FOMRHI Quarterly

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FELLOWSHIP OF MAKERS AND RESEARCHERS
OF HISTORICAL INSTRUMENTS

HON. SEC: Jeremy Montagu, c/o Faculty of Music,
St. Aldate’s. Oxford OX1 1DB, U. K.
Subscription Renewals: These are now due for 1983. We could say that due to great care, rigid economy, etc, etc, we have managed to keep the figure the same as for the last few years, but in fact it's due to you — if you'd sent us more Comms and other material, we'd have spent more money this year and would have had to put the rates up. You didn't; so once again it's £4.50 for UK and by surface mail to anywhere and £6.00 for airmail to anywhere (see below for comments on airmail to Europe). If you're paying in your own currency (not in £ sterling), please add the equivalent of £1 to cover what the bank will charge us to convert it; this applies also to Eurocheques, whatever currency they are expressed in. It does not apply to GIRO cheques (no, we don't have a GIRO account number, but GIRO cheques arrive quite safely through the usual international channels). I know that Eurocheques are a convenience to those of you who have such accounts, but they are a nuisance to us; it takes months to clear one and costs a packet, I don't know why.

When sending your subscription, please send it to Margaret's new address, not her old one: Margaret Crowe, 2 Well Lane, Enmore Green, Shaftesbury, Dorset SP7 8LP (it's on the invoice herewith as well as here); if you want to be formal, she is Mrs Dennis Crowe. Do please put her name on the envelope, not just FMRI - she may not have the post office trained yet, and do try to get the address right: a few subscriptions languished next door last year till her neighbours got back from a protracted holiday.

And do please send your renewal while it's still fresh in your mind. It's easier for Margaret if they come in over the next couple of months instead of a rush between Christmas and New Year. If you don't send it, you won't get the January issue and we'll have to waste your money sending you a reminder.

AIR MAIL to EUROPE: You've been paying us for this (some of you anyway) and we've been paying the post office for it. Despite the fact that Enzo has been putting ALL UP or LETTER or other cabalistic phrases on the envelopes, and paying the right amount when he takes them in, the post office have been stamping them 2ND PAID and sending them by surface; sending by surface we knew about from complaints from some of you; what we didn't know was the 2ND PAID stamp until Luis Pereira sent us back an envelope and Cary Karp quoted what his said. Enzo has sent a complaint to the Sheffield Head Postmaster (on 3rd September), asking him to send me a copy of his reply; so far (8th October) nothing has been heard. However, he will see that this one gets stamped properly when he takes it in, and we'll see what happens. The thing is that he takes in a great boxful of these, so many hundred 2nd class internal, so many printed matter Europe and overseas, so many Europe airmail and so many to each overseas zone airmail. He pays a lump sum to cover the whole and they then stamp them up after he's gone. This time I'm sure he'll stand over them. So, compare the postmark and the arrival dates of this issue and decide whether it's worth the extra cost for next year.

CHANGE of NAME: The sharp-eyed among you may have noticed something different about the top line of this page and the front-cover (I hope). The word Restorers has been causing some difficulty (it's basically a semantic problem in English) and it has therefore been
decided that it would be politic to drop it. It was generally agreed that FoMRHI is well enough known that we could not change the acronym, but it was not felt that the acronym was enough by itself; we ought to have a full name. So Researchers was chosen as something that covered all of us, makers, restorers, collectors, writers, lecturers, conservators and anything else; if you're not interested in research, you're not likely to read or to belong to FoMRHI. It has left only one problem: the preposition. Makers of but researchers ?? Any suggestions for getting round this without disturbing the FoMRHI would be gratefully received (but not if it means Makers of and Researchers into... that's too complicated even if it's grammatically correct.

REPRINTS: I asked those of you who have been waiting to be patient, and you have been. The trouble is that I can't cope. It's not a big job (though there is a back-log of those who are being patient) but I simply have not the time to leave the Bate, go upstairs and stand at the copying machine for an hour or two, nor can I, in fairness to the rest of the Faculty, gum the machine up for so long. So, can we have a volunteer please? Can somebody get access to a copy machine, preferably that will cope with double-sided printing, at a reasonable rate (say up to 4p a side, which is about half the commercial rate) with the time to spare to do the job and the willingness to do it properly instead of making a mess of it like me? There are quite a few members who want complete sets (1-11 are now out of print) and others who want odd Comms. If they can be stapled up properly, all the better, but in the past they have been supplied as flat sheets and the customer has been left to staple or sew them with needle and thread or whatever. Replies to me, please, with full details of cost (including postage in 100 gram steps to everywhere, and don't forget that envelopes cost money too). I can supply a set of masters, so it's not a matter of taking your own copy to pieces. Meanwhile, my apologies to the patient and frustrated among you.

NEW FELLOWS: Three have been elected, Bob Barclay, Friedemann Hellwig and Toon Moonen. I owe Toon an apology — I should have reported his election in the last Bull.

INDEX: You will find a brief Index for Qs 1-28 in this issue, thanks to Ken Williams. Meanwhile, Rod Jenkins, who compiled the last one (and who is compiling one for 1982) has got at a computer and is producing a fully detailed index for all Qs, which will appear in due course. Ken's will keep us going for the time being and I for one am very grateful to him.

LOST MEMBER: Has anyone seen or heard of Laurence Marshall? Q28 came back from Wilbraham Road, Manchester marked 'Gone Away'.

FURTHER TO: Comm.409. Robert Bigio writes:

I would also like to take Eph Segerman to task over his mention of screw cutting in his piece on bows (FoMRHI ??). Threads are very easy to cut on a plain lathe without screwcutting equipment by using thread chasers. I was fortunate enough to have been taught to chase threads by hand before I heard anyone say that it is supposed to be difficult. I find that I can cut accurate threads, inside and outside, in less time than it would take me to find and mount change wheels on a screwcutting lathe. Holtzappfel gives a reasonable description of the process. It is interesting that in London until very recently many threaded objects (including plumber's brassware) was produced by hand in this manner. A few years ago I came across a small firm that produced laboratory products in brass and plastics, all done using thread chasers. An old boy in this firm explained that 'in the old days' most of the work was done with
of the same pitch (26 TPI) because the men were often changing jobs but would have had difficulty adjusting to different pitches. On occasion precision work, such as for microscopes, cameras and telescopes was done using a finer pitched thread but always, according to this old boy, by hand.

A thread chaser is a chisel-shaped tool with teeth ( ) that must be moved at precisely the right speed in relation to the rotation of the work. This is actually not as difficult as it would seem. The only tricky part is in trying to pick up the thread in the same position when you go over the thread again and again. This is easy enough on a treadle lathe (you start cutting at the top of the travel of the treadle each time) and even easier on a pole lathe, which stops completely each time the treadle reaches the top or bottom of its travel. On a motorised lathe it is sometimes helpful to put a chalk mark on the chuck to help you see where you are.

I would be delighted to demonstrate the process to anyone who comes to the Tate Collection Flute Weekend in November.

Bull.28, p.3: Robert Bigio again:

I would like to take up David Owen's point about flute bores and how they were produced. The Stanesby flute that I copy has spiral marks similar to those described by David Owen in renaissance flutes. These marks appear only in the bore of the headjoint, which of course is cylindrical, and resemble the spiral marks in the bore of a rifle. My experience of Stanesby's work suggests that he rarely did anything without good reason (for example he seems to have allowed for the compression of the tenons of his flutes). However, in this case the spiral marks seem to have no effect whatever on the sound of the flute. My guess is that the marks were caused by the wide end of a tapered D-section reamer that was used by hand to remove the small amount required after the instrument was allowed to settle and to shrink. I have reproduced the spiral marks in this manner but, as I have said, have noticed no change in playing characteristics. (In fact the player who bought the flute from me took the marks to be a sign of poor craftsmanship!)

The reamer I mentioned is ancient - 18th or 19th century - and seems to have been forged from a round or hexagonal bar. The reamer has a long tang that is much thinner than the cutting edge and would allow it to be used to bore straight through a cylindrical section such as a flute headjoint:

I am not sure that I agree with David Owen that early flutes were produced on continuously-rotating lathes. It is perfectly possible that the finishing cuts were produced by rotating the instrument by hand against a fixed reamer (or vice versa), or indeed that the dozen or so revolutions of a pole lathe would have sufficed to bore through an instrument if little material needed to be removed. It is interesting that Holtzappfel notes that turners were slow to abandon their pole (or otherwise reciprocating) lathes and that Bergeron, who writes at some length on flute making, advises that flutes be reamed by hand. I have always believed that makers have always made do with the simplest and cheapest equipment they could get away with; some proof of this is that Rudall, Cruttenden and Co. had a pole lathe in their workshops until the 1950's.
Bull 28 p.5: Two replies to George Bowden's question about copal varnish, which may be useful to others too. The first from Paul HailDerin. first the original and then his "Gebrauchs" translation:


63.
Schöner und heller Kopalfirmisse.

Der stossse schönen hellen durchsichtigen Kopal, etwas gröbelich, bringe ihn in einen neuen gut glasaerten Topf und lasse ihn bey müssigem Schlenfauer, unter Öfterem Umrühren mit einem hölzernen Spatel, langsam schmelzen. Veraphret man während dem Umrühren, dass der Kopal völlig geschmolzen ist, so geisseet man heller wässern, aber ganz kochenden Leinölfirmisse, den man auf einen andern Schlenfauer in Bereit-schaft stehen hat, ganz langsam zu dem geschmolzenen Kopal und rühret während den Zugliessen mit dem hölzernen Spatell die Lasse fleissig um, damit sich beydess wohl mitminder verbindet.

