in D-sharp, United States, second quarter 19th century.  
 1981.393 fife in D-sharp, Walter Crosby, Boston, MA, about 1860-1874.  
 1981.394 flute in C, 12 keys, Germany, last half 19th century.  
 1981.405 flute in C, 4 keys, with 6 corps de rechange, G. Miller, London, about 1785.  
 1981.436 melodeon, Prince & Co., Buffalo, New York, NY, third quarter 19th century.  
 1981.442 egg crate viol, Luther S. Monk, North Bridgton, ME, about 1900-1910.  
 1981.655 five-string fretted banjo, John Haynes & Co., Boston, MA, about 1890-1900.  
 1981.746 regal, Simon Bauer, Germany, about 1630.  
 1981.747 double manual harpsichord, Henri Hensch, Paris, 1756.  
 1981.748 viola da gamba, division size, Richard Meares, London, 1657.  
 1981.749 violin, Giovanni Baptista Gabrielli, Florence, about 1750-1760.  
 1981.750 violin carrying case, W.E. Hill and Sons, London, about 1890.  
 1981.751 flute in C, 8 keys, United States, about 1850.  
 1981.752 double manual harpsichord, Arnold Dolmetsch for Chickering & Sons, Boston, MA, 1906.  
 1981.753 clavichord, Arnold Dolmetsch for Chickering & Sons, Boston, MA, 1906.

The Peggy Stewart Coolidge Collection (#'s 1981.755 to 1981.781)

- 1981.755 English guitar, French or German, early 19th century.  
 1981.756 three-quarter size violoncello, Montagnana school, Italy, 1768.  
 1981.757 hurdy-gurdy, Nicholas Colson?, Mirecourt, France, 1825-1850.  
 1981.758 rebab, South India, before 1890.  
 1981.759 balasaraswati, South India, before 1890.  
 1981.769 serpent, Europe, early 19th century.  
 1981.761 gekkin, Japan, about 1886.  
 1981.762 walking stick pochette, Moritz Glasel, Markneukirchen, Germany, late 19th century.  
 1981.763 pochette bow, Glasel, Markneukirchen, Germany, late 19th century.  
 1981.764 tar, Persia, early 20th century?.  
 1981.765 violon de Savart, Felix Savart, Paris, second half 19th century.  
 1981.766 violon d'étude, France?, about 1900.  
 1981.767 serpent forveille, 3 keys, France 19th century.  
 1981.768 oboe in C, 12 keys, Europe, mid-19th century.  
 1981.769 double flageolet in c, 7 keys, William Bainbridge, London, early 19th century.  
 1981.770 bow for violin-family instrument.  
 1981.771 bow for violin-family instrument.  
 1981.772 khene, Laos, 20th century.  
 1981.773 rebab, Kabul, Afghanistan, 20th century.  
 1981.774 flute, of jade, China, 20th century.  
 1981.775 erhu, China, 20th century.  
 1981.776 sheng, China, 20th century.  
 1981.777 spike fiddle, Malaysia, 1970's.  
 1981.778 serunai, Malaysia, 1970's.  
 1981.779 kendang, Malaysia, 1970's.  
 1981.780 "Excelsior" music box and three rolls, Switzerland, about 1900.  
 1981.781 musical snuff box, Switzerland, about 1810.
- 1981.782 qin (ch'in), Beijing, China, A.D. 1233-34.  
 1982.1 finger cymbals.  
 1982.2 neck and pegbox from viola da gamba, division size, Arnif Ronnegren, Lugele, Sweden, 1733.  
 1982.3 rebec (reconstruction), Dolmetsch shop, England, 1959.  
 1982.4 rebec (reconstruction), Eugene Joseph, Rehoboth, MA, 1977.  
 1982.5 bow (reconstruction), Kahlil Gibran, Boston, MA, about 1960.  
 1982.6 bridge to bass viol, probably American, early 19th century.  
 1982.7 bassoon in C, 7 keys, Dominique Porthaux, Paris, about 1800.  
 1982.8 bowed harp and birch stick bow, Dick Backlund, Helsinki, 1949.  
 1982.9 Appalachian dulcimer, George F. Brewer, Newton Highlands, MA, 1966.  
 1982.10 raspa, Puerto Rico, 1970s.  
 1982.11 cornet, Arsene-Zoe Lecomte, Paris, 19th century.  
 1982.12 tro-u, Kampuchea, 20th century.  
 1982.13 concertina, LaChenal & Co., London, ?late 19th century.  
 1982.14 langeleik, Norway, 20th century.  
 1982.15 three dulcimer hammers, 19th or 20th century.  
 1982.133 sopranino clarinet in E-flat, 8 keys, United States, about 1835.  
 1982.178 grand piano, Viennese School, about 1812-1815.  
 1982.227 flute in C, 1 key, Meacham & Co., Albany, NY, about 1820.  
 1982.328 clarinet in B-flat, 8 keys, William Whiteley, Utica, New York, NY.  
 1982.475 American bass viol, New England, first quarter 19th century.  
 1982.586 Steinertone piano action, by or for Morris Steinert, New Haven, CT, 1897.  
 1982.801 mandolin, Gibson Mandolin-Guitar Co., Kalamazoo, MI, about 1919-1920.

- 1983.148 American bass viol, Benjamin Crehore, Milton, MA, 1796.  
 1983.159 violin, David Henderson, Aberdeen, Scotland, 19th century.  
 1983.161 viola, Johann Michael Willer, Prague, 1793.  
 1983.260 clarinet in C, 6 keys, Graves & Co., Winchester, NH, first half 19th century.  
 1983.261 flute in C, 8 keys, Firth & Hall, New York, NY, 1821-1832.  
 1983.293 piano melodico, Giovanni Racca, Bologna, Italy, about 1900.  
 1983.330 flute in C, 6 keys, Caleb Gedney, London, 1769.  
 1983.344 violin, Thomas Dudley Paine, Woonsocket, RI, 1888.  
 1983.411 mayuri, Rajasthan, North India, early 19th century.  
 1984.79 American bass viol, Benjamin Crehore, Milton, MA, 1790's.

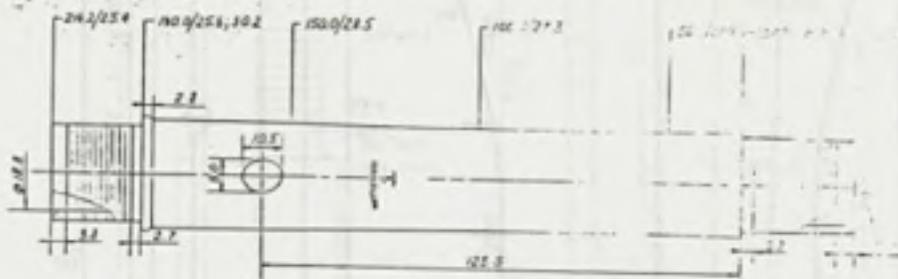
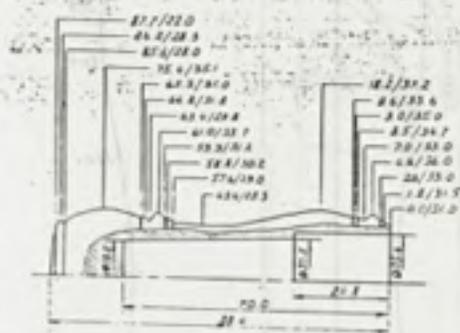
The Douglas Deihl Collection (#'s 1984.280 to 1984.405)

- 1984.280 nohkan, Japan, early 20th century.  
 1984.281 duct flute, Thailand, mid-20th century.  
 1984.282 dbang-dung, Tibet, possibly late 19th century.  
 1984.283 rkang-dung, Tibet, probably late 19th century.  
 1984.284 Jew's harp, New Guinea, second quarter 19th century.  
 1984.285 Jew's harp, New Guinea, second quarter 19th century.  
 1984.286 Jew's harp, Polynesia, about 1925.  
 1984.287 ocarina, New Guinea, about 1930.  
 1984.288 ocarina, New Guinea, about 1930.  
 1984.289 ocarina, New Guinea, about 1930.  
 1984.290 ocarina, New Guinea, about 1930.  
 1984.291 ocarina, New Guinea, about 1930.  
 1984.292 ceremonial flute, New Guinea, about 1925.  
 1984.293 end-blown flute, New Zealand, Maori culture, about 1860.  
 1984.294 dance whistle, Central Africa, probably Upper Volta, late 19th century.  
 1984.295 small dance whistle, Central Africa, Upper Volta, early 20th century.  
 1984.296 large dance whistle, Central Africa, Upper Volta, third quarter 20th century.  
 1984.297 long dance whistle, Chad, about 1925.  
 1984.298 long dance whistle, Central Africa, Upper Volta, about 1920.  
 1984.299 small double whistle, Southern Africa, Zulu culture, about 1950.  
 1984.300 side-blown trumpet, Nigeria, modern Benin culture, 1830-1897.  
 1984.301 side-blown trumpet, probably Kenya, late 19th century.  
 1984.302 side-blown trumpet, Africa, second quarter 20th century.  
 1984.303 flute in F, Douglas Deihl, Northampton, MA, 1977.  
 1984.304 piccolo in E, 6 keys, probably J.B. Martin, Paris, about 1899.  
 1984.305 kaval, Bulgaria, third quarter 20th century.  
 1984.306 flageolet, Eastern Europe, third quarter 20th century.  
 1984.307 duct flute, Eastern Europe, second quarter 20th century.  
 1984.308 double penny whistle, Douglas Deihl, Northampton, MA, 1984.  
 1984.309 ocarina, Austro-Germanic, third quarter 19th century.  
 1984.310 chromatic harmonica, Germany, late 19th century.  
 1984.311/12 rolmonica and box, United States, second quarter 20th century.  
 1984.313 rattle, New Mexico, Navajo Indian, first quarter 20th century.  
 1984.314 rattle, North America, Plains Indian, about 1930.  
 1984.315 courting flute, North America, Plains Indian, mid-19th century.  
 1984.316 end-blown flute, Southwest Pueblo Indian, about 1900.  
 1984.317 notched flute, Pre-Columbian, date unknown.  
 1984.318 and 1984.319 sundance whistle and stick, North America, Plains Indian, second half 19th century.  
 1984.320 shaman's whistle, California, Pomo culture, mid-19th century.  
 1984.321 war whistle, North America, Plains Indian, second half 19th century.  
 1984.322, 323, 324 medicine man's bandolier with two eagle bone whistles, sash, and case, New Mexico, Navaho Indian, late 19th century.

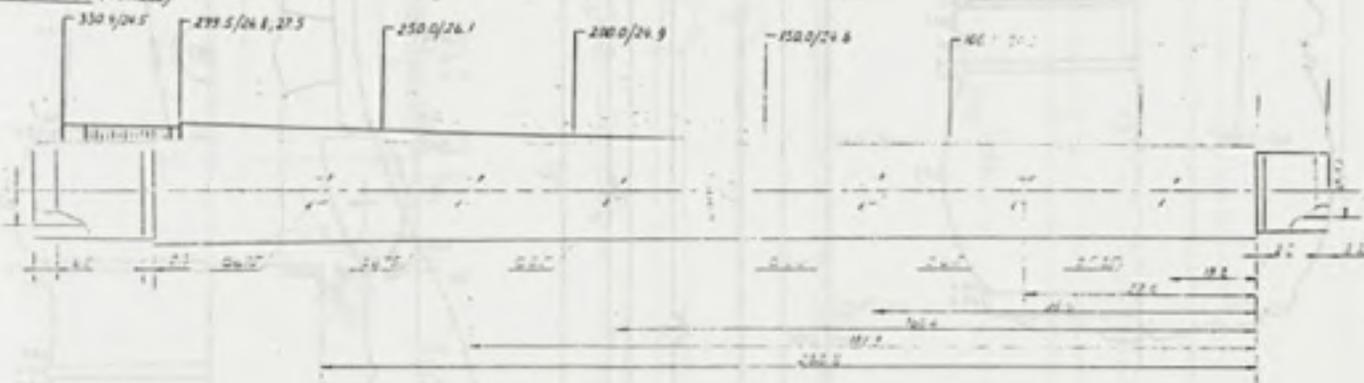
- 1984.325, 326 bone whistle with case, North America, Plains Indian, early 20th century.
- 1984.327 bone whistle, Pre-Columbian, date unknown, excavated in Tennessee.
- 1984.328 bone whistle, Pre-Columbian, date unknown, excavated in Tennessee.
- 1984.329 chirimia, Mexican Indian, mid-20th century.
- 1984.330 rattle, Peru, Viru culture, A.D. 200-400.
- 1984.331 shell rattle, Peru, Chancay culture, A.D. 1000-1500.
- 1984.332 panpipes, Peru, late Nazca culture, A.D. 1200-1500.
- 1984.333 panpipes, Peru, Nazca culture, A.D. 500-900.
- 1984.334 quena, Peru, Ica culture, A.D. 1000-1500.
- 1984.335 quena, Peru, Ica culture, A.D. 1000-1500.
- 1984.336 quena, Peru, Ica culture, A.D. 1000-1500.
- 1984.337 quena, Peru, Ica culture, A.D. 1000-1500.
- 1984.338 duct flute, Columbia, Quimbaja culture, A.D. 700-1100.
- 1984.339 large notched flute, Peru, Huacho culture, about A.D. 1000.
- 1984.340 large notched flute, Peru, Huacho culture, about A.D. 1000.
- 1984.341 quena, Peru, Inca culture, A.D. 1500-1700.
- 1984.342 notched flute, South America, Pre-Columbian, date unknown.
- 1984.343 whistle, Ecuador, Guangala culture, before A.D. 500.
- 1984.344 whistle, Ecuador, Guangala culture, before A.D. 500.
- 1984.345 ocarina/whistle, Ecuador, Bahia culture, before A.D. 500.
- 1984.346 ocarina/whistle, Ecuador, Bahia culture, before A.D. 500.
- 1984.347 ocarina, Ecuador, probably Guangala culture, before A.D. 500.
- 1984.348 ocarina, Ecuador, probably Guangala culture, before A.D. 500.
- 1984.349 ocarina, Ecuador, Bahia culture, before A.D. 500.
- 1984.350 ocarina, Ecuador, Bahia culture, before A.D. 500.
- 1984.351 ocarina, South America, probably Huanacanalica, A.D. 850-1500.
- 1984.352 ocarina, South America, probably Huanacanalica, A.D. 850-1500.
- 1984.353 ocarina, South America, ?Jama culture, Pre-Columbian, date unknown.
- 1984.354 ocarina, Ecuador, ?Carché culture, Pre-Columbian, date unknown.
- 1984.355 whistle, probably Jaina Island, Mayan culture, A.D. 550-750.
- 1984.356 whistle, probably Jaina Island, Mayan culture, A.D. 550-750.
- 1984.357 whistle, Honduras, Ulva Valley, Pre-Columbian, date unknown.
- 1984.358 whistle, Costa Rica, Pre-Columbian, date unknown.
- 1984.359 ocarina, Mexico, Nayarit culture, 300 B.C.-A.D. 250.
- 1984.360 ocarina, Guatemala, Pre-Columbian, date unknown.
- 1984.361 ocarina, Honduras, Ulva Valley, Pre-Columbian, date unknown.
- 1984.362 ocarina, Costa Rica, Atlantic watershed region, A.D. 1-500.
- 1984.363 ocarina, Costa Rica, Guanacaste culture, about 300 B.C.-A.D. 300.
- 1984.364 ocarina, Costa Rica, Guanacaste culture, A.D. 200-500.
- 1984.365 ocarina, Costa Rica, Guanacaste-Nicoya Period V, A.D. 500-800.
- 1984.366 ocarina, Costa Rica, Nicoya peninsula, A.D. 800-1200.
- 1984.367 ocarina, Costa Rica, Huetar culture, about A.D. 1000.
- 1984.368 ocarina, Costa Rica, Guanacaste culture, A.D. 800-1200.
- 1984.369 ocarina, Mexico, Pre-Columbian, date unknown.
- 1984.370 duct flute, Western Mexico, Colima culture, 300 B.C.-A.D. 250.
- 1984.371 duct flute, Western Mexico, Colima culture, 300 B.C.-A.D. 250.
- 1984.372 double duct flute, Western Mexico, Colima culture, 300 B.C.-A.D. 250.
- 1984.373 rattle, Peru, Chimu culture, about A.D. 1400.
- 1984.374 rattle, Peru, Chimu culture, about A.D. 1400.
- 1984.375 panpipes, Peru, 20th century .
- 1984.376 duct flute, South America, date unknown.
- 1984.377 notched flute, South America, date unknown.
- 1984.378 duct flute, South America, date unknown.
- 1984.379 duct flute, South America, Andes region, date unknown.
- 1984.380 notched flute, Ecuador, date unknown.