Man wird finden, sobald der Kochende Leinölfirmisse auf einmal zu häufig beyregessen wird, dass der Kopal augenblicklich auf einen Blumen zusammenfahrt, within ist dieser Hengriff (sic, Handgriff) wohl in Acht zu nehmen, auch muss beym langsemen ZuGliessen fleissig umgerühret werden. Ist dieses geschehen und der Kopal völlig in Fluss gebracht, so hebt man das Gefasse vom Feuer ab, und bringt noch so viel erwärmetes Terpentinöl dazu, bis der Leckfirmisse genug Flussigkeit zum Aufstreichen hat; nehemd wird er auf Glas oder Blech probirt, wie bey gesehetem Bernstein.


* aus 2.66 (g.64)

Denn thut man nochmals einige Tröpfen auf Glas oder Eisenblech, hält solches etwas abweise und bechoschen; ob der Firniss stehen bleibt oder langsam ablaufft.

Beym Stehenbleiben ist er noch zu stark und muss also noch mehr verdünnet werden; allein beym langsem Ablaufen ist er gut, und wird dann durchgesehet und zum Gebrauch aufbewahret.

Es ist auch mehr nutzlich, in betreff seiner Helligkeit, wenn man den verfertigten Firniss in Glasflaschen thut und in die Sonnenhitze stellt, wodurch er sich um vieles abkühret und heller wird.
Fine light copal varnish.

You rub (i.e., with mortar and pestle) some light, clear copal rather coarsely, put it in a new well-glazed pot over a moderate coal fire, and let it slowly melt while stirring with a wooden spatula. When you find that the copal is completely melted, pour clear white boiling boiled-linseed-oil— which you have standing ready on another coal fire—very slowly into the melted copal and stir diligently during the pouring with the wooden spatula, in order that both parts combine well with each other.

If you pour in the boiled-linseed oil too quickly, you will find that the copal instantly clumps: this step in general, needs care, even with slow pouring you have to stir diligently. When this is done and the copal is completely dissolved, take the pot from the fire and add enough warm oil of turpentine that the varnish is thin enough to brush on; afterwards the varnish is twice tested on glass or sheet metal, as above with amber.

The dosage of both oils which are added to the copal is of equal quantities, unless you use the varnish in warm summer days or in winter in a warm room. In the first case you can give it more firmness by adding more boiled-linseed oil; but in the second case give less boiled-linseed oil and instead more oil of turpentine, because of the quick drying.

Bill Samson produced another recipe, from Robert Alton's Violin & Cello Building and Repairing, Reeves, 1966, p.46:

1. Melt together 3 oz of copal and 1 oz of mastic
2. Heat, and mix together 1/4 pint oil of turpentine and 1/8 pint of 'best pale drying oil'
3. Mix, slowly, the copal and mastic with the turpentine and oil, stirring constantly.

Bill goes on: I should add that these ingredients are highly inflammable and great care is necessary. I might also mention that Winsor & Newton make two excellent copal varnishes that are used by several makers and are readily available in artists' suppliers.

George has written to say that he has had a number of very useful replies, for which he is very grateful. I (jm) would add that it is often useful to send copies of such replies to me, as Paul and Bill have done, because they are often useful to other members.
MATERIALS: One of our visitors at the Bate brought up an old bassoon that he'd bought, well worm-eaten as they often are, but very neatly patched. I asked him what he had used and he said Brummer, which is a paste widely used by carpenters for filling small holes because, unlike plastic wood, for example, it doesn't shrink. It comes in a variety of colours and will take stain or paint or ink. I wasn't going to stuff it into our instruments without some enquiry, so I wrote to the firm who make it; they replied: "...and feel that Brummer Stopping would be suitable for filling the wormholes in your instruments. It has been used for over fifty years on all kinds of furniture with no adverse results. Yellow Label is mainly an inert filler with various colourings in an animal glue medium and as the fillers are inert, they should not be a problem and bone glues are a traditional adhesive for use with wood..." He goes on to be rather dubious about mixing worm-killers with it, which is probably fair enough. I'd be very grateful for any comments from anyone who has tried it. Its main advantage is that it is much easier to get into the instrument than beeswax, especially if you have one of those gadgets that dentists fill with amalgam and then push on to your hollow tooth (I picked up a box full of dentist's tools in a junk shop a few years ago, and many of them are very useful for jobs on instruments), or a wide-bore hypodermic syringe such as are used by restorers on various jobs (available from Frank Joel Ltd, Oldmedow Road, Hardwick Industrial Estate, King's Lynn, Norfolk PE30 4HH at £3.00 for five).

Frank Joel also have small humidity gauges (see Cary Karp in this month's Early Music). They aren't meant to be accurate but with practice you can read them to 10% or with luck to 5%. They are cards with an impregnated strip which changes colour with humidity; the level is where blue gives way to pink. They are designed for use in a confined space (instrument case, small show-case, etc) and are very cheap, £7.40 for 10, £62.90 for 100 and so on. I find them useful in my storage cabinets and so do other museums.

For the past few years Alan Mills has been successfully growing reed cane, Arundo donax, in Adelaide, South Australia. He uses this cane for his own reeds and has had some good reports from other reed makers about its quality. If any reed making FOMRHI members would like to try some of this cane he will mail free samples of up to 6 un gouged tubes if the recipient promises to comment upon the quality of the cane when he uses it. If you are interested please send the diameter(s) of cane you require plus the equivalent of $3.00 Australian for Surface Air Lift postage to Alan Mills, Senior Lecturer in Music, Magill Campus, SACAE, Magill South Australia 5072.

William Groom offers help on methods for making small action parts for early keyboards and can supply keyboards, jacks, etc. His address is in the Supplement herewith.

When John Downing left for Canada, he left behind some wood he was in process of seasoning which isn't worth the cost of shipping over there as he can get hardwoods locally. He has three logs of English yew, two of them around five foot long by 10 inches diameter, the other three foot long, same diameter. They have been halved to reduce checking and have been seasoning for three years. They are lying at his mother's house in Oxford and are available to the first person to turn up with £15 (which is what it cost him, so no offers of less). His mother's phone number is 0865-63925. No, I won't collect them for you, but do drop in and see the Bate while you're at it.
Bob Smith (new address in this Supplement) runs or is otherwise involved with a firm called Timberline (1a Langton Road, Tunbridge Wells, Kent, tel: 0892-42051). They will supply all sorts of bits of instruments ready cut (lute ribs, in fact all the separate parts of which string instruments are made), also bow blanks, square-section bars for woodwinds, half logs and planks of most hardwoods. The stock list runs to 12pp, so I'm not reprinting it here, but write to them if you're interested. To give an idea of prices, 1/4" square African ebony costs £3.25 per foot run; boxwood from 80p per kg.

QUERIES: Paul Hailperin asks if anyone has a recipe for making water-proof glue with modern powdered casein and borax?

COURSES: A reminder (if you get this in time) about the Bate Flute Weekend, 13th and 14th November. Stephen Preston will be demonstrating, coaching and playing (open rehearsals 2.30 and concert at 8 in Holywell Music Room on the Sunday), the main work being in the Bate at the Faculty in St. Adalate's on the Saturday, from 11 am onwards. Stephen will be joined by Robert Bigio because I thought that we ought to have some time on measuring and making. I don't know how long we'll go on on the Saturday; I've said 'till 6 or later' — depends what people want. If anyone's keen, we can probably fit something in on the Sunday morning, too. All welcome; no charge except for the concert (£2.50).

Again short notice, there is a Baroque Trumpet course at the Germanisches Nationalmuseum, Nürnberg, 27-30 November, with Ed Tarr and Alfons Veronoo for playing and Heinrich and Max Thein for making. Cost is Hfl.325 and if interested get in touch quick with STIMU, Louis Peter Grijp, Drift 21, 3512 BR Utrecht, Netherlands, tel: 033-18703.

The Muskets are running recorder courses (18-20 Feb) and hurdy-gurdy (13-16 May) at £40 for boarders, £30 for day students. Their address is Michael & Doreen Muskett, Piper's Croft, Chipperfield Road, Bovingdon, Hemel Hempstead, Herts HP3 OJW. They are also dealing in instruments of all sorts.

West Dean College, as I've already mentioned, is now running an apprenticeship scheme. The first, which has just started, is for plucked strings with Chris Challen. They are hoping to add workshops for bowed strings, winds and keyboards. I have the impression that they might be interested to hear from makers who would be interested in setting up a workshop there and training apprentices (I may be out of turn; they may already know whom they want). They also run a lot of short courses in all sorts of subjects, some of which might be useful (eg blacksmithing, silversmithing. They would certainly like to hear from applicants for apprenticeships (over 18 with some woodworking experience but academic qualifications not necessary). Address is in this Supplement.

OTHER SOCIETIES: NEMA: I told you in the last Bulletin that the first annual general meeting had been postponed till September. Since then I haven't heard a thing (and I'm one of the initial steering committee). What's happened to NEMA, to its AGM or to anything, I have no idea at all. Maybe the whole thing's dead, but I'd have thought that we'd have heard if it were.