- 1984.381 notched flute, Ecuador, date unknown.  
 1984.382 quena, Peru, probably Mochica culture, about A.D. 1400.  
 1984.383 quena, Peru, date unknown.  
 1984.384 quena, Peru, date unknown.  
 1984.385 notched flute, South America, date unknown.  
 1984.386 notched flute, South America, date unknown.  
 1984.387 notched flute, South America, date unknown.  
 1984.388 quena, Peru, first quarter 20th century.  
 1984.389 flute, Ecuador, about 1930.  
 1984.390 flute, Peru, first quarter 20th century.  
 1984.391 duct flute, Bolivia, mid-20th century.  
 1984.392 notched flute, Bolivia, mid-20th century.  
 1984.393 flute, Peru, date unknown.  
 1984.394 pinkuylo, Peru, second half 19th century.  
 1984.395 tarka, Bolivia, second quarter 20th century.  
 1984.396 duct flute, Peru, probably late 19th century.  
 1984.397 whistle, Peru, probably Mochica culture, about A.D. 1400.  
 1984.398 whistle, Peru, Mochica culture, about A.D. 1400.  
 1984.399 double whistle, Peru, date unknown.  
 1984.400 ocarina, Ecuador, possibly 20th century.  
 1984.401 ocarina, Ecuador, possibly 20th century.  
 1984.402 ocarina, Ecuador, possibly 20th century.  
 1984.403 ocarina, Peru, probably Mochica culture, about A.D. 1400.  
 1984.404 signal conch shell (pututo), Peru, A.D. 1500-1800.  
 1984.405 charango, Peru, first quarter 20th century.
- 1984.544 "Stroh" violin, probably by George Evans & Co., London, 1st quarter 20th century.  
 1984.557 viola, Gerhard Deleplanque, Lille, France, 1787.  
 1984.914 flute in C, Brannen Brothers, Boston, MA, 1975. Reproduction of the 1832 conical Boehm-system invention.  
 1985.705 oboe, three keys, Hendrik Richters, Amsterdam, 1st quarter 18th century.  
 1985.724 tambura, Kotah, Rajasthan, Northern India, ca. 1800.  
 1985.725 folk sarangi, Kotah(?), Rajasthan, Northern India, ca. 1850.  
 1985.735 raven rattle, Northwest Coast American Indian, 2nd quarter 20th century.  
 1985.833 shaman's rattle, Africa, 20th century.  
 1985.834 bow harp, Central Africa, 20th century. Five strings.  
 1985.835 harp-lute, Edward Light, London, early 19th century.  
 1985.836 balalaika, Russia or Central Europe, 20th century.  
 1985.837 huqin, China, 20th century.  
 1985.838 gekkin, Japan, 20th century.  
 1985.924 grand piano, John Broadwood and Son, London, 1796. Case designed by Thomas Sheraton.  
 1985.931 flute in C, of gold, Robert Brannen for Powell Flutes, Inc., Boston, MA, 1972.  
 1985.936 drawing by Stephen Korbet, Newtonville, MA, ca. 1963, of the action of an 1804 Broadwood and Son grand piano,  
 1985.982 archlute, Italian, 18th-20th century alterations.  
 1986.7 lute, Andreas Berr, Vienna, 1699.  
 1986.23 keyed bugle in C, sterling silver, 10 keys, John Kohler, London, 1835/6. Original case, six tuning bits, and mouthpiece.  
 1986.56 grand piano, Hallet and Davis and Co., Boston, MA, ca. 1852.  
 1986.92 cornopean in Bb, three Stölzel valves, Charles Pace, London, 1834-1858.  
 1986.285 facsimile of an original drawing by Thomas Sheraton, London, 1796, of the case design for the Godoy grand piano.  
 1986.319 mandolin, Ezechiele Torricelli, Rome, 20th century.

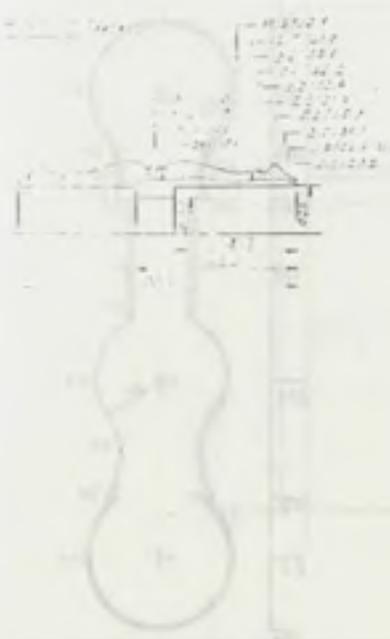
- 1986.518 harpsichord, Italian, early 16th century.
- 1986.599 ocarina, Guanacaste-Nicoya Zone, Costa Rica, A.D. 200-500.
- 1986.600 bamboo flute, Padang, Sumatra, early 20th century.
- 1986.601 flute, Middle East?, before 1930?.
- 1986.602 bone flute, Amazon Indian, before 1920.
- 1986.603 wood trumpet, Nazca Culture, Peru, ca. A.D. 500.
- 1986.604 lamellaphone, Botswana, before 1950.
- 1986.605 shaman's rattle, Cuna Indians, Sam Blas Islands, 20th century.
- 1986.606 necklace rattle, Cuna Indians, Sam Blas Islands, 20th century.
- 1986.679 clarinet in Bb, H. Selmer & Co., Paris, ca. 1920. "Mazzeo system" keywork alterations ca. 1955.
- 1986.680 clarinet in A, H. Selmer & Co., Paris, ca. 1920. "Mazzeo system" keywork alterations ca. 1955.
- 1986.783 end-piece of a metallophone (penyachah?), Bali, 19th century.
- 1986.797 piccolo in C, George W. Haynes, New York, NY, late 19th c.
- 1987.798 soprano flute in Eb, W.T. Armstrong Company, Inc., Elkhart, IN, 1970, gold plated
- 1986.799 flute in C, William S. Haynes Company, Boston, MA, 1945.
- 1986.800 alto flute in G, Jack Moore for Heritage division of W.T. Armstrong Company, Inc., Elkhart, IN, 1971.
- 1986.801 clarinet in Bb, Buffet-Crampon & Cie, Paris, late 19th c.
- 1986.830 double-vessel whistle, Columbia, Pre-columbian.
- 1986.937 bass drum, Frederick Lane, Boston, MA, ca. 1813-19.
- 1986.972 concert zither, Hartman Bros. & Reinhard, New York, NY, 1893.
- 1987.1 violin, John Gee Pickering, Greenland, NH, 1843.
- 1987.2 violin, Charles Emery Farley, New Boston, NH, 1890.
- 1987.3 violin, Ira Johnson White, Boston, MA, 1835.
- 1987.4 violin, Ira Johnson White, Boston, MA, 1860.
- 1987.5 violin, Asa Warren White, Boston, MA, 1876.
- 1987.6 violin, Thomas Dudley Paine, Woonsocket, RI, 1856.
- 1987.7 violin, Harvey Ball, Nashua, NH, 1872.
- 1987.8 violin, Moses A. Tewkesbury, Chester, NH, 1853.
- 1987.9 violin (Chanot-style), Peter M. Slocum, Newport, RI, 1834.
- 1987.10 folk fiddle, New England, 1st half 19th century.
- 1987.11 folk fiddle, New Hampshire, mid 19th century.
- 1987.12 folk fiddle, New England, early 19th century.
- 1987.13 folk fiddle, New England, mid 19th century.
- 1987.14 folk fiddle, New England, 19th century.
- 1987.15 American bass viol, Benjamin W. Willard, Lancaster, MA, 1810.
- 1987.16 American bass viol, Abraham Prescott, Concord, NH, ca. 1831-48
- 1987.17 American bass viol, New Hampshire, 2nd quarter 19th century.
- 1987.18 American bass viol, New England, 2nd quarter 19th century.
- 1987.19 American bass viol, Abraham Prescott, Concord, NH, ca. 1831-48
- 1987.20 American bass viol, Attributed to Abraham Prescott, Deerfield, NH, ca. 1809-31.
- 1987.21 American bass viol, New England, 19th century.
- 1987.22 double bass, Abraham Prescott, Deerfield, NH, 1823.
- 1987.23 violin bow, Asa Warren White, Boston, late 19th century.
- 1987.24 folk fiddle bow, New England, 19th century.
- 1987.25 folk fiddle bow, New England, 19th century.
- 1987.26 folk fiddle bow, New England, 19th century.
- 1987.27 double bass bow, New England, first half 19th century.



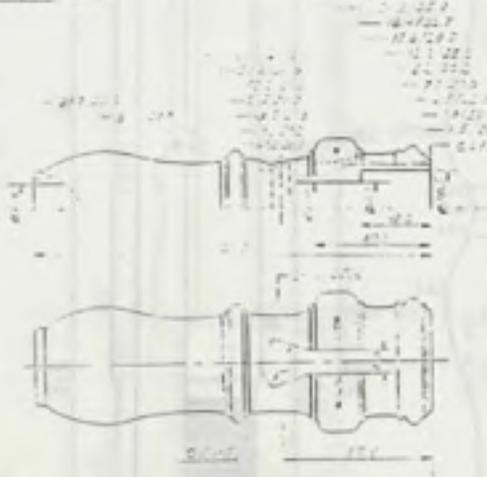
MIDDLE BODY (forward)



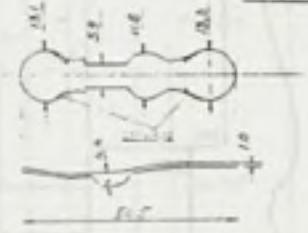
Diameters	101	102	103	104	105
1	27	27.2	27.1	27.3	27.2
2	28	28.7	28.5	28.7	28.6
3	27	27.1	26.8	27.7	27.4



FOOT



SILVER KEY



Manufactured by HORN... Museum of musical instruments Leningrad  
 All size scale, dimensions in mm





Transverse flute by W. Milhouse, London.  
(private collection, Groningen, the Netherlands)

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Description

Four part transverse flute (traverso) made of boxwood with one brass key ( $D_4^\#$ ). The head joint is stamped:

W. Milhouse  
London

337 OXF STR

General remarks

The instrument is not in very good condition, but it can be played. There is a repaired crack in the head joint and the embouchure hole has been damaged.

Pitch:  $A_4 = 440$  Hz

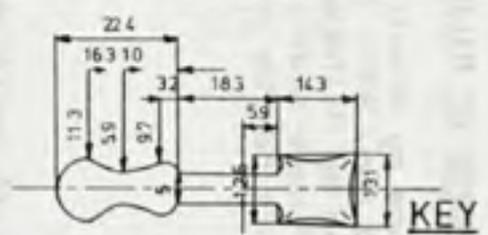
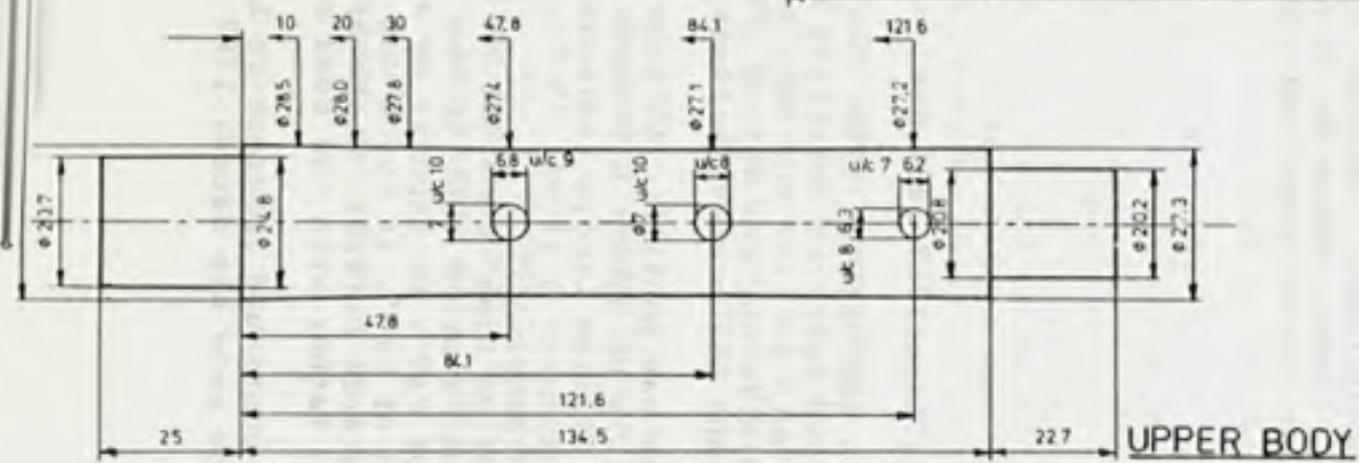
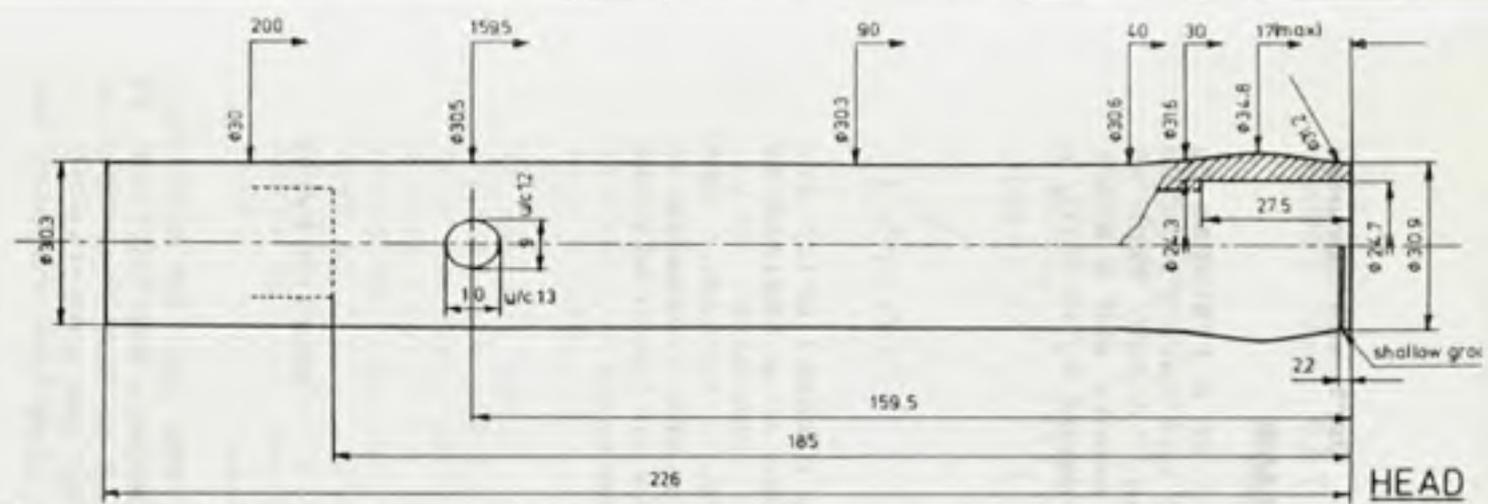
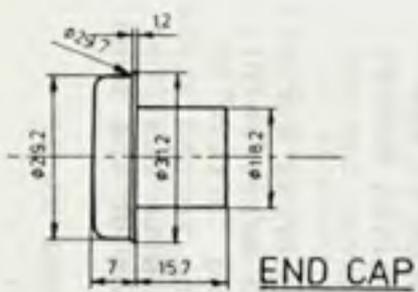
Tuning:  $D_4$  and also notes in the 2nd register from  $A_5$  up are a little flat.

Some remarks about the drawing and the measurements

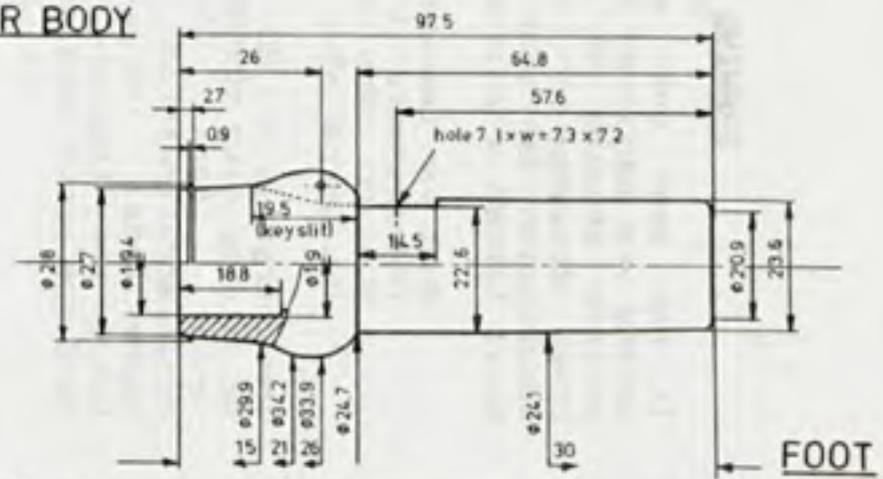
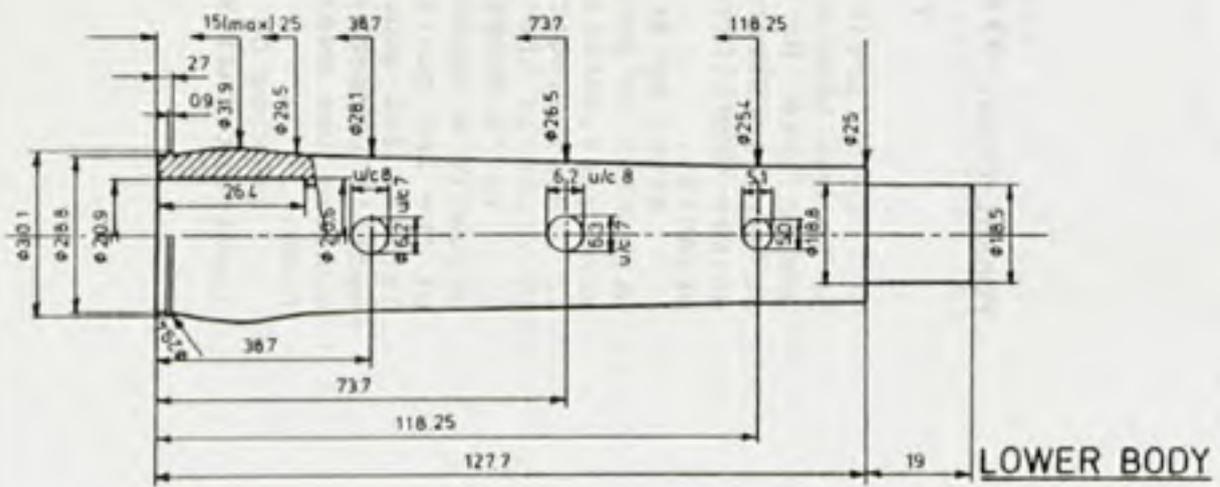
The bore is measured in two directions: in vertical direction (perpendicular to embouchure hole, finger holes and key hole) and in horizontal direction (perpendicular to the vertical direction).

Groningen, the Netherlands, March the 18th 1987

B.E. van Leeuwen



brass key 15 mm thick  
brass spring riveted to key  
brass hinge pin  $\phi 12$  L=19.5



dimensions mm	STAINED BOXWOOD, BRASS KEY PITCH A+440H2
full scale	
measured and drawn by BE van Leeuwen © 1985	
transverse flute by Milhouse, Londen ca. 1790	
dwg.no.	1A

Bert van Leeuwen

DRAWING OF A TRAVERSO BY MILHOUSE

It has been over a year since my drawing of a traverso by Eerens was published in FomrhiQ (no. 43). I now have finished another drawing of a traverso by Milhouse, London. Each of these drawings (+ tables of bore measurements and a short description of each instrument) can be ordered by writing a short letter or postcard to:

Bert van Leeuwen,  
Kramersheerd 114  
9737 PD GRONINGEN  
the Netherlands

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FOMRHI Comm. 826

Maurice Byrne

Thomas Ling, 1787-1851, Reed maker.

In my article in GSJ XXXVII (1984) 100, the year of marriage of Thomas Ling, the reed maker, to Amarillis Rogers was omitted. It was in 1826. He was born in 1787 and baptized on 9th September at St Mary le Strand. His father was Thomas Ling the musician of Helmet Court, Strand, and his brother William Ling the composer and organist.

After my article was published, Al Rice kindly drew my attention to an article by Egbert M. Ennulat, published in the same year, entitled: William Ling, a rediscovered English Mozart? in J. Musicological Research 5 (1984) 35-50, which gives the date of birth of the reed maker.

In 'A Profile of Mr Ling' Comm. 804 on p. 86 Geoffrey Burgess actually misquotes me. I wrote that TL was 'a reed maker mainly of the 2nd quarter of C19'. He reports me as saying 'active in 1st and 2nd quarters of C19'. It turns out that the second statement is probably the more correct. Whatever happens we must not confuse the musician father with the reed maker son of the same name.

In view of the continued interest in Ling reeds it is important that we now know his dates: 1787 - 1851.

FOMRHI Comm. 827

David L. Smith

## LEWIS, A FLUTE CASE-MAKER.

When repairing the case of a flute some time ago, I was very interested to discover a name and date pencilled on the wood inside the lid of the case. This was revealed when the velvet lining was carefully peeled back. The name Lewis and the date [obviously 1864] presumably date the flute very accurately, and appear as shown below:-

*Lewis**July 26<sup>th</sup> [1864]*

←————— 270mm —————→

The flute concerned is an early cylindrical silver Boehm system instrument by Rudall & Rose. The case, from its perfect fit, must be the original case made for that instrument, so it seems reasonable to assume that the date of the case's manufacture must closely coincide with that of the flute.

It was not until some time later that I realised that I should investigate the case of another flute [Rudall Rose Carte & Co.] from the same period. To my delight, the same signature and a date [April 24 '65] very near the date of the other flute was revealed. Because this second flute was an unusual one going down to B flat, the case needed to be much larger than normal, and was obviously tailored for that particular instrument. So again an instrument seems to be dated very accurately from its case.

There must be numerous other instruments from that period made by the Rudall firms which still have their original cases with them. The purpose of this Comm. is to alert owners and curators that it may pay them to investigate under the lining of lids of cases in the hopes of finding other dates and signatures.

With both the cases I have, the velvet lining peeled back very easily without any damage, because it was glued only very lightly around the edge.

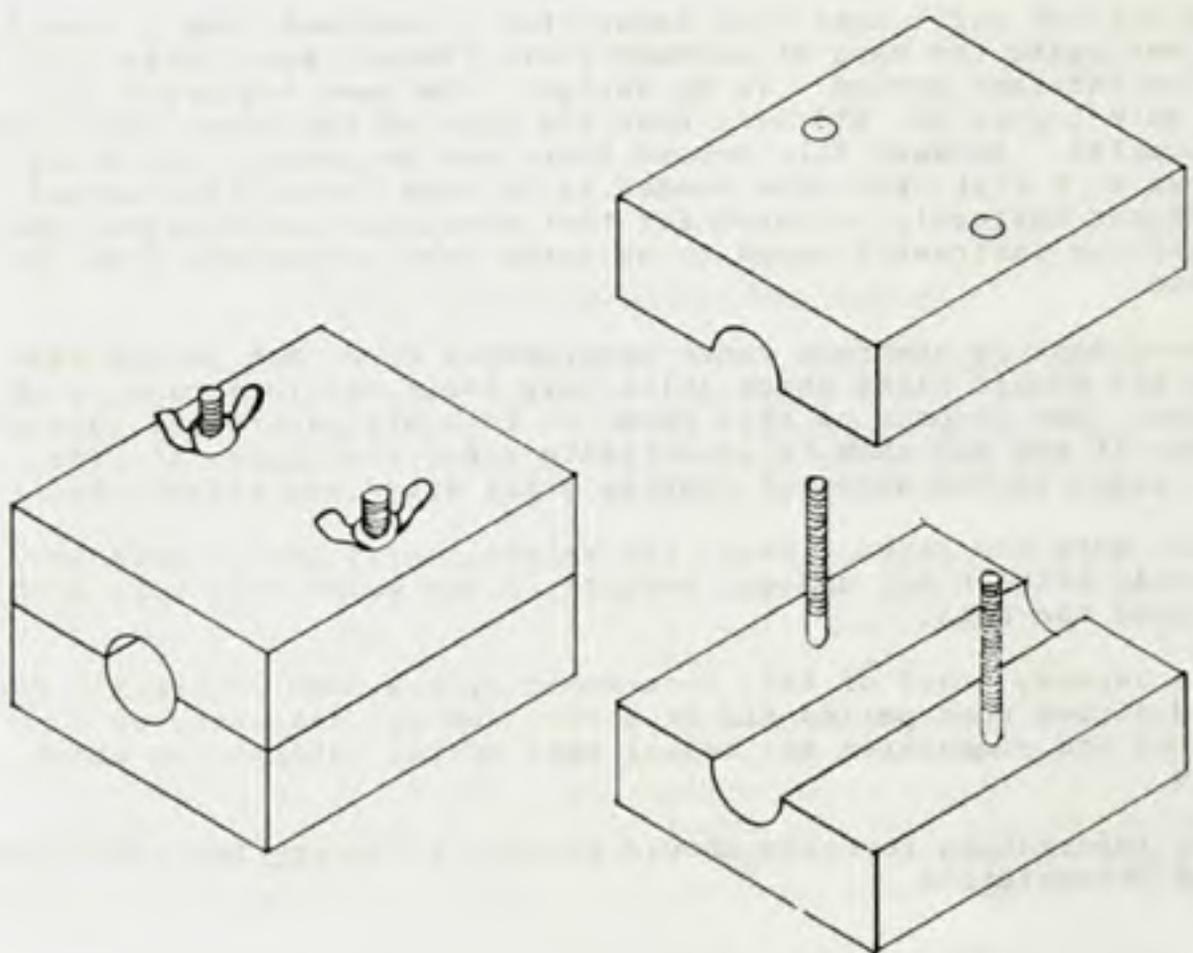
Has anybody heard of this case-maker of the name of Lewis? Where and during what period did he work? Perhaps discovery of more dates and signatures may reveal more useful information about him.

Any information revealed should be sent to Jeremy for collation and preservation.

More Thoughts on Woodwind Bore Measurement

In Comm. 761 and again on p. 4 of bull. 46 Ken Williams makes the mistake of ignoring friction in calculating the normal force exerted by a measuring tool on the wall of the instrument being measured. In the worst case of an infinitesimal included angle, the force exerted on the wall by the measuring device is equal to the insertion force divided by twice the coefficient of sliding friction. Taking a reasonable value of 0.1 for the coefficient, we see that the wall force is only 5 times the insertion force for an almost-cylindrical bore.

More to the point, how to demonstrate in a convincing way that metal telescoping gauges do not cause visible damage to woodwind bores? I constructed the device shown below as a demonstration tool. It consists of a split block of maple containing a slowly expanding conical bore. The use of the measuring tool can be demonstrated by inserting the tool into the block and "measuring" the bore. Then the block can be taken apart and the "bore" examined for any damage caused by the tool.



### What do we mean by A=415?

It sounds a silly question, "What do we mean by A=415?", but it does need an answer, and it's a question that any of us who build instruments, any of us who tune instruments, and any of us who are interested in temperaments must answer. What's more, judging from some conversations I've had recently with friends who do various of these things, it's not a question that anyone has really sorted out the answers to.

The point is this: Our standard reference pitches are all based on A, 440 Hz for modern pitch, 415 Hz for the commonly accepted but basically pseudo baroque pitch, 392 Hz for one of the real baroque pitches (Hotteterre etc; the rest of the baroque was anything from there - it wasn't often too much lower than that - up to about 415-418 but mostly somewhat lower than that, around 408-10, which we sometimes call Bressan pitch for easy reference), 461-465 Hz for some of the renaissance instruments (which nowadays often gets called Marvin pitch from one of its strongest adherents in making reproduction instruments), and so forth.

However, surely nobody ever tuned an instrument from A, neither now nor in the historical periods. If you start tuning a harpsichord from A in any historical temperament, you'll get some very funny intervals in the more common keys, and the meantone wolf will start howling in unexpected places. One tunes from C (or maybe from F - that's one of the points that has made me ask this question, as we'll see below) just as a piano tuner does today (he uses a C fork at 523.3 Hz, an equal-tempered minor third above the international standard of 440 Hz - at least he does if you brow-beat him into it; otherwise he either tidies the thing up from wherever it's got to under the influence of your central heating, without checking its actual pitch, or else he tunes it nice and sharp to make it sound more brilliant, just as too many orchestras are doing nowadays - we're well on the way back towards the mid-19th century High Pitch).

The real question behind that in the title of this Comm is how do we find that C or whatever base note we are going to use? Do we start on 415 Hz (let's take that pitch as our exemplar), and

- a) go up a minor third to C in the temperament we are going to use, and work from that?
- b) Or do we go up our modern equal-tempered minor third and start on C 493.9?
- c) Or do we go up to whatever C that will produce, by the time we have got round to the A in our cycle of fifths in whichever temperament we are using, an exact 415 Hz for the A?

The third of these, (c), would seem to be the most logical; our A will then really be 415 Hz, and if the ensemble is cuckoo enough to use an A as a tuning pitch (a D is much more logical as a tuning standard for almost any ensemble of early instruments; we settled on a D in *Musica Reservata* when we found that that was the note common as a good note to the largest number of instruments, whereas hardly anybody had a good A), that tuning pitch will actually be the one that we have agreed to use. However, it's hell's delight trying to cope with the maths (for an innumerate character like me) to work out in quarter-comma, or Werckmeister 3 (or any other Werckmeister number (or that matter), or even Pythagorean or anything else, what pitch I need from C in order to wind up spot-on 415 at A. And if I want to vary my

starting point (and I am convinced that in the old days people shifted the wolf - and the dirtier thirds or fifths - away from where they'd be a nuisance in the key of 'this' piece by doing just that, by altering the starting point of their cycle of fifths), then it gets worse, because I still need to wind up on A, whether A is now the supertonic or the mediant or whatever, spot-on 415.

The first of these, (a), is attractive in theory, but somehow I don't think it ever happened that way. We would be starting on a C which had no historical foundation (ie which never existed) because I don't think they had A tuning forks, and I don't think that they used A as a reference pitch. I suspect that the main reason that we do is that it's the only open-string note on the modern string band that an oboist can play with one hand while holding a fork to his ear with the other (which is standard practice in a lot of orchestras). The only other reason that I can think of is an idea that one should start at the beginning of the alphabet, presumably under English or German influence (la isn't the beginning of anything, whether you're thinking in French, Italian or Hexachord).

I suspect that (b) is what WE really mean by A=415; that we mean, as Alan Davis pointed out to me, that the pitch we want is an equal-tempered semitone below modern pitch, and that just as 415.3 is a semitone below 440, so 493.9 is a semitone below 523.3. The snag with that solution is two-fold:

- i) again that we wind up with some rather funny looking figures for our C or whatever, and
- ii) , much more seriously, that we never get back to 415 when once we have set our temperament (unless, of course, we are using equal temperament, in which case we don't need to bother with any of these questions anyway).

If I am right and that (b) is really what we mean by A=415, what we are saying is that we don't mean A=415!

My own interest in this question is both in setting historical temperaments on keyboard instruments and, more importantly, trying to work out what basic pitch and what temperament an instrument maker had in his mind when he was making an instrument and tuning its finger holes. We can produce tables of this note so many cents up, the next so many cents down, and so on and so forth (you'll find such tables on some of our Bate Collection plans), and one can analyse these tables (which is what I'm trying to do), but it gets very difficult unless one can agree on a logical starting point.

Hence this Comm. I'd be very glad of opinions and reactions from any of you who have ideas about this. I have sent out advance copies of this to a few of you who I know are interested in this area, and there are some responses in this Q on this subject (a mini-symposium; what's the written equivalent of a colloquium? A conscription sounds wrong!). Do please send me your opinions, also; they will be valued, and if we can establish a consensus of opinions it might be very useful, and not just to me.

PS I have not altered this Comm in response to some of the replies I've had, even where they have corrected me on such points as the survival of an early A fork (my only 18th century fork I take to be a C; it produces 244.8 Hz, and I don't believe in a B natural fork (it looks too old to be a very high-pitch B<sup>n</sup>), and the fact that A does make a good centre for keyboard tuning.

The responses so far have all been from the keyboard side. This is important, too, as I've said above, for wind instruments, especially

in trying to work out what the maker was aiming at. It is only on wind instruments that we have concrete evidence (as distinct from written descriptions) of temperaments. We sometimes say that an instrument is built out of tune; is it, or is that what the maker intended it to produce, in a temperament we no longer use? Unless we have some idea of where he started, it's very difficult to work out which it is.

Brussels, 14 September 1987

FoMRHI Comm 830

Nicolas Meeùs

Dear Jeremy,

Your question "What do we mean by A=415" indeed is odd. I find it most significant that what apparently made you aware of this problem is your computer. Numbers can be extremely tricky. Electronic calculators may help reconciling the least numerate of us with mathematics; but they do not teach how to appreciate numbers. It may be caricatural to state that your problem exists in the figures only and not in actual musical practice, but, for so far as this statement contains some truth, it indicates that the discrepancies that you ascertain in your computations are but a measure of the tolerance of instruments or ears.

You could as well have asked what one means by A=440. Despite the supposedly high standardisation of that pitch, and of instruments made for it, you recognize yourself that modern piano tuners do not tune at 440 unless "you brow-beat" them to do so and that "too many orchestras" tune higher than 440. The real question then, is whether a standard pitch is anything else than a remote ideal.

You rightly point that A=415 is pseudo baroque and that actual early pitches would better be defined as "about 415-418", "around 408-410" or "461-465". With some more computation, you will easily come to realize that the uncertainty in the definition of these pitches is about 10 to 15 cents, i.e. more than what you find when computing temperaments with varying starting points. Once again, you get here a measure of the tolerance that is or was considered acceptable.

What's your problem of tuning harpsichords? How accurate are you when you tune? How long do you think a harpsichord remains exactly at the pitch and in the temperament one purports to have set it to (especially when it is played)? You may perhaps start playing at A=415 in Werckmeister 3, but where will you be in the middle of the concert? And what about wind instruments raising in pitch as they heat? And, if no instrument of fixed pitch is involved, how fluctuating do you think the pitch of an instrument or an ensemble is as they play?