The Australian Association of Musical Instrument Makers has been founded. All the officers and branch secretaries are FoMRHI members and I imagine that every other FoMRHI member in the area has heard from them, but if not, get in touch with Raymond Holliday (address in the Supplement herewith). We wish them well and will
be happy to help them in any way that we can.

The Hurdy-Gurdy Society has now been formed (I mentioned it in Bull.27 on p.4, but that was very short notice) and if you're interested but have not been in touch with them, the Secretary is Mrs. Sheila Salisbury, 39 Nottingham Road, Bishopston, Bristol. Michael Muskett (address on previous page under Courses) is Chairman. Their sub is a bit higher than ours (£5 UK, £6 Europe, & £7 overseas, and they charge extra for a spouse, which we don't — nor do we for a partner or other associate, since all it costs us is a line in the List of Members — but they do reduce for students and OAPs, which again we don't since we work on the basis that everybody pays what it costs us).

The British Flute Society has not yet started so there's still time to get in on the ground floor if you write to the Secretary, John Francis, 65 Marlborough Place, London NW8 OPT before Jan 1st. No information on subscription yet, but they intend to produce a regular News Letter and go on from there, the aim being to bring together performers, teachers, amateurs, students and anyone interested in the flute.

GRANTS: The Crafts Council News for August has arrived, with a list of those who were awarded setting up grants etc. Two instrument makers are listed, one on violins and one on harpsichords, neither of them FoMRHI members. I don't know whether any of you applied (they say that 83 did and 11 were successful) but obviously there is at least some interest in instruments so that it is worth trying.

CRUMHORNS: You'll find a review in this issue of Barra Boydell's new book. In it, he mentions 'dubious authenticity' (or words to that effect) the instrument we have here in the Bate Collection (ex Morley Pegge). I've been having another look at it, and it is a right puzzle. The main reason for saying it's dubious is that it's made in two halves, which no others are. The trouble is that it looks old. It doesn't look like a Francioli fake (it bears no resemblance to the tournebouts, which Boydell firmly puts down to Francioli) and it doesn't look like a Mahillon or other late 19th century 'reproduction'. Obviously we don't want to niggle bits off it for dendrochronological examination, but the more I look at it, the more I wonder what, and particularly when, it is. Anyone who's interested in crumhorns might like to bear it in mind if they're ever in this direction.

FLAGEOLETS: Another puzzle while I'm at it. As you may know, we have in the Bate Collection on loan six of the instruments shown in the Zoffany picture of the Sharpe Family or the Musical Boating Party (a gang of people on a barge with a gent at the back waving his hate in front of a flag, a large lute, a serpent and so on; the original is in the National Portrait Gallery and it's also the last plate in Galpin's Old English Instruments). We have the two horns and the two clarinets, which are sitting on the harpsichord, and the two one-hand flagelolets being held in the air by the man leaning on the harpsichord. Laurence Libin was here during the summer and he looked at these and asked how they were played. I fished them out of the case and we tried them and they are damn near impossible to play with one in each hand. There are a number of rather odd features about them, and anyone who thinks he can sort them out for me would be very welcome. Also, you might have a look at the picture or Zoffany's photo (let's see if a xerox will work) and see what you think of the harpsichord.

To my and Libin's eye, unless Zoffany went badly wrong on perspec-
pective, this is not a full-size harpsichord, but a quint or even an octave instrument. It's obviously English, from what one can see. Does anyone know of an English harpsichord that might be this instrument? It would be interesting to locate it since we know where some of the other instruments are. The xerox is a bit murky, but it may come out OK.

BATE COLLECTION: We're almost back to normal after a summer of builders and plumbers. The trenches in the floor are filled, most of the carpet is back on the floor, so we are open every afternoon, Mon-Fri; one show-case is still off the wall, but that should be back before you read this and that case should be well on the way to being full of flutes, oboes and clarinets. Everything else is out in its showcases, and I hope that by Christmas everything will be labelled, though that's a slow job. Anyway, at least you can get in without breaking a leg.

SUBSCRIPTION RENEWALS: See the first paragraph of this Bulletin and the enclosed Invoice (so-headed for those who need something formal) — send it back to Margaret with your sub between now and the first of January and save yourself and FoMRHI the cost of reminding you.

DEADLINE FOR NEXT ISSUE: 4th January here for Bulletin items; up to a week later at RHT to Djilda for Comms. Djilda, Margaret and I are all on speaking terms, so if it saves postage, especially from abroad, each of us will send things to the other (ie bulletin items can go to Margaret with your sub, or your sub can come to me with bulletin items or comms, and so on).

Jeremy Montagu
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COURSES: Eric Moulder is running more reed-making courses, November 27/8, January 29/30, February 26/7, March 19/20, costing £20 per weekend, including all materials (but non-residential). January and March for shawm and curtal, November and February for capped and rackets. He says that a beginner can expect to make at least three reeds in a weekend and that last year, as people
brought their instruments with them, part of the time was spent on instrument surgeries. "Often the problems are not all to do with reeds but keys, crooks, holes etc. This makes the weekends more enjoyable as it is not all scrape, scrape, scrape." His address is in the List of Members; book in good time as his workshop is small and so numbers are limited.

PHONE NUMBER: I meant to say under BATE COLLECTION that the Post Office has changed our number, adding a 2 in front of it, so if you are ringing up to arrange a visit (always wise; if I'm at a meeting or something, the Bate isn't open, so you might waste a journey), please note we are now 0865-247069. Don't ring about FoMRHI things, though; they're easier dealt with by post.

EXHIBITION: I've just had a letter from Dirk Jacob Hamoen to say that there will be another Bouwdag in May next year. You may remember my enthusiastic reports of the last one here, both in our Bulletin, and in Early Music. They would welcome members of FoMRHI who would like to take a stand; I would remind you that the great feature of the last one was the exchange of information on how the instruments were made; it wasn't just a matter of selling your instruments, but also helping new makers with advice on how they should make instruments like them. If you're interested, put May 28th down in your diary, with a note that it will be near Utrecht, and write to Dirk Jacob at the Vereniging voor Huismuziek, Utrechtsestraat 77, Postbus 350, NL-3400 AJ Ijsselstein, Netherlands. Prepare for a strenuous day; last time, in a smaller hall than this will be, they had over 3,500 visitors in the one day. Re-reading this, it's not as clear as it should be (sorry) that it's Bouwerskontakt who are running it, our Dutch equivalent. Dirk Jacob is their me, as one might say.

TWO LAST POINTS: I said in the last Bulletin that Ben Bechtel was not a member; must have been thought transference or something, because no sooner had that issue gone to the printer but I received his renewal; welcome back again.

The other thing I should have remembered before was to congratulate (commiserate might be a better choice) Pauline Holden on taking over the Galpin Society Hon.Secretaryship. She's let herself in for a lot of work, and I wish her the best of luck with it.

That really is the lot now — off to the Post Office with it.
When Jeremy was writing his Book News (p.13) he was not aware that a review copy of the Catalogue of the Dayton Miller Flute Collection had actually been sent to us. It was sent to me as editor (a natural thing to do), and as Jeremy was reviewing it for Early Music, someone else is reviewing it for us.

Just before going to print Eph was glancing through the Bulletin and noticed Robert Bigio’s comments on screw cutting. Eph’s reply is:

“I must apologise for using secondary sources in writing the ‘History of the Screw’ section of Comm 409. Having not seen the original sources, I am not in a position to evaluate the conclusions made by the authors of the articles in the History of Technology Volumes. My statements in that section were actually paraphrases and sometimes direct quotes from those articles. The articles don’t mention the chaser until the second half of the 18th century (History of Technology Vol IV p 367) when it was used to finish up a thread that was started with a file. The historians of technology may know of evidence for the use of chasers before then and for doing the whole threading job with them easily and cheaply as Bigio suggests) and somehow didn’t include this information in the review articles I consulted. This should be looked into. But if such evidence turns out not to exist, I will stick with the historians and not go along with Bigio. We have to be very careful to realize that perhaps not obvious differences in materials and tools and in the training, traditions and attitudes of craftsmen could make what is easy at one time and place not so in another.”

At last we have got our computer printer to work in proportional spacing. Having heard so much about what readers thought of the other computer typeface, I don’t think we need worry whether they will tell us about this one.

As editor, I am responsible for monitoring the appropriateness and quality of submitted Comms. I’ve agreed with Jeremy that when there is doubt we give the author its benefit unless the issue is over-full. One area of doubt is what constitutes an historical instrument. Is modern decoration on an instrument which may otherwise be based on historical models rightfully historical? I had trouble with Comm.433. If it was longer, it certainly would have been sent back.

Comm.421 also gave me some trouble. Unauthentic practical solutions to problems that early makers seem to have solved can inhibit the search for an authentic solution. However this Comm. seems to have had the opposite effect, since our local luther/alchemist will answer it in the next issue with two historically possible soundboard finishes, with superior application and wear properties. If anyone can’t wait, contact George Stoppani at NRI.

At NRI’s new premises there is one remaining workshop available for rent. The craftsman who reserved it has not replied to our letter notifying availability and may not be coming. It is the best as far as natural light is concerned. It has about 700 square feet of floor space, eight wide windows, 3-phase electricity, floor built for heavy machinery, its own industrial electric fan heater system on a timer and thermostats, etc. The rent is £30 per week plus a pro-rata contribution to maintenance, insurance and rates. An instrument maker is preferred. Already in residence are string making, bowed instrument making and bow making under the NRI banner, and a completely independent clavichord maker. Due to join us by the new year are independent harpsichord and bagpipe makers. Anyone interested, contact me.