The example hereby is the one that I quote to my students to illustrate the relativity of pitch and tuning. Assume it to be for string quartet, and that the musicians play perfectly in tune. The second violin plays the e' at 386 cents, a perfect major third above c which we take as 0 (I neglect octaves). The cello and alto play the A and a at 884 cents, a perfect fifth below the e' which the second violin holds. The d and d'', perfectly in tune with the a, yield 182 cents. The following G and g, in tune with d'', are at 680 cents. The c of the second measure, a perfect fifth below g, must therefore sound at -22 cents, a comma below the starting point.



Playing these four chords (which form a very plausible harmonic progression) in tune lowers the pitch by one comma!! After five repetitions of the measure, one would be a semitone low...! How do you think this problem is solved in actual musical performance, unless by not playing in tune (which is equivalent to playing at a fluctuating pitch)?

I believe therefore that the matter of working out "what basic pitch and what temperament an instrument maker had in mind when he was making an instrument and tuning its finger holes" is of very restricted importance. Some of the fuss made today about fine shades of temperament seems to me much excessive.

o o o

This said, it remains that, starting from tables such as those on your Bate plans, one can perform computations that'd yield results such as, say, "this instrument best correlates with Werckmeister 3 at  $A=415.6$ ; it also has a satisfying correlation with  $1/4$  comma meantone at  $A=417.2$ ". This'd involve comparing slopes of linear regressions. As I love to play with numbers, I'd be ready to work out programs for these if nobody else more versed in statistics (and perhaps less sceptical about the whole matter) provided them in answer to your Comm. But you must realize that such computations don't help playing in tune, and wouldn't prevent anyone to play, say, at  $A=412.7$  on the instrument just described.

P.S. I believe that the true reason why one tunes from A (one does!) is merely that A is the best open string where to tune a violin, less prone to breaking than E and better sounding (less inharmonic?) than D or G. Also, if two instruments playing together have to adjust to each other starting from two different temperaments, then it is desirable that the common note on which they tune be such as to minimize the adjustments needed. This is achieved if the starting point, the common note, is in the middle of the series of good fifths, usually from Eb to G#: the middle of the series is between D and A, which therefore qualify as good starting points.

## 1987 FoMRHI List of Members - 2nd Supplement as at 8th October 1987

\* in left-hand margin = change of address or other change

- Alexander Batoff, Museum of Musical Instruments, 5 St. Isaac's Square, 190000 Leningrad, USSR; 314-53-45 (lute, M, R, res; all instrs. C).
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- L. Tarquin Billiet, 90 Rue de Savoie, B-1060 Bruxelles, Belgium; 02/538.80.63 (trav, crnett).
- Winfried Brendel, Buchholzen 52, D-5632 Wermelskirchen 1, West Germany; 02196/5771 (hpschd, spntt, virgnl; M).
- \* Julian Cardew, United Farm, Releath, Praze-an-Beeble, Camborne, Cornwall TR14 9NN, UK.
- Celesta, Tijdschrift voor Muziekinstrumentenbouw, Guido Gezellelaan 89, B-2670 Puurs, Belgium; 03/889.49.33.
- Chinese University of Hong Kong, University Library (Periodicals Dept), Shatin, New Territories, Hong Kong.
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- \* Olov Gibson, Villagatan 8, S-621 47 Visby, Sweden.
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- \* Peter Holtslag, Witte de Withstraat 26<sup>o</sup>BG, NL-1057 XX Amsterdam, Netherlands; 020-836737.
- Klemens Kleitsch, Gotenweg 14, D-6972 Tauberbischofsheim, West Germany; 09341/3458 (hpschd; M).
- Vladimir Kosheleff, Museum of Musical Instruments, 5 St. Isaac's Square, 190000 Leningrad, USSR; 314-53-45 (fag, M; all instrs, Curator).
- David Lasocki, Music Library, Sycamore 0009, Indiana University, Bloomington, IN 47405, USA (recrdr, trav; P, res, W).
- Paul Lewis, 37 Christchurch Hill, London NW3 1LA, UK; 01-794 4601 (horn, trav; P).
- Helen Lumley, 4 Floyd's Court, Borough Road, Gallowfields Trading Est., Richmond, N. Yorks DL10 4SU, UK (recrdr, trav, clarinet, M; ww, R).
- J.D. Mings, Gouden Leeuw 219, NL-1103 KD Amsterdam Zuidcoast, Netherlands.
- Marc Nobel, 103 Ramsden St, Clifton Hill, Melbourne, Victoria 3068, Australia (hpschd; M, R).
- Yoav Ran, 5 Benjamin St, 76244 Rehovot, Israel; 08-455246 (recrdr; M).
- Albert R. Rice, 495 St. Augustine Ave, Claremont, CA 91740, USA; (714) 625-1782 (early clarinet, P; Museum Curator).
- \* Angus Robertson, 3 Lovers Lane, South Queensferry, West Lothian EH30 9UP, UK. From December: 8 Whitten Lane, Linlithgow, West Lothian EH49.
- \* Marten Root, Ruyschstraat 8 boven, NL-1091 CB Amsterdam, Netherlands; 020-923974.
- Richard Schaumlöffel, 10 Yeo Ave, Highgate, SA 5063, Australia; (08) 272 3035 (hpschd, frtep; M).
- Cornel & Ildico Suboni, 20 Iosif Vulcan Street, 1900 Timișoara, Romania (vln; M, R, res, P).
- R. Kim Tipper & R.P. Spracklin, 801B 7th Avenue North, Saskatoon, Saskatchewan, Canada S7K 2V5; (306) 652-3651 (vln fam, bar str, recrdr; M, R, P).
- \* Andrew Wooderson, 28 Holmesdale Grove, Earnehurst, Kent DA7 6NY, UK; 0322-525558.

Museums: Claremont: Fiske (Al Rice)  
 Leningrad: Musical Instrument (Vladimir Kosheleff)

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ORGANOLOGICAL INDEX

All Instruments:	Alexander Batoff	Vladimir Kosheleff	
	Herbert Heyde	Albert Rice	
String Instruments:	R.P.Spracklin	Kim Tipper	
Piano etc:	Richard Schaumloffel		
Harpichord etc:	Winfried Brendel, hvs	Marc Nobel, h	
	Klemens Kleitsch, h	Richard Schaumloffel, h	
Lute:	Alexander Batoff		
Guitar:	Giuseppe Corizzo	<b>Bowed Strings:</b>	Jeffrey Hildreth
Violin Family:	Giuseppe Corizzo	Cornel Suboni	R.P.Spracklin
	Jeffrey Hildreth	Ildico Suboni	Kim Tipper
Nyckelharpa:	Jeffrey Hildreth	<b>Woodwind General:</b>	Helen Lumley
Transverse Flute:	Tarquin Billiet	Paul Lewis	
	David Lasocki	Helen Lumley	
Recorder:	David Lasocki	Yoav Ran	Kim Tipper
	Helen Lumley	R.S.Spracklin	
Clarinet:	Helen Lumley	Albert Rice	
Bassoon:	Vladimir Kosheleff	<b>Horn:</b>	Paul Lewis
Cornett:	Tarquin Billiet		

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GEOGRAPHICAL INDEX

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## FoMRHI Comm 831

A = 415?

John Barnes

Let us all be thankful that  $a' = 440$  Hz is widely accepted as a modern pitch. That being so, to have a Baroque 'convenience' pitch an exact equal-temperament semitone lower is most logical, especially since many harpsichords now have semitone transposing devices.

As a present-day practice, tuning historical temperaments from A on a keyboard instrument is sensible, because in the circle of fifths it is opposite  $E^b$  or  $D^{\sharp}$  which is usually one side of the wolf in meantone temperaments. The axis  $E^b - A$  is also near to the axis of symmetry of most temperaments of the kind advocated by Werkmeister. If you tune from an A fork, therefore, about half of your notes will be flatter than equal temperament and about half sharper. The note you start on and set to your fork for your cycle of fifths, despite Jeremy's third paragraph, does not need to have any effect on where you place the wolf or which fifths are pure and which are tempered.

In the past when asked for 415 I have tuned  $b^{\sharp}$  to my 440 fork. This results in  $a' = 413.9$  Hz when I use Barnes/Bach temperament and  $a' = 411.7$  Hz when I use  $\frac{1}{4}$ -comma meantone. I carry forks sounding 440, 442, 444 and 448 Hz. Obviously it would be more correct in the first case to tune  $b^{\sharp} = 442$  Hz giving  $a' = 415.8$  Hz and in the second case  $b^{\sharp} = 444$  Hz giving  $a' = 415.4$  Hz. Having been induced by this comm. to make these calculations, this is what I shall do in future, and it amounts to a practical version of Jeremy's alternative c).

## FoMRHI Comm. 832

Re.: Comment "What do we mean by A = 415?"

Dave Law

It would seem logical to find actual pitches for performance by studying extant wind instruments. Probably two pitches (Renaissance and Baroque) would be needed.

When A = 440 was agreed as an international standard, I imagine that the number was chosen as a convenient round figures close to pitches commonly in use at that time. Therefore the same reasoning could be applied to the problem of setting a standard pitch for the performance of early music. This has to be followed by the manufacture of numbers of tuning forks marked "Ren. C 550" and "Baroque C 470" (or 480 or 490!) and a publicity drive to sell them. It would be counterproductive to announce a new standard pitch system but not be able to produce the forks. I have had forks made marked C 493.9 (I am not sure anyone else has, the request was greeted with some amusement). The normal minimum number is 10, and the cost is no higher than for other pitches in production at present. It would be interesting to know when pitches were first measured.

FoMRHI Comm 833

D. Jacques Way

14 September 1987

Dear Jeremy

What Mean's A 415?

I try to think for whom the question is important. Among instrument makers, only those who must drill for finger holes, and for them the temperament must be much more important than the small variation in pitch depending on how the pitch is derived.

For stringed-instrument makers, the general area of pitch is most important, but I'm not worried about whether the tuning is derived from using a G# fork for the A, or a B fork for the C.

In the old days, before A 415 became popular, I tried to scale harpsichords so that they could be played at the universal A 440, but string lengths and tensions would be about what must have been used in the earlier centuries. Besides cutting me off from the 'dimensional language' of all the antiques, this approach caused many other problems--it was a bad idea. I hate the clutter of transposing keyboards, but there is no better way to go. And now that A 492 is becoming popular, we are having to transpose up and down!

Since I am not an instrumentalist, I probably shouldn't speak about whether it matters in the playing how A 415 is derived, but having been the servant preparing the keyboard instrument many times, and I venture the opinion that it doesn't matter a damn. The string players will do as they please, as they always do. The players of fretted instruments will do as their instruments demand (their thirds will be as wide as in equal temperament). The flutes and recorders will do as their makers determined. Which means that if everybody is dead on A when then tune up, they will be where ever they are ever after that.

Of course, in a good ensemble, everybody will be working with everybody else, blending together in pitch as well as in rhythm, having a sense of the whole--and this so far outweighs everything else in the performance, with every player making what small modifications he must, that even the particular temperament of the keyboard instrument becomes a very minor thing.

Tuning and tempering methods for the harpsichord start from C from ancient tradition, and for the practical reason that in many of the tunings and temperaments this brings the 'near' keys into cleaner harmony. But tuning a keyboard in Kirnberger III, then transposing a half tone higher throws the near keys out, so the temperament or tuning should be adjusted, at least if you are using a 'fourth comma' temperament; in a 'sixth comma' temperament the problem is not so great.

As a practical matter, if C is tuned with a B fork (493.9), the A comes out where it comes out--the strings will take their A from the keyboard, which will be at least as close to perfection as when the orchestra takes its A from the oboe (I never saw an oboist holding a tuning fork to his head.

But I have run into some queer situations. At the Metropolitan Opera I was instructed to tune the harpsichord to A 440 and one half (I said, "Yassuh, boss!"). I think the instrument stayed there for a few minutes into the first act, but of course everybody in the audience kept on breathing, which raised the humidity, which raised the pitch of the instrument, but that was the least of the problems with that performance!

A 415 is an arbitrary pitch, a convention of our modern times. Minor variations from it as a starting point are not important--the orchestra will drift far more than that as they go along even through a short piece. And nobody will mind at all if they are making music.

In solo performances on the harpsichord, the temperament of the instrument rates about one and a half on a scale of ten in the whole context of the performance, unless the temperament is wilfully foul (if you are playing in a dead hall don't try to spice things up by using a nasty temperament!).

I said that we are often asked to make double transposers nowadays--with transposing blocks both to the left and the right. But if an instrument was designed for A 390, we should be transposing only to the right and that makes for butchery of the case. Yet I am convinced that the geometry of many of the old instruments was designed for the lower pitch, that they sound best down there, given some adjustment in wire weights. But transposition down from A 415 does nothing for the sound of the instrument.

What do we mean by A 415? Nothing very exact, I'm afraid.

27 September 1987

Dear Jeremy

As an amendment and extension to remarks sent you the other day:

Lionel Party, head harpsichord honcho at Juilliard, and one of our more skillful continuo players, says that in his experience the string players care mightily about their A, and if they are playing at '415' they want to be certain that the note is exactly 415.3 Hz, and will often insist on a demonstration from a fork or an electronic tuning device that the 415 is not flat.

Since the revolving temperaments are tuned from C, he suggests that to make the players happy the harpsichordist take a perfect A 415.3 from the fork, make as narrow a fifth as he can stand to E, and a perfect third down to C, and continue laying the bearings from there. The A derived from using a B fork (493.9) for setting the C for a quasi '415' pitch will result in an A that is too flat.

And of course if you are using a transposed keyboard, the A# will never be at A 440 unless you retuned. Transposing the keyboard when using anything but equal temperament never puts you in tune in the transposed position, and so is not quite the sovereign remedy we assume it to be.

Bill Dowd remembers that years ago Mme Chambure showed him a fork pitched at 'le diapason de Taskin'--410 Hz. We should remember that A 415.3 derives from equal temperament, which is used by very few people for early music, that some other pitch approximately a half step lower than A 440 would work as well so far as the harpsichord is concerned, and as well for the strings save for their insecurity about their A. But for the woodwinds, the exact pitch is important since there is not much they can do comfortably to shade their pitch outside very narrow limits. The d" of the flute seems to be a critical note. I'm told that the low F# of the bassoon can't be matched by any harpsichord temperament that is satisfactory for the strings or the other woodwinds.

We make pretty diagrams of temperaments (Velloti, Kirnberger, Werckmeister, etc.), but in actual practice the harpsichord soloist consults his repertory and tunes his instrument accordingly, and a sensitive continuo player devises a temperament to suit the other instruments, even using some retrograde ('wide') fifths if necessary. And I think this must have been the ancient practice.

If a group of musicians decide to make music together, they will find a way to do it. But no amount of historical research or statistical analysis or search for the authenticities make a satisfactory substitute for musicianship.

Wohltemperierte is the guiding word we have been given--not a formula, not 'gleichschwebende', for example.

There are very cogent reasons for pitching the ensemble to the woodwinds, for forcing the string players to take their A from the oboe. The harpsichord should do the same. String players who insist on an abstract standard outside the possibilities of the rest of the ensemble are silly. If their pitch memory is a handicap to good musicianship, they should train themselves to overcome their handicap instead of being proud of it. The continuo player who insists on using a temperament mechanically derived is also silly. "Mr Silbermann tunes his organs as he pleases, but I play the music that pleases me."

Those who can, do. Those who cannot hunt for formulas, statistics, rules and regulations, or something to copy (whether it is apropos or not).

## A=415 AND UNEQUAL TEMPERAMENTS

Jeremy asked for my comments, to appear together with his, as to 'What do we mean by A=415?'. I quite agree that A at 415 HZ is only a pseudo-baroque pitch. I see it as a compromise between the French c409 and the c422 for which I believe there is also some evidence.

I can't agree that 'nobody ever tuned an instrument from A'. Violinists (whom I deeply respect because we need so many of them and because I used to take violin lessons but could never play very well in tune) start from A and can't really be expected to start from C or F, which are the starting points in the old keyboard tuning instructions. I have met oboists who wanted the harpsichord's A to match theirs but didn't mind so much about the other notes. I have heard many piano tuners start from A.

Jeremy implies that piano tuners like to work with 3rds, and I think this is true of most good keyboard tuners. Of course they do it by listening to beats. So should we all. If you start from A440 or 220 and you know the number of cents by which the major 3rd F-A is to be tempered (the difference between your desired F-A and 386 cents), then half that number will be the number of beats per second. That's where I usually start. For the 3rd or 6th between A and middle C, the number of beats per second would be  $\frac{3}{4}$  the difference between your desired interval and a pure minor 3rd (316 cents) or major 6th. If A is around 415, allow for beats 5% slower, since 415 is about 95% of 440.