Finally, the Early Music Competition will be held in Manchester on Saturday 26th February 1983. There will be an associated exhibition of early instruments, and makers are invited to come and display their wares. There is no charge. Space is limited so early booking is advisable. Eph is organising it, so contact him here at NRI.
Doreen Muskett has produced a new edition of her Method for the Hurdy-Gurdy, revised and enlarged. It costs £9.75 plus postage (£6p UK, 50p surface abroad, £1.30 air to Europe, £2.60 to USA, Canada and other middle distance areas, £3.00 to Australia, New Zealand are Far East), cheques made out to her & Michael Muskett. Address under Courses in the Bulletin in this issue. It's also available in French at 115NF, including postage, from Mr. A. Bury, 19 rue des Carmes, 4500 Orléans, France.

The Dayton Miller Flute Collection at the Library of Congress in Washington is producing a new series of catalogues, compiled by Michael Seyfrit. The first volume has appeared, covering the recorders, fifes and one-key flutes. They've not sent us a copy to review, so you'll have to wait till my review appears in Early Music (probably not till April next) to see what I think of it; other reviews will doubtless be appearing over the next few months. One thing I will say here is that there isn't much more information in it than there is in the old Checklist, though there are lots of detail photos.

Contents of Bouwbrief 73 (June 1982)

10.1: Lamp spoon-type drills. Recommends drills made by Record Highways Ltd of Sheffield ("lamp standard shell augers").

10.2: A recipe for violin varnish

10.3: Principles of tuning wind instruments by Geert Jan v/d Heide.

10.4: Fret placement. (Reaction to article 10.2 in Bouwbr.24.)


11.3: Course (playing) for medieval psaltery. Will take place under the direction of belly van Ree on 11/12 Sept 1982, if there is sufficient interest. Cost 65.-. Tel. 02502-6126

For further information, write to the Hon Sec., not to me. (P.G.)

Incidentally: 18 of the 40 pages in this Bouwbrief consisted of translations from FoMRHI and one more was their equivalent of my contents summaries. How much longer will I need to bother?

JM adds: Paul has asked his final question before. The answer is that as long as they send us the Bouwbrief (which they do in exchange for FoMRHI), we'll list their contents. Paul offered to do it because he reads Dutch and I don't. If he's fed up with it, I'll go back to doing my best with it, as I used to before he took over. Or would anyone else like to do it? Preferably someone who is one of their members as well as one of ours, since I can then keep the exchange copy here for anyone who wants to see it (or can pass it on to whoever offers to take over the xeroxing of back issues, as that's one reason for keeping it).
Review of: The Recorder Collection of Frans Brüggen, Zen-On
Music Company, Tokyo, 1981. Available from Tony
Bingham, 11 Pond Street, London NW3 @ £20 plus £1 p&p.

A Catalogue with a difference. It comes in a large black fibre
folder and is in two major parts. One part is a 37 page booklet
with, on each right hand page, a photograph of one of Brüggen's
recorders, and on the opposite page, a brief description, giving
the name of the instrument (eg Recorder in f'), the maker's name,
birth place and date, if known, and death ditto. The entry for
one maker is: Hotteterre*, Paris(?) 17/18 Century (the * referring
to: The Hotteterre family being quite large, it has not yet been
clearly established as to which particular member made it). In
other words, all the available information about the maker is
there. This is followed by a list of all ascertainable former
owners, a valuable feature usually lacking in instrument cata-
logues, though normal and expected in the catalogues of art museums.
The provenance of an instrument is part of its history, a part
which is only too often neglected. The photographs look odd at
first glance until one realises that all have been printed to the
same scale. Thus the first in the book, a Stanesby jr fourth
flute in B flat (ex Bergmann) takes the full height of the page,
and the last, an octave flute in f" by Benjamin Hallett (ex Joan
Dixon) takes only the bottom third of its page. It looks odd but
it's a good idea and worth emulating.

The other part of the Catalogue is going to make it one of the
most sought after of all. It consists of a sheaf of sheets of
stiff cartridge paper, each one with a drawing with all dimensions
of one of the recorders by Frederick Morgan. As a non-maker, I
feel that it is not for me to say whether the dimensions given are
sufficient for producing a copy — it looks to me as though they
are indeed sufficient, especially since there are cross-section
drawings from which any undercutting or upward or downward sloping
of the finger holes can be gauged. All external and decorative
details are, to my eye, exactly noted. My copy of this cata-
logue will live here at the Bate Collection and any maker who
would like to examine it here and add a further review to cover
such details is very welcome to do so.

There are divergent views on Fred Morgan's plans. Some people dis-
like them because they are not laid out as engineer's drawings;
everything is handwritten and hand-drawn and there are little
notes and comments squeezed in here and there, which makes the
sheet look crowded. All the information is here however, and if
this is the way he likes to draw plans (and I've often heard it
said that nobody produces better or more exact measurements),
this is the way we get them. Personally I like them, and in many
respects there is a positive advantage in his style of lay-out:
it makes it imperative that one reads every word on the sheet,
because it's so easy to miss something important if you don't.

I think that every recorder maker will treasure this Catalogue
and will greatly appreciate Frans Brüggen's generosity in making
his whole collection available to everybody in this way. You
should realize that we have here all the information necessary
to copy every recorder in his collection. As well as those
mentioned above, the instruments are: tenor in c' by Hotteterre,
ditto by Dupuis, voice flute by Bressan, another same, another
by J.C.Denner, treble (alto) in f' by Steenbergen, another by
Stanesby sr, another by Heitz, another by Bressan, another same,
another (at church pitch) by Gahn, a fifth flute in c" by Wijne, another by Steenbergen, another by Haka, a sixth flute in d" by Stanesby jr. Plans of all these and the two mentioned at the end of the first paragraph are a bargain at £20 for any maker and I would hope of absorbing interest for any serious player and collector.

FoMRHI Comm. 427

Jeremy Montagu

Review of: W.N. James, A Word or Two on The Flute reprinted from the original edition of 1826 with an introduction by Stephen Preston. Tony Bingham, 1982. £10 (£11 by post from the publisher).

If I may quote from the blurb: "A personal and idiosyncratic view of flutes, flute players and their playing. The book is divided into three parts:— (i) a history of the flute as seen by Mr. James. An archaic view with some amusing stories. (ii) Observations on flutes and flute playing in the early 19th century. (iii) 'Scientific Memoirs' on the floowing flute players:— Nicholson, Drouët (sic; Drouët himself used the é but James uses è throughout), Rudall, Tulou, Berbiguier, Parrenou, Camus, Weidner, Saust, Ashe, Küffner, Weiss, Sola, Dressler, Monzani, Gabrielsky, Negri, pertaining to their style and performance. All of Mr. James' opinions appear to be from his personal attendance at their performances."

Part (i) is mainly of historical interest; this is what was known and thought then about the history of the instrument. The rest is of growing importance, now that early music is coming into the nineteenth century. It gives one a very good idea of what was considered important in style and technique, and it is books like this that give us the only clues to the recreation of playing styles 150 years ago. It is, for example, quite clear that mean-tone was still in use. James is discussing, mainly, the use of the 8-key flute and he stresses the variations of pitches produced by the keys when playing in different keys (in the other sense of the word). The third part is of particular interest; James heard all these players and he tells us exactly what he thinks of them, and because he goes into considerable detail we can make our own judgements through and past his own preferences. He was quite a critic: I have a certain reputation as a reviewer, I believe, but I can assure you that I am sweetness and light compared with Mr. James. Stephen Preston's introduction adds a lot of useful information about James himself. Let us hope that this reprint, which is well produced on good paper and well bound, will be followed by others which will be equally revealing on the use of other instruments.
As before (see Comm.423 in Q.28, and Qs.24 & 26) there's a lot of interesting material. From what I remember of the Reid School in 1968, when we had the Galpin 21st Anniversary Exhibition there, I can't imagine how they are getting it all in. This is really building up into a major collection, especially when you remember that the Russell Keyboard Collection in St.Cecilia Hall in the Cowgate is also part of the Edinburgh University Collection.

The single reeds, like the flutes (Q.28) and double reeds (Q.26), are based on the Rendall Collection, though again with a lot of other material. The strings are equally important, with a lot from Anne Macaulay herself and from other collectors. The percussion includes a few things from Jimmy Blades and a lot from other sources, and includes a good deal of non-European material (other non-European was separately catalogued and was reviewed previously).

It is, I think, enough to say that this is a major collection and that these check-lists tell you what's in it, and as they are so cheap, there's no reason not to have a complete set. I don't want to go into such details and questions as to why some dulcimers are catalogued as hammered strings, some as percussion, and some as both, since it then worries one about whether some other fascicles are as untidily arranged, and also whether there are some instruments which are in neither, and just what else might have dropped down the cracks. I notice, for instance, that the alto fagotto, which appeared among the double reeds, also surfaces among the single reeds (more reasonably since that's what it had), but this sort of irregularity is a worry in a catalogue and suggests lack of sufficient editorial supervision.

However, don't let that worry you enough not to buy them; after all, if they are in both places, we are doubly sure that they are there.

Much improved, too. Twenty plates, instead of twelve, and both plates and text much better printed. English notes throughout so no problems for non-Norwegians. A lot of new acquisitions since 1976, when the first edition appeared. Unfortunately, Peter Andreas didn't tell me the price, but his address is in the List of Members, so you can write and ask and then order a copy. The information given is basic but sufficient to know what's there. Eg: "Fagott RM175/2 (the museum number) Tykland (Germany). Signert: Sattler // S. Johann Cornelius Sattler, Leipzig l.halvp. 13 Sgr. Lønn (maple). 4 klaffor, Dep fra Trøndelag Folkmuseum." The words in () are taken from the glossary at the back and the rest are obvious. As with all catalogues, a must.

Toon Moonen

The book has been divided into 10 chapters each dealing with different aspects. These aspects being so divergent it seemed best to me to examine each of them separately in order to enable the reader to form as clear a picture as possible of the contents and values of this book. In its first draught this is Boydell’s dissertation. It is therefore necessary to realize that time for research was limited — much the same could be said for the collecting of data and the actual writing. This limitation clearly shows from the fact that research was halted after the phase of collecting and jotting down notes and observations. This must be the reason why and again — when reading or rather studying the book — the question rises: why doesn’t he probe deeper? However, one conclusion should be added at once — had the writer done so, two books at least would have been written and he would have been required to invest five times as much work.

A most positive side of this all is that thus many people can enjoy the book and will be stimulated to dig into the matter more deeply themselves. Using examples I’ll try to indicate for each chapter how this could be done. This is not meant to be “mere criticism” but should be taken in a different spirit: this is what the book offers, the following are some possibilities.

Chapter 1: Typology of crumhorns described — division into 5 types. I will abstain from any comment here since much of this chapter leans heavily on my own publications. A condensed version of these articles (with further elaborations) is to appear in GSJ 1985.

Chapters 2 & 3: In these the historical references and iconographical evidence have been arranged chronologically, the difference between them being that Ch. 2 deals with the certain references and evidence while Ch. 3 contains the uncertain and incorrect references. These two chapters could be best described as a filing cabinet in book form. Here and there small commentaries have been added. Personally I think these are the most interesting chapters: its total strikes me as a jigsaw puzzle with a lot of missing pieces although the picture can already be clearly distinguished. The details are influenced, of course, by these missing pieces and automatically one begins to combine the pieces, filling the gaps of the missing links oneself by hypotheses. The urge to strike out on one’s own and investigate further is thus greatly stimulated. Hence I strongly suspect that this book is going to be used regularly in future as a starting point for further research and for research into adjacent fields. The more so since this book in its subject and treatment is unique, the first of its kind.

Chapter 4: Deals with surviving crumhorns in museums, the latter having been arranged alphabetically. For each instrument, a total of 55, the following have been listed in tables: Museum number, size (soprano, alto, etc) the two significant measurements (overall length without windcap and length down to opposite upper venthole), maker’s mark and origin (if known), type and wherever necessary comments. What appears clearly is the quality of the Brussels crumhorn consort and the bad quality of the Berlin consort. Sadly enough it was the latter that served as a model for the copies built by Otto Steinkopf. It took 40 years before any true, exact copies of the Brussels consort were built by Eric Moulder. A lesson to be learnt: thorough research is necessary to determine what qualities have remained among the old surviving instruments. It is a well known fact that many instruments have survived because their quality was no longer acceptable.

Chapter 5: Deals with Jorg Wier of Meiningen whose name appears on a number of surviving instruments and who built 24 of the 55 surviving crumhorns.
don't know when he was born or when he died but he must have been dead by 1549. It can be concluded from references and sources that there must have been 500 crumhorns. In reality the number was probably higher — between 450 and 500, certainly not more. Should we estimate the number up to Jörg Wier’s death, this would yield about 120. Therefore about two-thirds of the number of crumhorns was built after Jörg Wier’s death. Of the surviving crumhorns only the Brussels and Berlin consorts are representative of post Wier crumhorns. We need no longer take the Berlin consort into consideration because it is highly probable that it was made for commercial reasons by somebody who lacked the skills and knowledge to make good instruments. As far as we know now most young crumhorns were made from older ones in a period of time following the crumhorn era.

Remains the Brussels consort, representative of about two-thirds of the total number of crumhorns that ever existed. That’s why I would have preferred Boydell to have a closer look at the probable builders of the Brussels consort: the Bassani brothers from Venice. The more so since we have known for quite some time now that, technically and musically speaking, this consort had developed most in comparison with other crumhorns. In his Jörg Wier chapter Boydell also plays around with the idea of two Jörg Wiers — a father and a son. Historically speaking this may be an interesting thought but in our crumhorn framework it neither gets us here nor there!

Chapter 4: This chapter demonstrates that the French ‘cromorne’ and the German ‘Krumhorn’ are quite different instruments. A French cromorne is not a crumhorn but a different instrument. Which instrument it is and what arguments are used to clinch the matter can be read in this chapter. This discovery is especially important in relation with the performance of early French baroque music.

Chapter 5: Deals with the origins and use of the crumhorn in the Renaissance, containing a summary account of possible origins. Far too little (to my taste anyway) is made of what Renaissance literally means: ‘rebirth’. Meant was the rebirth of Antiquity — the very reason why Italian instrument makers started looking for classical examples and modelled their instruments on these. One such crumhorn example was the Phrygian aulos used by a sect that regularly organized bacchanalian activities in the woods, far from the people’s habitats. (Wein, Weib und Gesang being the main ingredients).

The wedding of Francesco di Medici and Johanna of Austria (Florence, 1565) shows us the following. At the banquet, with crumhorn accompaniment, a scene was performed featuring 12 nymphs in the nude and an equal number of satyrs. In my opinion Boydell allows himself to be lead too strongly by the technical construction of the crumhorn rather than the Renaissance spirit when it comes to determination of origins. Not a word is said about the dark ages of the 4th-13th centuries although there certainly were crumhorn-like instruments (at least as far as shape is concerned). Cf. Charles the Bold’s Bible at Utrecht. This chapter also deals with the different names used for crumhorns, one of the most difficult yet very important obstacles to be faced. A universal one way spelling of words did not exist. There was no such thing as an Advanced Learner’s Dictionary and different names were used — a field apart to study! Every possible spelling or related concept is dealt with.

Another section of this chapter is dedicated to the social context of the crumhorn’s use. Boydell shows crumhorns were only used by professional musicians, operating at court and in the big, rich towns. He has also studied the kind of music typical of crumhorns. Several pieces are well known, but the total picture is disappointing. However, this is not such a surprise since for very few instruments only music was especially composed.

After chapter 7 — The plates: First we get clear maps of Europe, one for every period of 25 years, indicating references and sources. It is strange, to say the least, that not more data have been indicated for Spain. The three Jörg Wier crumhorns of the Brussels museum stem from Maastricht, according to Boydell’s
own information — moreover five crumhorns at Salamanca cathedral are mentioned! To my mind there must be more information in Spain. Presumably language is a problem here, to be solved by a Spanish musicologist only.

Next are the pictures of about 30 of the 50 surviving crumhorns and other wind-cap instruments, including some X-rays. Finally some iconographical pictures, about 40 — probably all there is. The plates conclude part I.

Part II: Chapter 8: The cornamusa. This is an instrument that has certainly existed, though not one has survived and there's no pictorial evidence. Again we meet the filing cabinet — all the sources have been indicated chronologically. It is striking to see in what combinations of mixed ensembles it was used. This clearly proves that a cornamusa cannot have sounded very soft. According to Praetorius they matched soft crumhorns — and this in its turn proves crumhorns must have sounded very loud. In the previous chapter Boydell mentions this phenomenon, here it is proven.

Chapter 9: Windcap shawms. Fortunately some of these have survived and there is pictorial evidence. This chapter contains several observations on the names used for these instruments. One could differ of opinion — much will probably remain hypothetical anyway.

Chapter 10: Dealing with miscellaneous and possible windcap instruments. Added as an appendix: The dolzaina because it is not certain whether or not the dolzaina is a windcap instrument. From the familiar sources it is deduced what its shape must have been like and what instrument that we know it could best be compared with. Again language and variant spellings provide an obstacle. This problem will never be satisfactorily solved unless a new Praetorius were to be unearthed suddenly (preferably a book dating back a bit further than that!). No one would object, I daresay, to it being the diary of one of the Bassani brothers!

Conclusion: The book is a rich collection of eminently usable bricks. Anybody willing can build his own wall with the available data, forming a picture of that part that interests most. It is a book that stimulates creativity. It belongs in every reference section of most libraries since it is a fascinating work not only for musicologists. Players of Renaissance music can find in it a treasure of information concerning instrumentation and the atmosphere and environment in which this kind of music was played. For people interested in cultural history it is a valuable source of information as well.

The mistakes that were made in translating (from German into English e.g.) which were pointed out to me are not of such a nature that they distort the total picture. We can differ in opinion as to the several hypotheses offered; the possibility to do just that is left open. The value of this book at least balances, if it does not outweigh, the price that has to be paid for it.