(I use the schisma as a unit of measure for the amount of tempering in an interval. It is the difference between the two commas, and since the pythagorean comma amounts practically to 12 schismas (12.008), the 5ths in equal temperament are tempered by 1 each, the major 3rds by 7, the major 6ths and minor 3rds by 8. Eighteenth-century German tuning theorists used 1/12-comma as their unit of measure for tempering, but sometimes confused the two commas. As the schisma is some 1.95 cents, the number of beats per second for my initial F-A is equal to the number of schismas when A is at 440, or about 5% less if A is around 415. For A-C or C-A (middle C), the number of beats is half again the number of schismas.)

By starting from A and going thence to F and/or C, we can take A=415 (or A=whatever) literally and thus solve Jeremy's problem. Perhaps I should mention that because of the inharmonic timbre of harpsichords as well as pianos, the object in tuning them should not to be make any one interval match the theoretical reckoning of the beats 100%, but to make them all match quite well. Good

tuners muddle through in this respect. For a reckoning which takes the inharmonicity into account, you should know how much inharmonicity characterizes each string, which of course depends on just how the instrument has been strung. That way lies madness, so it's better to muddle through and tune the intervals by ear than to tune by unisons with an 'electronic monochord'.

Jeremy's problem has had a long history, *mutatis mutandis*. Before equal temperament was much used on keyboard instruments, theorists used to say its adoption would help. According to Zarlino in 1590 (p. 212), a certain Girolamo Roselli, abbot of S. Martino in Sicily, said that if all instruments were tuned alike in equal temperament, they could 'unite themselves... and the organs will be neither too high nor too low'. When Neidhardt recommended various subtly unequal temperaments in 1732, he said nonetheless (p. 41) that some people used equal temperament on the organ and 'if oboes, flutes etc. were adjusted accordingly, then Chor- and Cammerton must necessarily go together (*zusammen stimmen*) through and through at the purest.'

When Christiaan Huygens measured a pitch frequency (see his collected works, vol. 19, p. 375), he did it for a D, which he reckoned at 547 pulses per second. He advocated the division of the octave into 31 parts, so we can calculate his A as follows:  $\log 547 - \frac{13}{31} \log 2 \approx \log 409$ . Then Sauveur in 1701 reckoned low A at 100 by finding that it beat four times per second with an adjacent  $A^b$  when organ pipes for both were tuned pure (locked into resonance) with a pipe for F a 3rd below (so the ratio for the semitone was  $6:5 \times 4:5 = 24:25 = 96:100$ , hence the four beats per second). Ten years later he said that with greater precision this method yielded 102 for low A (= 408 for our concert A), from which he calculated C# at 255 (=  $5:4 \times 204$ ) and said that since this is so close to a power of 2, we might as well take C# 256 for our pitch standard.

415 can't do duty for 392, but may be a good compromise between 409 and 422, particularly if you don't have an oboe or the like made for 409 but do have a harpsichord which transposes by a semitone and which is to be played now and then at A440. There may be some tendency to use equal temperament at the higher pitch and unequal at the lower pitch; since A is halfway between  $E^b$  and D# in the series of 5ths, the use of 415 as starting point will minimize the sum of adjustments between any regular meantone temperament and equal temperament, regardless of whether the latter has A or G# at 415: if its G# is at 415, its A will be at 440 (which is how 415 came into use). This may be a considerable factor, as the adjustments unsettle the harpsichord's tuning stability and bend the strings at the nut, shortening the life of the top copper-alloy strings on an instrument where the scaling entails mostly iron-alloy strings. If other historical unequal temperaments are involved, a similar but longer argument can be made for the use of 415 HZ as a quasi-baroque A.

## Tuning an Unequal Temperament Using an Equal Temperament Pitchmeter

FoMRHI Comm. 835

R. A. Chiverton

If you have an equal temperament pitchmeter and know the Hertz values of the notes of the unequal scale you want to tune to, the list below gives you the cents deviations from the nearest equal temperament note and whether the deviation is sharp or flat.

The program follows this. It is in Microsoft Basic (there seem to be nearly as many variants of Basic as there are types of micro) so it should be generally usable. I've used the convention of more than one instruction on a line, separated by colons, to save space and speed up run time. As it stands, the program gives a screenful of information at a time, but you have to rewrite line 120 each time (419 to 399, etc). If you want a single run for your printer, change 120 to read 440 TO 220, and the word PRINT to LPRINT. For a more exact set of results (but twice as many) change 120 to 880 TO 440. Compromise by 880 TO 440 STEP -2.

HZ	DCT	NOTE	+/-	399	4	G	+	30	357	4	F	+	38	
440	4	A	+	0	398	4	G	+	26	356	4	F	+	33
439	4	A	-	4	397	4	G	+	21	355	4	F	+	28
438	4	A	-	8	396	4	G	+	17	354	4	F	+	23
437	4	A	-	12	395	4	G	+	13	353	4	F	+	18
436	4	A	-	16	394	4	G	+	8	352	4	F	+	13
435	4	A	-	20	393	4	G	+	4	351	4	F	+	8
434	4	A	-	24	392	4	G	+	0	350	4	F	+	3
433	4	A	-	28	391	4	G	-	5	349	4	F	-	2
432	4	A	-	32	390	4	G	-	9	348	4	F	-	7
431	4	A	-	36	389	4	G	-	14	347	4	F	-	12
430	4	A	-	40	388	4	G	-	18	346	4	F	-	17
429	4	A	-	44	387	4	G	-	23	345	4	F	-	22
428	4	A	-	48	386	4	G	-	27	344	4	F	-	27
427	4	G#	+	48	385	4	G	-	32	343	4	F	-	32
426	4	G#	+	44	384	4	G	-	36	342	4	F	-	37
425	4	G#	+	39	383	4	G	-	41	341	4	F	-	42
424	4	G#	+	35	382	4	G	-	45	340	4	F	-	47
423	4	G#	+	31	381	4	F#	-	50	339	4	E	+	48
422	4	G#	+	27	380	4	F#	+	46	338	4	E	+	43
421	4	G#	+	23	379	4	F#	+	41	337	4	E	+	38
420	4	G#	+	19	378	4	F#	+	37	336	4	E	+	33
419	4	G#	+	15	377	4	F#	+	32	335	4	E	+	27
418	4	G#	+	11	376	4	F#	+	27	334	4	E	+	22
417	4	G#	+	7	375	4	F#	+	23	333	4	E	+	17
416	4	G#	+	2	374	4	F#	+	18	332	4	E	+	12
415	4	G#	-	2	373	4	F#	+	14	331	4	E	+	7
414	4	G#	-	6	372	4	F#	+	9	330	4	E	+	1
413	4	G#	-	10	371	4	F#	+	4	329	4	E	-	4
412	4	G#	-	14	370	4	F#	+	0	328	4	E	-	9
411	4	G#	-	19	369	4	F#	-	5	327	4	E	-	14
410	4	G#	-	23	368	4	F#	-	10	326	4	E	-	20
409	4	G#	-	27	367	4	F#	-	15	325	4	E	-	25
408	4	G#	-	31	366	4	F#	-	19	324	4	E	-	30
407	4	G#	-	35	365	4	F#	-	24	323	4	E	-	36
406	4	G#	-	40	364	4	F#	-	29	322	4	E	-	41
405	4	G#	-	44	363	4	F#	-	34	321	4	E	-	46
404	4	G#	-	48	362	4	F#	-	38	320	4	Eb	+	48
403	4	G	+	47	361	4	F#	-	43	319	4	Eb	+	43
402	4	G	+	43	360	4	F#	-	48	318	4	Eb	+	37
401	4	G	+	39	359	4	F	+	47	317	4	Eb	+	32
400	4	G	+	34	358	4	F	+	42	316	4	Eb	+	26

315	4	Eb + 21	283	4	C# + 35	251	3	B + 28
314	4	Eb + 15	282	4	C# + 29	250	3	B + 21
313	4	Eb + 10	281	4	C# + 23	249	3	B + 14
312	4	Eb + 4	280	4	C# + 17	248	3	B + 7
311	4	Eb - 1	279	4	C# + 11	247	3	B + 0
310	4	Eb - 7	278	4	C# + 5	246	3	B - 7
309	4	Eb - 12	277	4	C# - 2	245	3	B - 14
308	4	Eb - 18	276	4	C# - 8	244	3	B - 21
307	4	Eb - 24	275	4	C# - 14	243	3	B - 28
306	4	Eb - 29	274	4	C# - 20	242	3	B - 35
305	4	Eb - 35	273	4	C# - 27	241	3	B - 43
304	4	Eb - 41	272	4	C# - 33	240	3	Bb - 50
303	4	Eb - 46	271	4	C# - 40	239	3	Bb + 43
302	4	D + 48	270	4	C# - 46	238	3	Bb + 36
301	4	D + 42	269	4	C + 48	237	3	Bb + 28
300	4	D + 36	268	4	C + 41	236	3	Bb + 21
299	4	D + 31	267	4	C + 35	235	3	Bb + 14
298	4	D + 25	266	4	C + 28	234	3	Bb + 6
297	4	D + 19	265	4	C + 22	233	3	Bb - 1
296	4	D + 13	264	4	C + 15	232	3	Bb - 9
295	4	D + 7	263	4	C + 9	231	3	Bb - 16
294	4	D + 1	262	4	C + 2	230	3	Bb - 24
293	4	D - 4	261	4	C - 5	229	3	Bb - 31
292	4	D - 10	260	4	C - 11	228	3	Bb - 39
291	4	D - 16	259	4	C - 18	227	3	Bb - 46
290	4	D - 22	258	4	C - 25	226	3	A + 46
289	4	D - 28	257	4	C - 31	225	3	A + 38
288	4	D - 34	256	4	C - 38	224	3	A + 31
287	4	D - 40	255	4	C - 45	223	3	A + 23
286	4	D - 46	254	3	B + 48	222	3	A + 15
285	4	C# + 48	253	3	B + 41	221	3	A + 7
284	4	C# + 42	252	3	B + 35	220	3	A + 0

5 DIM A\$(20)

10 A\$(1)="A ";A\$(2)="Bb";A\$(3)="B ";A\$(4)="C "

20 A\$(5)="C#";A\$(6)="D ";A\$(7)="Eb";A\$(8)="E "

30 A\$(9)="F ";A\$(10)="F#";A\$(11)="G ";A\$(12)="G#"

40 A\$(13)="A ";A\$(14)="Bb";A\$(15)="B ";A\$(16)="C "

100 PRINT TAB(2)"HZ"TAB(6)"OCT"TAB(11)"NOTE"TAB(17)"+/-"

120 FOR X= 440 TO 420 STEP -1

130 E=((LOG(X/55)/LOG(2))\*24+43)/24

140 F=INT(E);G=(E-F)\*12+.5;H=INT(G)

150 I=G-H;I=I\*100;J=INT(I);H=H+3

157 IF J > 50 THEN H=H+1

160 IF J < 50 THEN K# = " + "

170 IF J > 50 THEN K# = " - "

180 IF J > 50 THEN J = 100-J

200 PRINT TAB(1) X TAB(6) F TAB(12) A\$(H) TAB(14) K#;J;

210 NEXT

EUROPEAN MUSIC WIRE MAKING PLACES:

German and French speaking regions - 17th.-19th. C.

Different studies have been published these last few years dealing with early music wire. These studies formed also the subject of many comments in FoMRHI-Qs. In most of them early music wire is treated as a general concept: "the early music wire". Thus we forget that the historical technical background was not only very different from ours, but changing from region to region, from epoch to epoch to a degree we sometimes cannot grasp. So it is not possible to speak clearly of the early music wire without geographical precisions. The great and difficult problem is then the attribution of a geographical origin to an old wire sample. In her recent and exciting study, Martha Goodway emphasizes that point making the following remark with which I fully agree: "in practice it is the uncertainty as to the source and date of manufacture (of early music wire samples) that remains a major problem in research on ancient materials." (I, p.929). A long road lies in front of us: many spheres of research must be interconnected to approach a reliable state of knowledge in that field. Only when the puzzle is more complete - technical and commercial early documents, analyses and practical experimenting - we will (perhaps) be able to specify, when studying a given sample, which of the different early iron music wire available at that time is meant.

"The" music wire mentioned in today's publications has a theoretical existence (in our modern studies) but the chemical and physical characteristics of the different kinds of early wire having really existed were dependent on the techniques used in the regions of their origin. As it is not possible to speak of a standard early music wire, it seems important not only to make research on the surviving wire itself - to collect as many analyses as possible - but to find out the places of production and the processes used there, the appearance, the changes and the disappearance of these together with the trading conditions and commercial changes.

Starting from the remark of Martha Goodway, my aim in this communication is:

a. To call the attention to the problem of geographical diversity, when touching historical facts.

b. To publish some documents which, I hope, will help us to reach our goal.

a. We must remember that geographical diversity leads very often in early times to a technical diversity. It is not rare to see, in the history of technology, two neighbouring places having two very different approaches to the same problem, i.e. in a given technical area two processes differ completely, though the product obtained can be employed for the same purpose. To illustrate that remark with a comparison of what happened in a yet better known field than the metallurgical processes for refining iron or preparing steel for music wire, one could refer to early harpsichord building

divided into its diverse regional schools for example. Seen in this context, we may ask ourselves if the discovery made by Martha Goodway is applicable to all kinds of wire made in Europe during the "three centuries of harpsichord making". Maybe! But generalizing, as we often do, is sometimes not suitable for early times!

b. To provide researchers with data which could be a step to establishing a map of European music wire making and further that of European music wire trading, I publish here some documents found in early sources. These data could bring us to other discoveries in a more technical field: knowing where iron/steel music wire was made in the past, it will be possible for us to get precise information on what kind of ores and processes were respectively used and, further, to get an insight into the influence of these raw materials and processes on the quality of the music wire in close correlation with the geographical origin. This latter determines the characteristics of the ores having been employed, which in turn influence the processes of the craftsmen, and so on....

### First place: Nuremberg

1. We know that Nuremberg was the great centre of music wire making until the middle of the last century. As far as I know, no exhaustive work, devoted to the history of music wire making in Nuremberg has been published until recently. Though the Franconian town was well known for its music wire available in all countries, some other regions also produced this specialized product.

### Crain

2. In his description of the "Herzogthum Crain", published in 1689, Johann Weichard von VALVASOR mentions music wire making in the chapter devoted to the locality called Wochain or Bohina: "Insonderheyt seynd daselbst viel Drahtzieher / beschäftigt / sowol einen ganz dicken / als auch den subtilsten Drat / und gleichfalls solchen / welcher den Instrumenten / Cithern / und Harpffen / bequem / zu ziehen." [Many wire drawers are occupied here to make very thick wire together with the finest one, and also those which are used on musical instruments, cithara and harps.] (2, III, p.395) The wire made here was **iron or steel** wire as we learn from the rest of Valvasor's text. As the latter points out, the owner of that wire drawing factory is "Herr Locatelli" who owns many other "Hammerwerke" ironworks in the same region. Further research must be undertaken to attempt to describe the techniques in use here to produce iron or steel (?) for music wire. Crain is the region south of Carinthia and Styria, two of the principal places of iron and steel manufacturing over centuries.

### The Austrian Monarchy

3. In 1827, Höck gives a good account of music wire making in the countries belonging at his time to "the Austrian Monarchy". "Im Lande unter der Ens ist der Lilienfelder Draht aus dem Drahtzuge zu Frauenthal bei Lilienfeld der beliebteste (...) und von Claviermachern, Nadlern u. starck gekauft. (...) In Waidhofen an der Ips sind 2 vorzügliche Eisendrahtwerke, welche allein jährlich 80,000 Pfund Draht von der

größten Sorte bis zu den feinsten Claviersaiten liefern. In Oberösterreich gibt es im Salzburger Kreise, zu Schwertberg und Freistadt im Mühlkreise und zu Hochhausen im Traunkreise Drahtzuge. Die Salzburgerischen Drahte werden insbesondere sehr häufig zu Claviersaiten benutzt und die Hochhauser zeichnen sich durch ihre Feinheit und Geschmeidigkeit aus. (In Steiermark findet sich) der fürstlich Schwarzenbergische Drahtzug zu Murau, welcher sehr feinen Saitendraht liefert." <3, p.58-59>. Six places clearly named where iron/steel music wire was made. Praised for its good quality, we hear from HÖCK that it was made from high ductile raw material (pure Osemundlike iron or a special kind of ductile steel-like iron?). This latter term can disturb our modern mind. But we must know that the Ancients did not understand by "steel" exactly what we mean today.

4. Also in Austria we again hear of a place not mentioned by Höck, but producing brass and copper music wire, in the work of C. Fr. G. THON: "Die k.k. Nadelburger Fabrik, unweit Neustadt in Oestreich unter der Ens, liefert dem Handel folgende Sorten von Messingdraht: (...) Perldraht in Schachteln von 1 Pfd.; Zitterdraht in Schachteln von 5 Pfd. ect..." <4, 1, p.303>. It is not yet clear whether the "Zitterdraht" was also used on keyboard instruments or only on Citharalike instruments.