Toon Moomen, Maastricht, Sept. 1982
The advantages of unsoldered staples are that they are easy and quick to make, one can easily make sure that they are properly hardened and springy, and one has great freedom in experimenting with different shapes and sizes, as the mandrel does not have to fit the finished staple exactly (but of course it helps the closer it is). In fact it is better not to use a mandrel when tying on reeds, and with a properly made unsoldered staple there is no danger of its overlapping no matter how hard you pull. Using plenty of wax on your thread and wrapping snugly will ensure a good seal.

I use 0.35mm brass sheet for oboe staples, cutting and filing the pieces to precise dimensions top and bottom, for example 9.4 and 16mm for a staple of internal diameters 3.4 x 2 (shape: \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\]) at the top and 4.9 at the bottom (length 57 or thereabouts). The sides should be very slightly bowed to fit the mandrel best — find the right amount by trial and error. I turn the mandrel to a straight taper, but the bow accounts for the amount removed when filing the tip of the mandrel oval. When the piece of brass is correctly filed — and be careful to keep the edges filed at right angles and remove the burrs (a scraper is helpful for this and final smoothing) — anneal it, by heating to red-hot and allowing to cool. The hammering and forming of the staple I do entirely in a groove carved to fit the mandrel (plus staple) in a boxwood block, laid on top of an anvil for stability. (I never hammer directly on the anvil, except to flatten the edges of the brass after cutting roughly to size with shears). The first few blows need a hardened mandrel, tempered to a good dark straw (or light brown) colour so it won’t break. I centre the brass over the groove and give usually one good hard whap on the mandrel in the middle (x):

From this stage (result-in section: \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] or \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] at the tip) you can bend it around with your fingers and proceed if you want with an unhardened mandrel. (It is difficult to harden a mandrel without its warping slightly). Then hammer evenly all around to form and harden, except at the tip be careful not to hammer directly on the sides: \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] that will keep the tip \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] nicely shaped.

While forming the bottom you may need to use needle-nose pliers once or twice if it’s like this: \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] and then you can get it round: \[\begin{array}{c} \text{\textbullet} \\ \text{\textbullet} \end{array}\] easier. It doesn’t matter if the sides of the staple don’t meet all the way down, as they will when it is wound with thread. In any case, don’t worry about getting the staple to close until it is well rounded and hardened. Then beginning at the tip, hammer gently while withdrawing the mandrel slightly, and work your way down. With practice one can get the staples to close
at least half way down. It is important for the groove in the wooden block to be well rounded and not too wide.

As it is difficult to file an accurate and symmetrical oval shape into the mandrel by hand, some remarks may be helpful. To begin with, the mandrel must be turned on a lathe and polished smooth. In general I turn a straight taper to match the desired internal diameter at the bottom and the larger internal diameter at the top. Leave enough material for support at the tip and keep the mandrel on the lathe for filing — if you have turned it between centres, put it now in a chuck. Position the chuck with one jaw pointing exactly vertically, for example, so that you can rotate it through 180° and back, turning it to the same position each time. It is helpful to mark a line down each side of the mandrel. Begin filing, with a large (12 inch) flat file preferably single-cut, exactly horizontally. Count your strokes (10 or less), rotate the mandrel 180°, and make the same number of strokes with exactly the same angle and pressure on the other side. Continue, keeping the file always horizontal, and alternating sides, until the tip of the mandrel (or rather where the tip of the staple will be, which can be a little back from the tip of the finished mandrel) is the desired thickness. The surfaces you have filed should, in my experience, begin at a point about halfway down the length of the staple (or a little more) and curve slightly in towards the tip. One can gauge this by eye with the help of a small steel rule — rock the edge on the surface and observe the gap underneath. When these two surfaces are finished down to the desired minimum diameters and as symmetrical as you can make them (as good as you can see is good enough), then start rounding; it helps to do this at first in a similarly geometric fashion, eg. make four surfaces sloping about 40° away from the first two, still counting your strokes:

Then you can begin to make rounded strokes to complete the oval shape, and finish off with a fine file and sandpaper on a block. When it is done, cut the excess off the tip and file smooth.

The amount that the two surfaces which form the oval slope in at the tip is one factor which influences how the reeds will close. I find it helpful to have the final 6mm or so sloping in rather more than the rest, and not curved; however, every reedmaker will have his own ideal staple shape. I find it better to have the shape of the tip built into the mandrel as much as possible, rather than filing the tip of the staple too much and possibly weakening it. In my experience the step between the inside of the staple tip and the inside of the reed is not something to be avoided, but some might debate this. The outside of the staple will probably need to be smoothed over somewhat with a file, especially over the seam, and the file marks will help the thread to grip — I add some scores as well with the edge of a small scraper. When filing the ends straight and to length, don't forget to scrape the burr off the inside edges and to round the outside edge of the bottom of the staple so it can't scratch the bore.

Mary Kirkpatrick
27 September 1982
There has been much discussion recently about the materials used to finish lute soundboards. It would certainly be to our advantage if we knew exactly what was used on the soundboards of old instruments, although some makers insist that it is a moot point since no one is using exactly the same woods or strings that were used on old lutes. The old lute-makers were almost certainly working under the same commercial pressures as any large 20th-century workshop, and, like us, used whatever high-quality timbers they could get ahold of. In addition, different craftsmen probably used different materials and techniques to finish their soundboards. It is well known that old lutes have very little or nothing at all on their soundboards. This would seem to be the most relevant point of all. Modern craftsmen have discovered that even one coat of varnish on a lute soundboard has a deleterious effect on the tone of the instrument. Our main concern is to produce instruments that are acoustically, mechanically, and aesthetically similar to the instruments produced by early makers. This does not, however, preclude the use of any and all modern finishing materials. Modern craftsmen must also respond to commercial forces and the demands of their customers, as long as this can be done within historical parameters. Bare wood accumulates sweat and dirt at a rate that is intolerable to musicians who are used to having a protective varnish on their instruments.

I agree entirely with Tim Hobrough (Comm. 375) that construction methods have a marked effect on the finished product. The choice of materials has, of course, an even greater effect. But until it is known what kinds of substances the old makers used to finish their soundboards, something must be done that will have an effect similar to what was intended by those early makers. In this case it would seem to be a negative rather than a positive effect, for no finishing material can improve the tone of an instrument. Lute soundboards were finished (or not finished) with the idea of doing the least damage to the tone. My current method of finishing lute soundboards is an attempt to be consistent with this motive.

Since, as a full time instrument maker, I build a great many lutes each year, I have been able to experiment with a variety of protective coatings on lute soundboards. Although my main concern has always been acoustical, I cannot ignore cosmetic considerations since lute-making is rapidly becoming a very competitive market. I have tried and rejected egg-white sealers because they turn green, especially where the soundboard comes in contact with human skin. Sodium silicate (water glass) also turns green. Oil finishes penetrate the wood too deeply and remain soft.
They also collect dirt and discolor badly. What is needed is a finishing material that will adhere to the surface but not penetrate it too deeply; a material that will dry to a hard, durable surface resistant to mild solvents; a material that will go on in an extremely thin layer, so as not to have an adverse effect on the tone of the instrument. Modern finishing lacquers have all of these properties when applied in the following manner:

Mix one part of lacquer sanding sealer with one part of solvent. This makes an extremely thin solution that dries instantly when sprayed on the soundboard, preventing it from soaking into the wood. (If the spray gun is held too far from the soundboard, the solution will actually dry in the air and deposit a dusty film on the instrument.) Sand lightly with very fine paper. This is followed by two coats of lacquer, also mixed 1/1 with solvent. This makes an extremely thin coating that seems to have no effect on the tone of the instrument, but provides a hard and reasonably durable surface. The lacquer sanding sealer not only seals the wood but makes an excellent bonding coat between the wood and the lacquer coat. The surface may be lightly sanded or rubbed, reducing the gloss to a uniformly dull finish. Of course, this method requires the use of a compressor and spray gun. I use a touch-up gun, which is smaller than the standard gun, easier to handle, and about right for spraying a lute-size instrument.

I have tested the acoustical effects of this finishing technique by playing the instrument in the white and after being finished. I have also compared the tone of finished instruments to identical instruments that have not been finished.

It has been noted that old lute soundboards seem to be somewhat dark in color. This was probably due to the effect of ultra-violet light on the wood. Mask one-half of a newly-cut and sanded soundboard with heavy paper and leave it around the shop for a month. It does not have to be in direct sunlight. Notice how dark the exposed side of the wood becomes after such a short time. I really doubt that early craftsmen artificially darkened the soundboards of old lutes, since this would mean coating the wood with an additional substance when the tendency seemed to be to put as little as possible on the soundboard. I regularly see a variety of Middle Eastern stringed instruments, including Ouds, in my shop for repair. These instruments normally have bare, untreated soundboards. The older ones (20-60 years old) have turned quite dark and closely resemble the lute soundboards in old paintings. In most cases they are not just UV-light darkened but uniformly dirty. In any case, why should we be trying to build lutes that look 20-60 years old when they are brand new? For one am content to wait a few years.
Two Possible Sources of Instrument Making Timber

Alan Mills

On page five of the July FOMRHI Quarterly, Jeff Hildreth offers small quantities of Curl leaf mountain mahogony, Cercocarpus ledifolius for pegs, frogs, etc. This offer prompts me to write the following communication.

During a recent period of study leave I visited Dr Edward Dealy, Principal Plant Ecologist, USDA in La Grande, Oregon USA. This visit was in response to an article he had published entitled "Mountain Mahogany Makes Music", American Forests. Vol. 83, No. 6, 1977. In his article he outlines the general physical characteristics of the tree, its habitat, past uses of the timber and its possible use in the making of transverse flutes.

This deciduous tree grows in the Pacific inter-mountain regions from South­eastern Washington to the Baja with large groves occurring on the flanks of the high desert mountains in Southeastern Oregon. The tree has the appearance of a small, gnarled apple or cherry tree. The leaves are small and elliptical, resembling large needles of a cedar tree. The trunk of a mature tree can reach a diameter of 50 cm or more and have straight sections of several meters. The average tree is smaller yet yields logs of 10-15 cm in diameter and a meter or more in straight section.

The sap wood is white to yellow in color and when stained with nitric acid it could be mistaken for similarly stained boxwood, Buxus sempervirens. The heart wood varies in color from nut or chocolate brown to a deeper reddish brown. With nitric acid staining these colors darken further and when iron is added as a mordant the color is almost black. It is a very heavy timber with a specific gravity of 1.00 and has excellent turning and general working properties.

In the past Cecrocarpus ledifolius has been used for firewood, fenceposts and the smoking of meat. A recent attempt was made to chip it and sell the chips as a bar-b-que flavoring agent. Due to the vicissitudes of the market place and the damage done to the chipping blades by the hardness of the timber this venture failed.

Felix Skowronek, Associate Professor, Department of Music, University of Washington, Seattle and his pupils have used this wood for the making of head joints for modern transverse flutes and some quasi-baroque traverses. Until Jeff Hildreth's mention of it I knew of no other users.

The rarity of this timber comes from the fact it is not being harvested. Dr Dealy informed me that the large groves in Southeastern Oregon need thinning and that access for cutting could possibly be gained by interested and properly equipped individuals.

The other timber I wish to discuss is the humble Australian mulga, Acacia aneura. This wood is held in general low regard in Australia due in part to the common prejudice against anything non-European and because mulga is the wood commonly used in the production of instant aboriginal artifacts sold along with beer, petrol and the other accoutrements of travel at roadside stops. It is, however, being used by a few bagpipe and string makers.

Mulga is found in the more arid regions of South Australia and adjacent states. Under good conditions it is a small erect tree up to 7 meters high with a straight trunk having a diameter of 15-20 cm. The average tree trunk is slightly smaller with a diameter of 10-15 cm with straight sections being up to 1.5 meters long.
The sapwood is yellow in color and the heart wood dark reddish brown. The texture of the wood is long grained, very hard and heavy with a specific gravity of .96. Its turning and general working properties are excellent even though it is hard on tools.

I have not done any acid staining tests on the timber but it should react in a manner similar to curl leaf mountain mahogany. Mulga is seldom cut except by souvenir makers, woodturners and those needing firwood. It is not a rare wood however and could be of some value in instrument making.

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Perforating Soundboard Holes with Scissors.

Set out the pattern below on the paper, parchment or other material to be used, cut out the central circle and alternating sectors with small scissors, then repeat on another piece. Superimpose the two pieces with the spirals in opposite directions and weave together with a pin. The result will be a multitude of lozenge shaped perforations, the size and shape of which will alter with a slight relative rotation of the two pieces. Dip in lacquer to fix the construction and fill the central circle with a pyramid of cutout stars. Then work out some different patterns.
Susan Andersen & Thea Miller, POBox 850, Elora, Ontario, Canada NOB 1SO; tel: (519) 846-5005 (perc, ww, keybd; M).

Australian Association of Musical Instrument Makers – see Raymond Holliday.

E.J. Baars, Yellowlaan 24, NL-1695 HV Blokker HL, Netherlands.

Frederick Battershell, Route 3, Box 34X, Roscommon, MI 48653, USA; tel: (517) 275-8382 (viols, hurdy-g, dulcimer, harp, psalt; M).

Lode Bauwens, Centrum voor Muziekinstrumentenbouw, G. Gezelletelaan 89, B-2670 Puurs, Belgium.

Christopher Bayley, 46B Hampton Road, Teddington, Middx TW11 OLH, UK; tel: 01-977 1777 (all bagpipes; M, P, W).

Ben Bechtel, 3952 Brotherton Road, Cincinnati, OH 45209, USA (harp, hurdy-g, fiddle, rebec, psalt; M).

E.W. Chapman, Pulshays, Combe Raleigh, Honiton, Devon EX14 OUI, UK; tel: Luppitt (040486) 326.

Richard Collier, 5 Hurgill Road, Richmond, N.Yorks DL10 4AR, UK; tel: Richmond 3105 (mainly ww; M, P).

James Crabtree, Acoustic Timbre Co, 2314 Adacan Street, Abbotsford, BC, Canada V2S 4S9; tel: (604) 852-2022 (harp, M; timber, supplier).

David C. Crookes, 94 Lansdowne Road, Belfast BT15 4AB, Northern Ireland; tel: 772074 (rebec, gemshorn; M, F, res).

Dennis & Margaret Crowe, 2 Well Lane, Emmore Green, Shaftesbury, Dorset SP7 8LP, UK.

Jim Downie, 7 Hillside, Pitmedden, Ellon, Aberdeen AB4 OGE, UK; tel: Udny 2669.

John W. Edwards, 1 The Dell, Finner, Middx HA5 3EW, UK; tel: 01-866 1325 (hpschds, recrdrs, organ; M).

Andrew Fairfax, 15A Holmesdale Road, Sevenoaks, Kent, UK; tel: 7oaks 457858.

David Fisher, 30 Vista Way, Kenton, Harrow, Middx HA3 OSW, UK; tel: 01-907 5443 (guitar, hpschd, clavchd; M).

Catherine E. Folkers, 64 Hovey Street, Watertown, MA 02172, USA; tel: (617) 924-8405 (bar traversi; M, P).

Galpin Society – see Pauline Holden.

Klaus Gernhardt, Musikinstrumenten-Museum des Karl-Marx-Universität, DDR 7010 Leipzig, Täubchenweg 2c (Conserv).

William Groom, 7 Bashildene Close, Gilwern, Abergavenny, Gwent NP7 OAW, UK; tel: 0873-831117 (early keybds; M).

Haags Gemeentemuseum, Stadhouderslaan 41, NL-2517 HV 's-Gravenhage, Netherlands; tel: 070/514181.

Andrew Haddow, 45 West End Park Street, Glasgow G3 6LJ, UK (keybds, strings; M, P).


Raymond A. Holliday, 35 Day Road, Cheltenham, NSW 2119, Australia; tel: (02) 86 1865 (flutes, violins, M, R, C; Sec. AAMIM).

Peter L. Jackson, 'Hollythorn', 108 Whittingham Lane, Broughton, Preston, Lancs PR3 5DD, UK; tel: 0772-863542 (bows; M, R).

Ruth Kelly, Yelki, One Tree Hill, SA 5114, Australia (viols, recrdrs, sackbuts; P).

Geoffrey E. King, POBox 889, Bath, SC 29816, USA (capped winds; M, P).

Ian Laidlaw, 17B Balnakeil, Durness by Lairg, Sutherland, UK; tel: 097-181338 (string instrs, esp. plucked; M).

D. B. D. Mann, 31 Church Road, Shoeburyness, Essex SS3 9EU, UK; tel: Shoeburyness 2524 (ww; M).

Thea Miller – see Susan Andersen.

Sam F. Murray, 3 Fairyknowe Pl, Newtown Abbey, Co.Antrim, Northern Ireland; tel: Belfast 771406 (flute, M; ww, R).
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- Pegs: Robert Smith
- Woods: Robert Smith, James Crabtree

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- Dulcimers: Fred Battershell
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Sackbut: Ruth Kelly

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West Germany: Ian Watchorn
Netherlands: Haags Gemeentemuseum  H.G.Venhorst
Northern Ireland: David Crookes, Sam Murray, James Russell
Scotland: Jim Downie, Andrew Haddow, Ian Laidlaw
Wales: William Groom, Gwent

Please correct any errors or omissions in this list, in the first Supplement and in the Main List with your subscription renewal.
As announced in Fomrhi-q of April '82 there has been an "Instrumentenforum" on 7th & 8th August during the two-weeks "Bach-Sommerakademie" in Stuttgart. (Next Bach-Akademie will take place 14th to 28th August '83, again with an Instrumentenforum). It was a good opportunity to hear interesting lectures by Van Der Meer and Skowroneck about old German harpsichords and to see the actual production of many well-known and less well-known harpsichord makers mainly from Germany or German-speaking countries. Unfortunately there were no instruments by Ahrend or Skowroneck but after Skowroneck's lecture a quite lively discussion aroused about today's makers techniques and especially about the problem of copying more or less exactly an original instrument; it was a pity the time allowed for such a discussion was so short but it has perhaps helped to destroy some tenacious legends which run about the grand man of German harpsichord-building. It seems today that some young makers tend to think that it is better to copy even the obviously faults of old instruments, e.g. an obviously wrong scale (owing to some ravinement, extension or shifting of the keyboard). Of course it is necessary first to understand why or how such an irregularity has been committed and I personally think that it is not enough to make copies: one can acquire even more knowledge in studying old instruments and old and new literature about instrument making and speaking with other makers: of course the experience in making comes mainly from making but the right skills alone aren't the whole thing: the right knowledge is more important: there has been a generation of harpsichord makers mainly in Germany who have produced beautifully-made and quite cheap harpsichords in great quantities but, as we know today, these are the wrong instruments for old music. Most harpsichord-players need I shall try to deal with later.