#### France

5. During the greater part of the 18th century it seems that France was totally dependent on the foreign market in the field of music wire. In the 1780s we hear of French music wire in the work of DE DIETRICH. The three volumes he published in 1786 are the account of his long travel through France visiting the mines and forges of the kingdom. DE DIETRICH's writing gives very valuable details concerning metallurgical works in France during the 18th century. "La forge de Ramberviller, sise sur le ruisseau de Mortagne, établie en 1719 (...) ne consiste qu'en deux affineries et un marteau. (...) On y fabrique annuellement environ quatre cent cinquante milliers de fer en barres, dont cent vingt se reduisent en fer de martinet. (...) Des douze cents quintaux de fer martinet, cents milliers sont convertis en verges crénelées et expédiés pour les manufactures de fil de fer de Tours en Touraine et de l'Aigle en Normandie. La ductilité de ces fers les rend susceptibles d'être files d'une grande finesse et on en fait des cordes de clavecin." <5, p.9>. Ductile iron was here also praised and used for making harspichord wire.

#### TOURS

DE DIETRICH mentions Tours as a place of wire drawing in France. The "Direction des Archives d'Indre-et-Loire" made some research at my request and informed me that no wire-drawing activity can be found in Tours itself but that a 'Manufacture Royale de tréfilerie' did exist near Tours (Ripault located on the Indres). It was created in 1770 and disappeared in 1786, the year of the publication of DE DIETRICH. The Archives provided me with a copy of the visiting protocol dated 1784. On the last page of this manuscript we see the detail of the stock found in the warehouse by the investigators (See next page). The gauge numbers visible there do not correspond to a music wire gauge system but to the typical French "normal" wire gauge. (The PP -passe perle- is usually between 0,40 and 0,65mm. in diameter). Was music wire drawn in that

Tarif des Fets de Soie de leur manufacture,  
pris au dit Magasin des Soies Primées  
et compagnie.

Numeros.	Prix des boites de 10 <sup>2</sup>	Prix ou cent perces.
<u>Passerelle</u> <u>marque PP.</u>	3 <sup>o</sup> 152	37. 10 <sup>s</sup>
1	3 10	35.
2	3 5	32. 10
3	3 2 6 <sup>f</sup>	31. 5.
4	3	30
5 et 6	2 17 6	28. 15.
7 et 8	2 15	27. 10.
9 et 10	2 12 6	26. 15.
11 et 12	2 7 6	23. 15.
13 et 14	2 5	22. 10
15 et 16	2 2 6	21. 5.
17 et 18	2	20
19 et 20	1 17 6	18. 15.
21 et 22	1 15	17. 15
23 et 24	1 10	15.
00	5 5	52. 10
0	4 5	42. 10 <sup>s</sup>

Je soussigné, inspecteur des manufactures, soussigné, de la  
d'aujourd'hui, certifie que le présent est un rendu par nous  
à Monsieur l'intendant de la situation actuelle  
de la manufacture Royale de tréfileries de cané,  
est exact et véritable, et que nous l'avons fait  
l'examen et vérification de toutes les parties qui la  
composent. en soy sequoy l'avons signé. A Tours  
ce quinze Novembre mil sept cent quatre vingt quatre

M. de la Roche  
[Signature]

factory? Does the precise statement of DE DIETRICH apply to both Tours and L'Aigle or only to this latter? In that case DE DIETRICH's data are confirmed by other sources.

#### L'AIGLE

In fact concerning the second town mentioned by DE DIETRICH, L'Aigle, we know that this locality was the great centre of wire drawing in France. Needles and wire for the carding industry were the two specialities of the wire drawers of that region over centuries (S. Hubbard...p.205). In the last decades of the 18th century, stimulated partly by the increasing demand in France for wire of higher tensile strength (for building of the first suspension bridges) great efforts were made in that town located in the present "Département de l'Orne" to produce the high quality iron and steel wire which had to be imported up to that time from foreign countries. Among those imported goods was also music wire.

A family of wire drawers whose name is MOUCHEL is attached to the rise of this industry. They began to produce good music wire right from the last decades of the 18th century. This was made possible by choosing a supplier of well suited raw material, ductile iron bars. We know that the wire drawers of Normandy for a long time used the iron prepared in their own region for their traditional products requiring a harder iron. (See above and Musique Ancienne, 18, p.10). Since this raw material was inappropriate for music wire, the Mouchels had the idea to visit different "affineries" in France <6, XXII, p.63->. Finally they decided to use iron bars coming from the "Département de Haute-Saône", another wellknown place of very old metallurgical traditions (See DE DIETRICH). The method usually employed there in the fineries was the so called "méthode Franc-comtoise".

The quality of the Mouchels' product was so high that the special Jury of the Society for Encouragement awarded them a gold medal in 1820. An account of that is found in the "Annales de l'Industrie": "La tréfilerie de France doit beaucoup à ce manufacturier [Mouchel]; La Prusse qui, jusqu'à ce jour, nous avait fourni les cordes de clavecin et de piano, ne doit plus nous en approvisionner, puisque ce fabricant les vend à 10 pour cent meilleur marché. Ses qualités sont excellentes et les prix modérés." <7, II, p.120-121>. Apparently French musical instrument makers from the end of the 18th century onwards did no longer depended on foreign products in that field. (As we hear from the account of 1820, France imported its harpsichord and forte-piano wire from what was called in 1820 "Prussian countries"). But it remains unclear whether all French instrument makers used this new French product and how it did spread over the country.

#### PLEYEL

An other name must be recalled finally in this context: Pleyel. The patent he took out in 1810 has been translated and published by HARDING, (Hist. of the Piano-Forte, p.386-389). It is a well known document and we do not need to linger over it here. Finally, we do not know if Pleyel produced his wire for his own purpose or if he sold it all over the country and elsewhere.

To go farther...

These various excerpts of early documents inform us of some of the places where music wire was produced in the 17th, 18th and beginning of the 19th centuries. We have limited our scope to German and French speaking regions.

These documents do not give us useful information on when the production of music wire began or ceased respectively here and there. They also do not inform us of the trade in these products and their diffusion. Where were they available? Which instrument makers used them, when and where?

Nevertheless these are two important questions, if we consider that the surviving samples found on historical instruments and analysed and/or measured today can have one of those (or other not yet known) countries of origin. Once more, due to the specificity of the processes in use in the past, cross-regional thinking on our part is then not always possible.

Despite the weakness of these data, they are finally very valuable sign posts for further research in the archives, a long path but the only one which can help us to obtain a precise image of the history of music wire as it has been and not as it seems to have been or as we would like it to have been.

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- <1> Martha Goodway, Phosphorus in Antique Iron Music Wire, Science, 236, May 1987.
  - <2> Valvasor, Johann Weichard von, Die Ehre des Herzogthums Crain, Laubach, 1689.
  - <3> Höck, Der Nadler und der Drahtzieher, Neuer Schauplatz der Künste und Handwerke, Band 31, Weimar, 1827.
  - <4> Thon, C., Fr., G., Warenlexikon, Ilmenau, 1829-1832.
  - <5> Dietrich, Frédéric de, Description des gîtes de minerais et des bouches à feu de la France, Paris, 1786-An VIII.
  - <6> Journal des mines ou Recueil de Mémoires sur l'exploitation des Mines, et sur les Sciences et les Arts qui s'y rapportent..., Paris, 1807.
  - <7> Annales de l'industrie nationale et étrangère, ou Mercure technologique, Paris, 1820.

WIRE DRAWING and WORKING CONDITIONS

18th Century - England

When studying early documents in the history of technology we are always interested by data or recipes of a purely technical nature. As I have emphasised many times, a pluridisciplinary position is more than desirable when a quite precise image of a given part of early civilisation must be reached. In that interdisciplinarity we are not allowed to forget the sociological aspect of historical technology. We remember that behind all the facts that we are interested in, there are humans living in a given epoch and in a given country. Humans with their specific mentality and traditions, with their everyday problems and their own possibilities for finding solutions.

The following excerpt deals with a case of a special nature encountered in a wire drawing factory in England in the mid-18th century. My aim in publishing this text is not to disturb highly sensitive souls, but to show once more the distance which exists between us and ancient times, not only on the technological level, but in working conditions and "health services".

My second more secret aim is to pay homage to those of the early wire drawers who often passed their entire lives, working 14 hours daily withdrawn from society in a valley, the only place where energy was available. It would be interesting for us to get a better insight into their minds and to hear what they knew about the use of the music wire they produced daily. Did some of them have at least one opportunity in their lives to hear the sound of an arrogantly... decorated two manual harpsichord?

Philosophical Transactions.... of the Royal Society, London, 1761,  
vol.LI, 1760, Part II, p.936.

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LXXXIV. *An Account of the Case of a young Man, who had lost the Use of his Hands by cleansing Brass Wire; by Mr. Samuel More, Apothecary in Jermy-Street. Communicated by Charles Morton, M. D. Secretary to the Royal Society.*

Read Dec. 11, 1760. **T**HE disorders, to which mechanics are unavoidably subjected by their employments, have exercised the pens of several ingenious writers; among whom I would not presume to appear, but that, I hope, the publishing the following case may be of some service: for I am certain, every one, who has been in the least conversant with the labouring people of this town, must frequently have observed their hands in a condition something

something resembling, though perhaps not quite so bad as, that of the young man, whose disorder is the subject of the following paper.

And as there is great reason to believe, that the complaint, herein treated of, frequently happens to persons employed in the dyeing business, they will hereafter have a method of cure laid before them, which, with little expence, will probably be of great service to them. And, on that consideration only, I have been induced to submit this account of the disease to the inspection of the public.

*The Case of Francis Newman, Nephew and Apprentice to Mr. Newman, Dyer, in the Maize, Southwark, who had lost the Use of his Hands by cleansing Brass Wire.*

FOR the more readily explaining the following case, it is proper to premise, that, in drawing brass wire for the pin-makers, the frequent passing it through the fire, to anneal it, covers it with a crust, which it is necessary to take off, before they can make use of it; and, for this purpose, it is sent to the dyers, who, letting it lie for some time in the liquor, with which they have dyed what they call Saxon colours, (which liquor is composed of water, oil of vitriol, alum, tartar, &c.) and then throwing it forcibly three or four times against the ground, the crust is, by degrees, broken off, and the wire rendered bright, and fit for use. The gratuity given for this is generally allowed to the apprentices; and in this work Francis Newman had frequently (at his leisure hours) employed himself, till about the month of August 1759, when the cuticle on the palms of his hands, and the inside of his fingers, was become so hard and rigid, that he was no longer capable of doing either this, or any other business.

For relief of this disorder, he applied to the person, who attends the family in capacity of apothecary, who gave him several doses of purging physic, but without success.

He was next admitted an out-patient at St. Thomas's hospital, where he attended six weeks or two months, but without receiving any benefit.

Somebody then told him, his complaint was owing to the scurvy, (to which he had been subject) and he accordingly applied himself to several persons, who advertise remedies for curing that distemper, and, among the rest, to Mr. Ward, of whom he had some pills; and once, by mistake, took two of them for a dose, which operated so violently, that every body in the family imagined he could not survive it: however, he still continued in the same condition.

And now thinking, that if he was admitted an in-patient at the hospital, he should be more likely to obtain a cure, he got himself admitted, and was there about two months longer; at the end of which time he was discharged, but in no better condition than before.

About a fortnight after this, and a twelvemonth from the beginning of his disorder, viz. August 10, 1760, the person, who is foreman to Mr. Newman, desired leave to write to me, for my opinion of the case; which being very readily granted, he desired me, by letter, to come and see a young man, who, as he expressed it "had poisoned his hands with brass and oil of vitriol."

When I first visited him, I found him with his hands quite stiff, and utterly incapable of any business whatever; and having already had so much advice, and taken so many medicines, he concluded his disorder was incurable, and that he should entirely lose the use of his hands, the *skin on the palms* of them (the right hand rather the worst of the two) having the *exact appearance of parchment, full of chaps*; and when I endeavoured, by force, to streighten the fingers, the *blood started from every joint* of them.

After hearing the best account I could get of the cause of his complaint, I imagined, that, as the disease had been contracted by his frequently dipping his hands into a violently-acid liquor, the most probable method of relieving him would be, by the application of an emollient liniment, mixed with an alkaline lixivium. For this purpose, I ordered as follows:

℞ Ol. Olivar. ℥iv.  
Lixivii. Salis Alkalin. fix. ℥ii. M.  
F. Linimentum.

With this he was ordered to anoint his hands frequently, especially going to bed; and, to prevent the liniment being too soon rubbed off, constantly to wear a pair of gloves.

About four days after, I found the skin a little softened, and I could extend the fingers with less pain than before; and no blood issued, upon my endeavouring to move them. This would have encouraged me to have continued the use of the same liniment; but as he complained much of its making his hands

smart every time he used it, (and, indeed, this was the first application among the many he had tried, that ever gave him any uneasiness) I concluded, that the addition of some yolk of egg might lessen the acrimony of the alkaline salt, without at all abating the efficacy of the liniment: I therefore composed the liniment thus:

℞ Ol. Olivar. ℥iv.  
Lixivii. Salis Alk. fix. ℥ii.  
Vitel. Ovor. N<sup>o</sup>. ii. f. Linimentum;

to be used as before. This mixture not giving him so much pain as the former, he had used it all in three days; and then, coming to me for more, I found his hands still continue to mend; the skin that had grown hard scaling off, and a new flexible one appearing underneath; the chaps were many of them healed; and he began to have some use of his fingers. Encouraged by this success, he continued the use of the last prescribed liniment; and as, from his not having had the proper use of his fingers for so long a time, the joints of them had, in a great degree, lost their motion, I advised him, alternately to clench his fist, and to stretch out his fingers, many times a day.

The disorder had been so long upon him, and (if I may be allowed the expression) had taken so deep root, that, although he began very sensibly to amend, from the first application of the liniment, yet it was full two months before I thought it adviseable to leave off the use of it; and then, to prevent a relapse, I gave him the following ointment:

℞ Axung. Porcin. ℥ii.  
Vitel. Ovi.  
Ol. Lavend. gr. v. f. Unguentum.

with orders to anoint his hands with it every night going to bed. This ointment he has continued to use about a month; and is now perfectly restored to the use of his hands, and begins again to work at his business.

During this course of anointing, he took no internal medicines, except three doses of purging physic.

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## THE CASE OF THE MYTHICAL KINKS

Nicolas Meeùs

Eph's discussion of the physics of bowing (Comm. 820) in response to the questions in my Comm. 795 is far from satisfying. "Some people imagine, he writes, that the stick part of the cycle ends when the increased force due to increased displacement finally overcomes the frictional force". This "error", he adds, has been made by such distinguished acousticians as A. Wood or A. H. Benade. The Grove article on the Acoustics of bowing indeed claims that "the bow is freed from the string not as a result of the gradual increase in stress between the rosined hair and the rosined string, but because the kink has arrived to set it loose". The main point of my Comm. 795 was of asking how the kink sets the bow loose. Eph provides no answer on this and leaves the impression that the whole matter is one of dogma.

We might find a ground for agreement in the facts that the kink is a shape taken by the string and that the increase in restoring force is not so much a matter of displacement than one of the shape of the string. The points where the string is bent, more precisely, are the only points where a restoring force can apply; the forces acting at points where the string is straight exert themselves in opposite directions and cancel out. It might appear, then, that adepts of the force of the kink and those of the power of the restoring force actually speak of the same thing.

Eph rightly points that if the string were freed because the bow pulled it a critical distance from its rest position, then the frequency would be controlled by the bowing pressure and speed and by the coefficient of friction. This is perfectly true and I agree that what determines the end of the cycle must be the return of the kink traveling along the string rather than the distance at which the bow pulls. But at the same time the reason why the string is freed when the kink arrives must be that the shape of the kink at that moment is such that the restoring force overcomes the frictional force. Wood and Benade might then be reconciled with Schelleng and Hutchins in the following statement (paraphrasing Wood): "The string adheres to the bow and moves with it until, because of the return of the kink, the tension overcomes the static friction ...". This is what I implied in Comm. 795 when I said that the kink synchronizes the vibration.

A closer consideration of the problem indicates that this solution isn't watertight, however. Indeed, if the string still sticks to the bow when the kink reaches it, then whether the kink can free it or not may depend on bowing pressure and speed and on the coefficient of friction. In other terms, the claim that the kink frees the string rather than the restoring force may not afford a solution. This seems so unescapable that I now believe that the string is freed from the bow before the return of the kink. More about this below.

Before turning to a closer examination of the movements of the bowed string, a word ought to be said about the 'Helmholtz approximation'; Eph's comments on it are inadequate. It is not 'a highly idealized and simplified picture of what happens when a string is bowed'; rather, it is the analysis of what Helmholtz was able to observe looking at a real string through his 'vibration microscope' (a microscope fastened to the prong of a tuning fork).

Helmholtz saw curves of various shapes, which he resolved into plottings of the displacements of one point of the string against time. Appendix VI of Sensations of Tone provides a mathematical analysis of these plottings.

The description is purely experimental; it is not a hypothesis. If it includes approximations, it can only be that the apparatus was not accurate or that Helmholtz himself introduced simplifications when plotting the curves; both seem probable. But it is not true that Helmholtz 'neglected that the bridge is not a stationary end of the string', since he observed a real violin string.

I find it almost incredible that modern descriptions (Grove's, at least) of the effect of bowing still rely these observations and report no methodological improvement since Helmholtz. Eph seems to be aware of a better description, as he alludes to an 'extra kink in the string's shape at the bow' which is not accounted for by Helmholtz. May I repeat my request in Comm. 795, that I'd like to know about more accurate descriptions of the effect of bowing, or is this a secret?

It is not extremely difficult (1) to draw string shapes of a bowed string following the same principles as those used for plucked strings. The traditional analysis of the movements of plucked strings assumes that the system is non-dissipative, that the string is perfectly flexible and that there is no rounding at the plucking point. If these assumptions are good for a plucked string, they should be acceptable for a bowed string as well. Additional assumptions have to be made concerning the speed of the bow and the moment when the string sticks. The figure below is drawn for a string bowed at  $1/4$  of its length, assuming that the bow speed  $b$  is  $1/3$  of that of the free vibrating string,  $v$ . The assumptions concerning the moments when the string sticks will be discussed below.

At  $t=0$ , the string starts slipping. I assume it to be completely free, that is that the frictional force immediately becomes negligible (2); everything happens, therefore, as if the string had been plucked. The point under the bow starts moving downwards at a constant velocity  $v$ ; the relative speed string/bow is then  $v+b$ ; or, as we assumed that the velocity of the bow is  $v/3$ , the relative velocity  $rv$  is  $4v/3$ . The kink formed by the bow divides into two halves that travel in opposite directions along the string at the natural velocity  $c$  of the wave in the string. At  $t=P/8$ , the left-hand half of the kink (let's label it  $LK$ ) is reflected at the left end of the string. At  $t=P/4$ ,  $LK$  is back under the bow. The point of the string under the bow stops at this moment (as the theory of plucked strings indicates) and the relative velocity falls down to that of the bow,  $v/3$ .

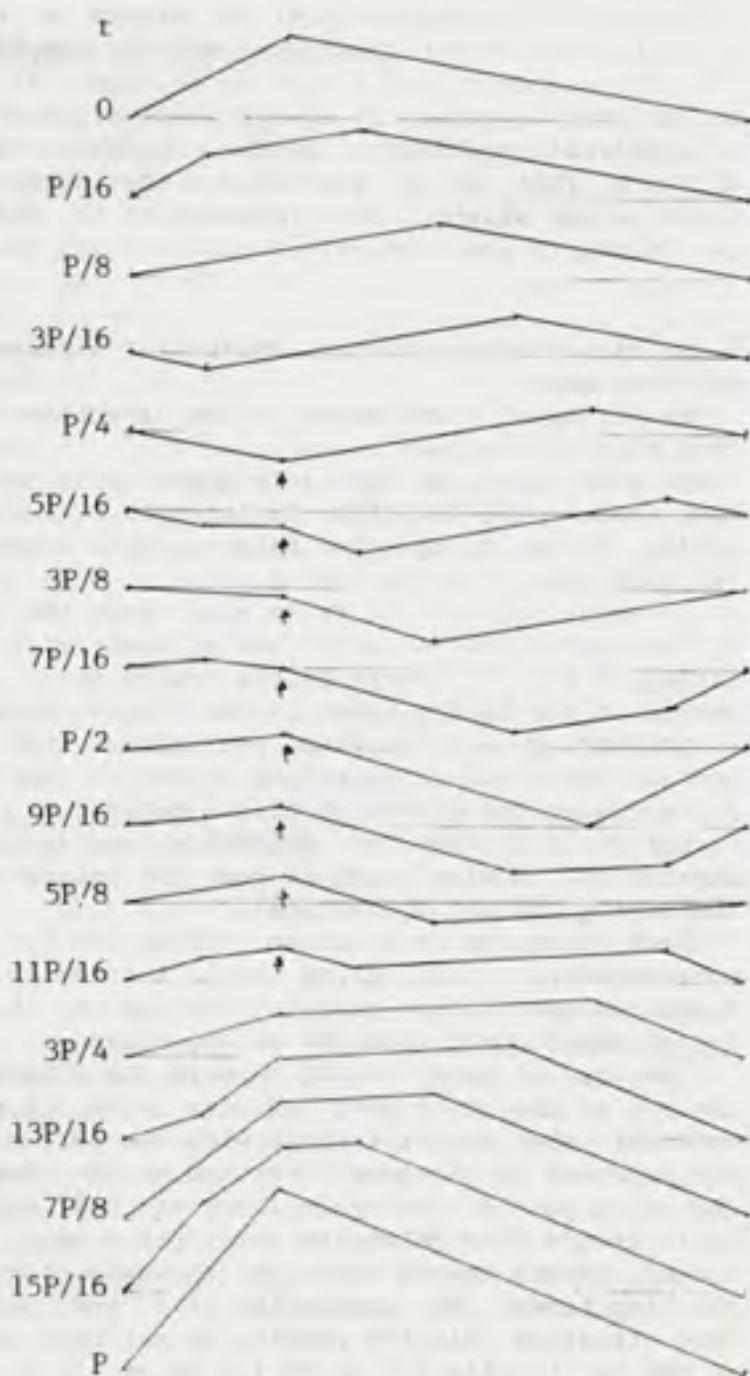
(1) Well, it may not seem that easy. The figure is constructed considering that the kinks travel at the constant velocity  $c = \sqrt{T/lm}$  where  $T$  is the tension and  $lm$  the linear mass of the string; the velocity of any point along the string is affected by the passage of the apex of the kinks. The two halves of the initial kink accelerate the string by an amount  $v$  (or  $-v$  after reflection) that depends on the initial amplitude and on the bowing point ratio. The two halves of the extra kink to be mentioned accelerate by an amount equal to the velocity of the bow.

(2) The transformation of the rectilinear movement of the bow into the oscillatory movement of the string implies that the friction coefficient drastically reduces as the relative speed bow/string increases.

This must be the start of the stick part of the cycle. The point under the bow now moves upwards at the speed of the bow. This creates a new kink (Eph's extra kink) which again divides into two halves traveling in opposite directions at a velocity  $\underline{c}$ . The reflections of the left-hand part of this extra kink at the left end of the string produces a most interesting oscillation between the bowing point and the left end, as can be seen between  $t=p/4$  and  $t=3P/4$ . The period of this oscillation appears to be  $P/4$ ; it is of course dependant on the bowing point ratio.

The right-hand half of the initial kink,  $\underline{RK}$ , is reflected at the right end of the string at  $t=3P/8$  and starts traveling towards the left. The right-hand part of the extra kink (say,  $\underline{RE}$ ) is in the meanwhile traveling rightwards with  $\underline{LK}$  (these two happen to be superposed, since it is the passage of  $\underline{LK}$  that created  $\underline{RE}$ ).  $\underline{RK}$  meets  $\underline{RE}+\underline{LK}$  at  $t=P/2$ , when the point at  $3/4$  of the string length reaches its maximum amplitude and starts its return movement. Because of this superposition of kinks, the return velocity will not be  $\underline{v}$ , but rather  $\underline{v}+\underline{b}$  (the free-vibration velocity + that of the bow).

$\underline{RK}$  continues traveling towards the left and reaches the point under the bow at  $t=3P/4$ . At this moment,  $\underline{RK}$  tends to accelerate the point under the bow to an upwards velocity of  $\underline{v}+\underline{b}$ . The whole thing appears to make sense only if  $\underline{RK}$  is able to free the string at this moment, so that I assume that the stick part of the cycle now stops and that the string continues its fly-back movement at the velocity  $\underline{v}+\underline{b}$  (the relative velocity string/bow being equal to  $\underline{v}$ ). The subsequent shapes are drawn on the basis of this assumption. As can be seen, the initial kink is fully reconstructed at  $t=P$ , ready for a new cycle.



The height of the kink at  $t=P$  is more than twice what it was at  $t=0$ . This is due to our assumption that the system is non-dissipative: the energy fed in by the bow is not dissipated and the amplitudes would soon become enormous if subsequent cycles were to be drawn. It is unfortunately not possible to include the effect of energy dissipation at the bridge: this would involve unsolvable problems of bridge impedance. It may reasonably be argued that a figure that would account for the dissipation (if that were possible) would become slightly more ressemblant to the one that can be deduced from the Helmholtz description. It could hardly become identical, though.

If my elucubrations are not entirely ridiculous, the following conclusions may be drawn:

- the string at times moves in the direction of the bow at a velocity larger than that of the bow.
- the stick part of the cycle starts when one half of the initial kink is back under the bow after having been reflected on the nearest end of the string. For a bowing point ratio  $r$ , this happens at  $t=rP$  (for a bowing point ratio of  $1/4$ , at  $t=P/4$ , etc.).
- the stick part of the cycle ends when the other half of the initial kink is back under the bow after having been reflected on the farthest end of the string, i.e. at  $t=P-rP$  (for a bowing point ratio of  $1/4$ , at  $3P/4$ ; see the arrows at the bowing point in the figure above).
- the string is free when the initial kink halves return after a full period; their effect therefore is not of setting the string loose, but well of inverting the direction of its motion.
- contrarily to what the Helmholtz description says, it is not indifferent whether the bowing point is near the bridge or near the nut. The shapes of the string are not symmetrical.
- there occurs an oscillation between the bow and the bridge at a frequency corresponding to the string length between the bowing point and the bridge. A similar oscillation probably obtains on the other side of the bow, but it is not immediately apparent on the drawing.

The crucial point in all this is the determination of the beginning and the end of the stick part of the cycle. It seems an oversimplification to consider that it corresponds with the part of the cycle during which the string moves in the same direction as the bow. According to my hypothesis, the stick part of the cycle lasts one half of the period for a bowing point ratio of  $1/4$  (the Helmholtz description says  $3/4$  of the period for the same ratio). Actual bowing point ratios would often be less than  $1/4$ , with longer sticking times. My assumption of a bow velocity equal to a third of the free-vibration velocity permits to estimate amplitudes in the order of .3 mm at 660 Hz (violin e") or of 1.5 mm at 130 Hz (cello C) for a moderate bow speed of about 20 cm/sec, with relative velocities string/bow in the order of 60 and 80 cm/sec. Actual amplitudes may be larger than that, which would indicate larger relative velocities. From the scant information that I found about friction coefficients, there would be so to say no friction at such speeds.

Response to Meeus on the Bowed String

I am disappointed that my explanation of the physics of bowing was not satisfying to Nicolas. I was trying to impart understanding and not promulgate dogma. It is obvious that I should have gone into more detail about the dynamics of the string motion and its interaction with the bow.

We agree that the shape of the string and not the increased restoring force resulting from increased displacement is what sets the string loose from the bow to start the fly-back. This corrects the error made by the acousticians mentioned in my Comm (and which Benade has acknowledged). The kink is the important aspect of the shape, and the important other factor is what Helmholtz measured with his vibration-microscope: each point on the string is in sawtooth motion, ie with two alternating constant velocities of different magnitudes (different except at the string centre) in opposite directions. The change in velocity of that point on the string occurs when the kink passes it. Almost all of the energy of the string's vibration is invested in the one mode of motion with the kink looping around the string back and forth between the two ends. This mode of motion is stable and continues if one lifts the bow.

Let us now consider the point on the string where the bow hair is. For most of each cycle the string velocity equals the bow velocity and we have the stick part of the stick-slip cycle. Then the kink in the string comes to the bowing point. There is a change in string velocity at that point with magnitude equalling the sum of the magnitudes of the individual velocities (because the directions are opposite). The string has mass so a change of velocity implies a change of momentum. The rate of change of momentum is by definition a force. That force, coming from the energy carried by the kink, not only changes the string's velocity but also pulls the string away from its locked position onto the bow hair.

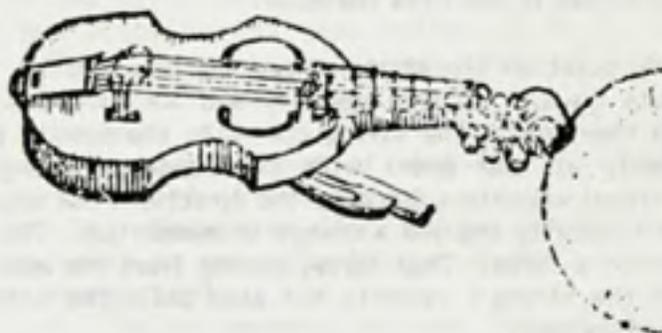
On the last page of Nicolas's Comm he mentions the possibility that his 'elucidations' (I hadn't realized that Nicolas works with candlelight or an oil lamp) might possibly be ridiculous. Unfortunately, they are, being easily dismissed by following the velocity of movement of any point with time in his diagrams and noticing that it does not conform to the results of Helmholtz's vibration-microscope observations. The extra kink at the bow position is purely the result of the force the bow hair exerts on the string (displacing it further than it would be without the bow) during the 'stick' part of the cycle, and the sliding-friction force during the 'flyback' part of the cycle. For references on the physics of the bowed string, the book Musical Acoustics, ed C M Hutchins (Stoudsberg 1975-6) has an excellent selection of reprints of the best articles up to that date.

## An Embryonic Bass Bar?

Michael Morrow has sent me these woodcuts of viols that he found in the Basel University copy of Reutterlein, Christian Egenolf (Frankfurt am Meyn, 1536). What I find particularly interesting are the black areas under the closest feet of the bridges. Whether these are the treble or bass feet is not clear since the arrangement of pegs in the pegbox implies reversal. If they were holes that the bridge feet went through (like on the Welsh Crwth), then what are the little white radiating lines (like toes) at the hole plane? My guess is that they are metal plates between the soundboard and bridge which perform the function of a bass bar in increasing the inertia of one foot of the bridge. Any other ideas?

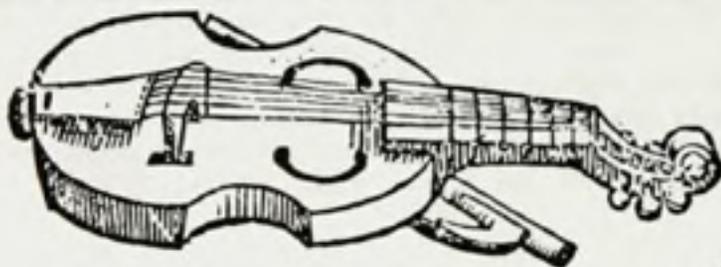
## DISCANTVS

So



## BASSVS

So

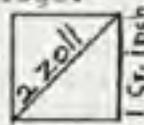


THE APPARENT GEOMETRY OF JAKOB STAINER: AN ELEGANT SYNTHESIS OF TIROLEAN ZOLL, BRUNSWICK INCH; AND CREMONESE INCH

The apparent geometry used by Jakob Stainer in the two violins and the cello described here, is remarkable for the way he combines the measuring systems of the Tirol, Brunswick and Cremona, and also for his complex interrelations of various triangles (particularly equalateral), circles and squares. This is a summary of a brief study which is necessarily rather experimental; the geometry is that which I think explains the shape and dimensions of Stainer's instruments. I am indebted to Kevin Coates' fine book "Geometry, Proportion and the Art of Lutherie" (Clarendon Press, Oxford 1985), which provided the inspiration and suggested the methods of study. Many thanks also to Tim Whelan, Richard Schaumloffel, and my mother.

VIOLONCELLO 1647 I think this is probably a genuine Stainer, but I have not had this verified. The cello is mine, I did the drawing, and I worked out the the shape, size and position of the unoriginal parts (neck, fingerboard, tailpiece, bridge, tailpin and tuning-pegs). Body-length B-Dd c. 724mm = 26 Tirol zoll (within 0.5mm). (One Tirol zoll = 27.84mm). Main geometry: Two circles, centred at E and F, both with diameter 8 zoll, and which intersect half-way into each other at C (centre of body). Diamond BJDJ of two equalateral triangles whose sides are 15 zoll, and whose common base runs through C. Equal. triangle QPP which forms a 6-pointed star (almost perfect) with triangle DJJ. Square SSPpp, sides 11 zoll.

VIOLIN 167- Owned by Stanley Ritchie, recently reconstructed to baroque-form, and described on pp. 185-6 of The Strad, July 1981. Outline taken from a drawing by Ian Watchorn. Body-length B-D 354mm = just over 9 Cremonese inches (0.75mm more). (I take the Cremonese inch in the shortest version given by Coates: one Cr. inch = 39.25mm.) Main geometry: Circle centred on F, diam 4 zoll. this circle encloses a complex of geometry in Cr. inches: square, sides 2 Cr. inches, and 4 semi-circles diam. 2 Cr. inches forming a figure like a 4-pointed star, which is also linked to the bridge. (The Cremona inch and Tirol zoll have a convenient relationship: a square with sides of one Cr. inch will contain a diagonal of two zoll.) Semi-circle TKKkT, diam. 7 Br. inches (one Brunswick inch = 23.78mm). Diamond BJDJ of 2 equal. triangles whose common base runs through C. Diamond QRUR of 2 equal. triangles, sides 5 Br. inches, and diamond QTDT of 2 equal. triangles, sides 7 Br. inches. Equal. triangle BSS, sides 5 Br. inches, and triangle BPP forming star with triangle JJD.



VIOLIN 1679 This violin appears on pp. 195-9 of "Französische Schule und Deutsche Meister", vol. VIII of the series "Alte Meisterergeligen" (Verlag das Musikinstrument, Frankfurt am Main, 1982); reconstructed since then to baroque form. The pegbox is thought not to be original, therefore I have reconstructed the geometry only of the body. Outline from a drawing by Ian Watchorn. Body-length B-Dd 352mm = just under 9 Cr. inches (1.25mm less). Main geometry: Circle centred at F, diam. nearly 6 Br. inches (c. 1mm less), which intersects half-way two more circles of the same diameter centred at PK and Pk; F is 6 Br. inches from Dd. Circle centred at f, diam. 4 zoll; f 5 zoll from D and 6 zoll from M. The f circle encloses a complex of geometry in Cremonese inches, including 4 semicircles constructing a 4-pointed star linked to the

bridge, and linked to a square  $qlfl$  (sides 2 Cr. inches), which in turn is linked to C and S by a semicircle (diam. 2 Cr. inches) centred at q. Another semicircle (diam. 5 zoll) links S and E, and is centred at B. Diamond  $QTDDT$  is of two equal triangles, sides  $4\frac{1}{2}$  Cr. inches. Equal triangle  $LLDd$  (sides 6 Cr. inches) touches circles F and f, and intersects square  $Qlfl$ . Equal triangle  $JJDd$  has sides of 7 zoll, and equal triangle  $MfM$  has sides of 6 zoll. Triangle  $QJJ$  has 2 sides of 5 zoll and one side of 7 zoll, and it forms a diamond in zoll  $QJDDQ$ , while triangle  $QLL$  (2 sides of 4 Cr. inches, one side of 6 Cr. inches) forms a diamond in Cr. inches  $QLDdL$ . (L marks the narrowest part of the body.) Equal triangle  $qpp$  forms an almost perfect 5-pointed star with  $JJDd$ . That the zoll-circle f is measured in zoll from D, the Brunswick-inch-circle F is in Brunswick inches from Dd, and the line L that contains the Cremonese-inch-square is in Cremonese inches from Dd, strongly suggests that Stainer used these three units of measurement deliberately.

**SIDE GEOMETRY** The side-dimensions and apparent geometry of the bodies of both violins are almost identical. On the cello, 167- violin and probably the 1679 violin, there is an apparent base-line level with the highest point of the back, a centre-line (somewhat off-centre in the cello) running through the tail-pin, and various diagonals linking the different parts through mid-points and corners. All three systems of lines are apparently used in determining the position of the pegbox. In the cello, there is also the apparent continuation of lines from the inner edges of the top and back-plates to the pegbox. There is no doubt as to the height of the bridge when 4 diagonals converge at its top! Three of these cello diagonals join the line of the inner-edge of the back-plate at equal distances from each other, and exactly half-way between these points are other landmarks (A and the two ends of the upper bout). The cello ribs are tapered: 4 zoll at saddle, 3mm less o/end.

**SHARED PROPORTIONS** Many measurements on the cello are exactly double that on one or the other violin or both: Total length of instrument: 167- violin (Aa-D) = 21 zoll, cello (Aa-Dd) = 42 zoll. A-C: 167- violin = 13 Br. inches, cello = 26 Br. inches. Pegbox: 167- violin (a-f parallel to base-line) =  $3\frac{1}{2}$  zoll, cello (Aa-j) = 7 zoll. B-V: 1679 violin = 8 Br. inches, cello 16 Br. inches. Narrowest width of body: 1679 violin = 4 zoll, cello = 8 zoll. Depth of body: violins (depth of body + bridge) = 4 Br. inches, cello (depth of body at bridge, without bridge) = 8 Br. inches. Depth of top and back plates: violins =  $1\frac{1}{2}$  Br. inches, cello = 3 Br. inches. Bridge width: violins =  $1\frac{1}{2}$  zoll, cello = 3 zoll. (The height of the cello-bridge is a harmonious 3 Br. inches.) Sound-hole-circle: violins = 4 zoll, cello = 8 zoll. T/T-Dd (lower-bout + tail-pin): 1679 violin =  $6\frac{1}{2}$  Br. inches, cello = 13 Br. inches. P/P-S/S = S-S (at extremities of the corners) on the 1679 violin and the cello.

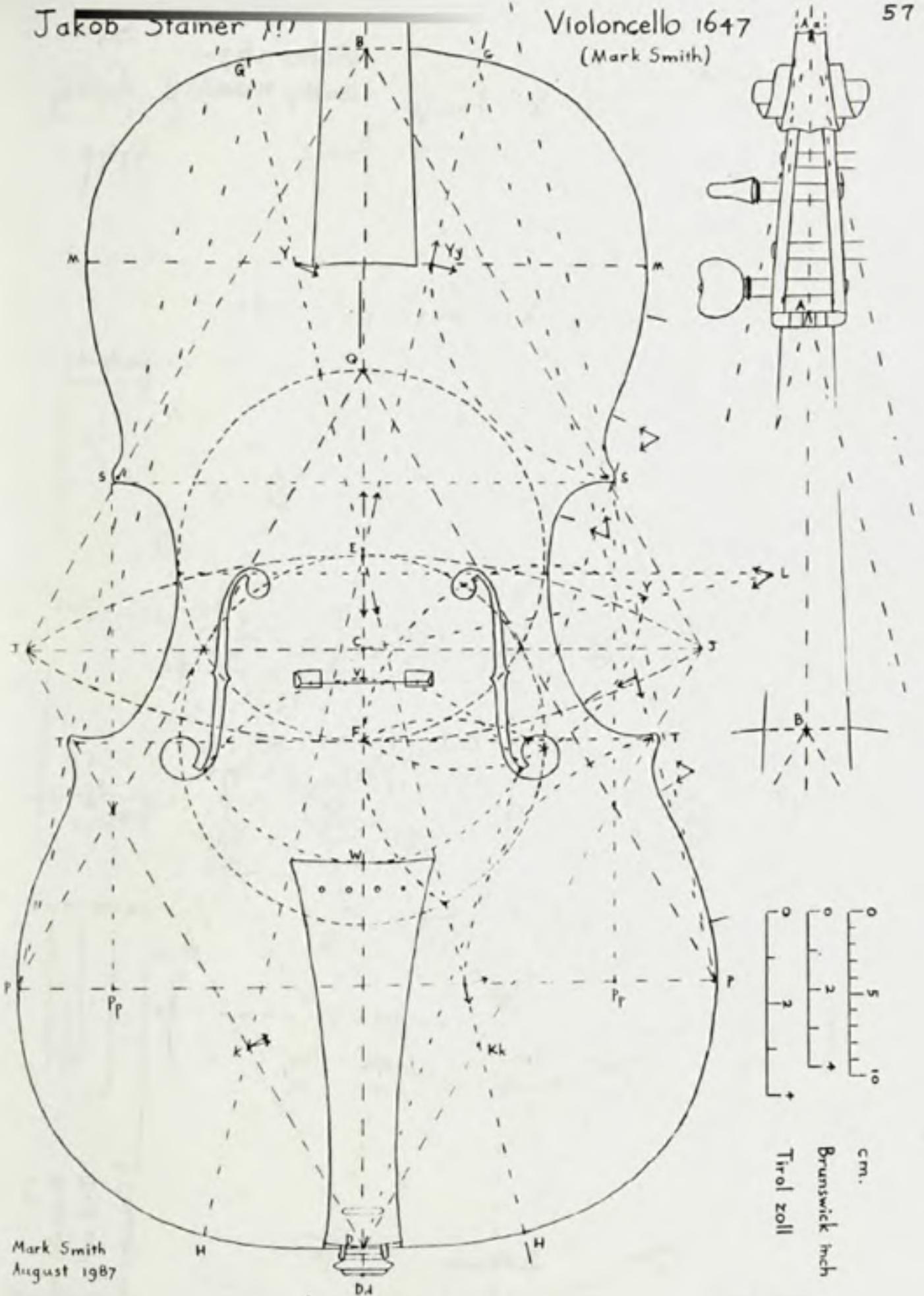
**POSSIBLE INFLUENCES** Some of Stainer's apparent geometry is the same as that used by the Italians, e.g. the sound-hole circle, and the cross centred at E (given by Coates), and the diamond  $BJDJ$  (given by Sacconi for Stradivarius). Have Coates and Sacconi given all the geometry? Perhaps there is more that Stainer copied. According to Coates, the Br. inch was apparently used by many luthiers "in the south" (i.e. Italy), and in Coates' 1654 Strad violin the Cr. and Br. inches both seem to be used, although Coates believes this is probably coincidental. If Cremonese makers combined these two units of measurement, it is only one step further for Stainer to add the Inch of his native Tirol. Was Stainer's use of the Christian Vesica Piscis, Jewish star, and Islamic crescent deliberate?



Jakob Stainer !!!

Violoncello 1647  
(Mark Smith)

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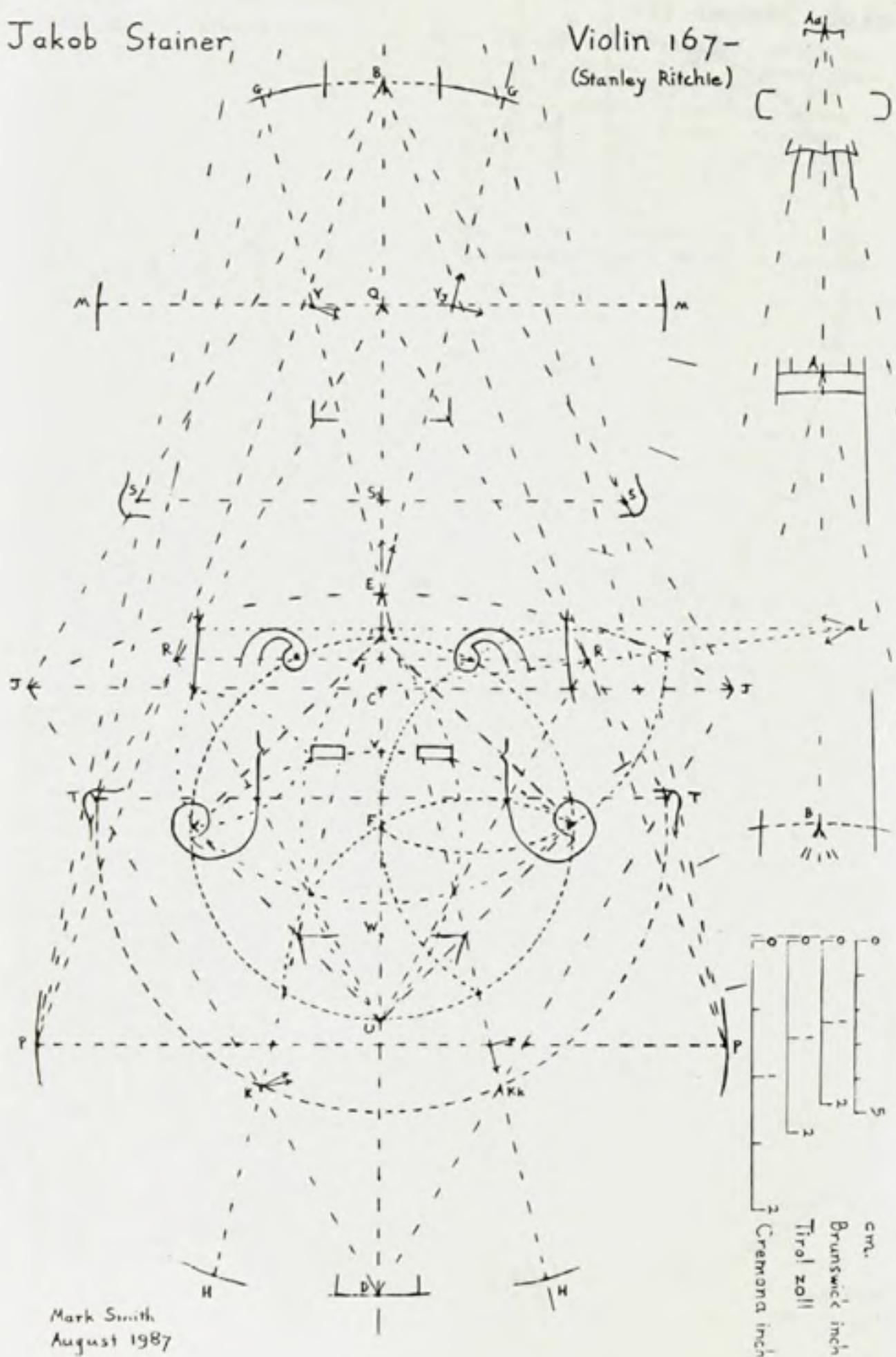


Mark Smith  
August 1987

cm.  
Brunswick inch  
Tirol Zoll

Jakob Stainer,

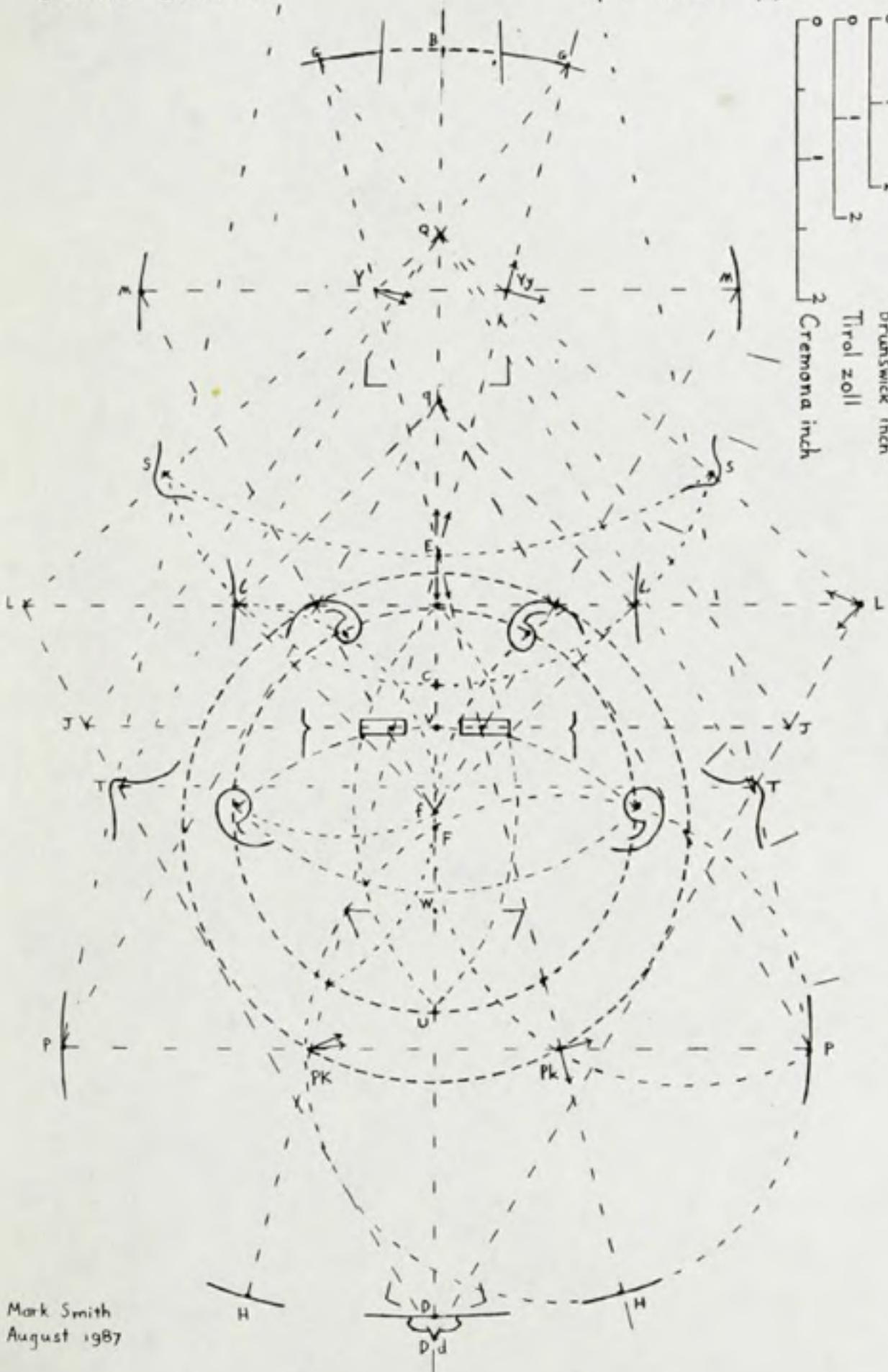
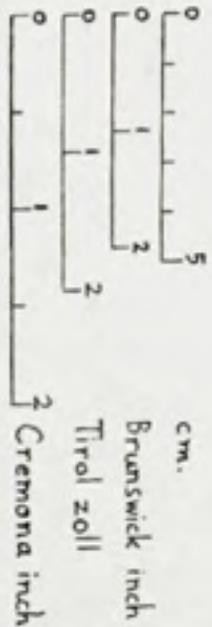
Violin 167-  
(Stanley Ritchie)



Mark Smith  
August 1987

Jakob Stainer

Violin 1679



Mark Smith  
August 1987