To go back to Stuttgart there were only "historical-made" instruments and it is with pleasure that one can say that every instrument would have been good enough for a concert. Even such makers like Heupert, Janssens and Ruckers who were known many years ago for their rather unhistorical instruments exhibited copies or historical-patterned ones after de Man, Fassin, Zell and Ruckers. But there were not only big French double keyboards but also smaller instruments of four octaves, even with two manuals, some of them knowing that a smaller instrument may have even a better tone than a big one (in big, long harpsichords some problems occur which don't in smaller ones). Rémy GUL, a Fomrhi member, exhibited some lavishly decorated instruments, partly with the soundboard made of the wood taken from 100-years-old cupboard. The appearance
was antique indeed, the whole instrument would be difficult to distinguish from an original Ruckers if the name of the actual maker were not on the name-board (it was!). Actually I don't know if the old wood improves the tone; it surely makes another one that a new wood. It remembers me what I often said, that is that if one wants to know how any 300-years old Ruckers did sound as it left the workshop, one could put a new soundboard in it. Please don't throw bombs in my workshop, I don't have any Ruckers now. (I've only a clavichord and a square piano, both "only" two hundred years old and still good enough, and I don't want to know how they did sound).

There were further: a rather unusual double-manual Italian, G/E-c'', B'b'4', short-scaled, a very big undecorated muselar of perhaps two metres long, HH-d'', a handsome Vater copy with his S-shaped bentside and half a dozen clavichords. Of these only two were large five-octaves, unfretted ones and the rest were small four-octaves fretted undecorated clavichords of ca. 1,42m x 0,35m. I found the one by Iten good with a pleasant appearance (plain yew). One wonders which temperament makers of fretted clavichords choose, I found all possible kinds of half-tones, but not the ca. 76 cent which is the value of the chromatic half-tone in mean-tone temperament, the one which is the most practical to put "in" a fretted clavichord because it reduces the necessary gap between two fretted tangents (provided one chooses the "standard-fretting", leaving the a's and the d's unfretted). Anyway, another legend has been destroyed, that is that big clavichords are better than small ones and unfretted easier to play than fretted. A somewhat painful "demonstration" was made: showing an original, but much altered harpsichord by Ring ("1700") and a "copy" (enlarged from FF-d'' to FF-f''), played alternatively by the same harpsichord player playing the same pieces; after the rather enormous publicity made around this Ring story and also about this "reconstruction" including a book, some articles, lectures and articles in local newspapers with overwhelming songs of praise, one was disappointed that the copy was so different. But anyway, such comparisons are interesting, the last one was in Herne in December 1978 when a superb Merzdorf copy of the 1640 Ruckers double (GG/HH-c'') was shown and played together with the original. I personally would have preferred the copy.

While in Stuttgart I went to the Landesbibliothek and copied an article by Foroni-Fellow Uta Henning in the June issue of a local magazine, the "Württembergische Blätter für Kirchenmusik". It represents the abstracts of an article to be published in the next issue of Early Music (Oct.82) on the Lautenclavizymbel or Lute-harpsichord. Could be interesting for intended makers of this quite unknown instrument. In this article there is made mention of a maker (a German one, I was told) who plans to make such an instrument. But, as Uta Henning told me, he wishes to remain incognito; nevertheless he wishes to be mentioned. If he's a Foroni member or if he reads this comm., please could he contact me for exchanging views; I'm interested since many years in making a Lute-harpsichord, as I'm always interested in all rare and unusual instruments, like the grand clavichord (has anybody seen the "o*l*r Prague ?) and since we have a little son mix 12 years old - children's keyboards. So, if anybody has experience with - please write again (10 to 12cm)
or with interchangeable keyboards of different spans for the same instrument, please contact me. ( Fellow John Rawson?).

Before I close this paper one question: has anyone views on the relationship between the age of an instrument and the diameter of the tuning pins? I have an unfretted clavichord C-e'' 5' long, painted, with 3.2mm thick wrestpins; can this help to date the instrument? Scale is c'' 23cm, C 121cm.

I wonder if you can understand my english, as I often cannot. Next I'll write about general harpsichord construction and design and about a method to represent temperaments with easy to understand figures even by absolutely non-mathematical people.

Marc Champollion
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Speculations on the Rote

Ephraim Segerman

At the 1983 Manchester Conference on Medieval and Renaissance Music in August, Lawrence Wright mentioned that the rote (rotta, chrotta, or cruii), the medieval instrument so often mentioned by the poets, was most probably a vertically-held triangularly-shaped psaltery-like instrument with strings on both sides.

As Marcuse's "Survey ...")(1975) points out, the association of the name with this oft-illustrated instrument was convincingly established by Steger in 1961. But Marcuse states that it is unlikely that there were strings on both sides since one hand was needed to support the instrument. I would have thought if at least one finger touched a string on each side at all times, this would be enough to keep the rote balanced. The question of playing position is confused by the player often shown tuning. The construction could easily be such that the row of pegs associated with the strings on the back side would not be seen in the illustrations. Since he is famous for his work on sculptures, I would put my money on Wright. It is to be hoped that he will write a Comm. outlining the evidence on this point.

When an instrument-making student requested a project involving more interest than experience, and I though of the rote, I started wondering how it might work. A possible construction is easy to imagine. As in the harp, we can have structural members (arms) corresponding to the three sides of the triangle which plug into one another, held tight together by the string tension. They each could have two grooves cut into the face towards the inside of the triangle. The two soundboards will fit into these grooves. An alternative for the arms at both ends of the vibrating string is the soundboard held in a rabbet between the arm and a capping strip (that could have bridge functions - see Comm.11), again held together by the string tension. An alternative for the third arm which is parallel to the strings is for it to be thinner that the others so that it is all under the two soundboards.

No hitchpins would be needed, with each gut string going from a peg across the soundboards, around the opposite frame member (perhaps restrained from sliding by a notch), back across the soundboard on the other side and onto another peg. This supposition is inspired by 16th century cittern stringing. Marcuse mentions a 13th century source where Guiraut de Calenson tells a jongleur to string his rote with seventeen strings. This probably meant 17 notes. A 34 note is unlikely at such an early date. If my suppositions are true it could be that the point of this quote is to ask for the very difficult (since 17 is not a multiple of 2).

A few later illustrations I've seen imitate the harp in several ways, including full diatonic tuning on the visible side. This is evidenced by approximate doubling of string length for an octave of seven strings. Such an instrument would then be like a double harp with mostly duplicated notes on each side plus perhaps a few chromatic differences.

Earlier illustrations show many fewer strings for each doubling of string length, leading me to suppose that there would be little if any duplication and that both sides of such an instrument would be used to provide the diatonic notes for each octave. A scale would mostly alternate between the two sides and adjacent strings would mostly be a third apart. The simplest tuning would be a simple diatonic scale alternating between the two sides. This makes notes an octave apart to be on opposite sides. If this arrangement is a disadvantage, one could have eight notes to the octave instead of seven, with perhaps both a b and a b' or some note repeated.

Ideally, string stops should be harmonically related to pitch, with length doubling for each octave. On the harp one hopes this is approached by the curve in the arm holding...
the tuning pins combined with the bulge in the soundboard. But the rote has straight arms with the amount of increase in string stop per octave always remaining the same. (The shape is linear rather than exponential). This means that a string somewhere in the middle would be the ideal full length for its pitch, and strings on either side of this string get progressively shorter than the ideal length for their pitch the further away from this string that they are located.

This situation is not as bad as I had originally anticipated. If the string an octave below the highest one is the one tuned as high as it can comfortably go without breaking (and so be at its ideal relationship between length and pitch), I calculate that the highest string is 61% of its ideal length, the string two octaves below the highest would be 85% of its ideal length, and the string (if the instrument had one) three octaves below the highest would be 60% of its ideal length. The tonal disadvantages of a string 60% of its ideal length is equivalent to that of a string on a fingerboard instrument tuned a major sixth lower than the highest string. This is not too bad since for such a string on such a hypothetical fingerboard instrument we wouldn’t feel the need to use especially flexible strings (i.e., high twist or roped strings) to achieve acceptable tone.

So plain gut strings should work on a rote of up to 3 octaves of range if the difference in string stop per octave is approximately equal to 2.3 times the stop of the highest string (or .7 times the stop of the string an octave lower), and if the pitch of that string an octave lower is as high as it can comfortably go.

A few suggestions for getting started in the design of such an instrument might be useful. Decide on the angles of the triangle from a favorite illustration. The pegs arm is horizontal and on top. The strings are parallel to one arm.

Decide on the pitch of the string an octave below the highest. This gives the stop for that string. Examples (at modern pitch) are 10cm for c", 13.4cm for g", 15cm for f", 20cm for c"", etc.

Draw a triangle having the appropriate angles with the side parallel to the strings being equal in length to the string an octave below the highest. Measure the length of the top side and mark off .3 times this length on this side from the corner opposite to the string in question. This is the point that the highest string leaves the top side. The distance between the two strings along that side divided by 2.3 or 2.7 (depending on the tuning system) is the distance between tuning pegs along each row. If this distance is too small to manage with, pick a lower string pitch.

The rest of the designing is rather straightforward. Don’t forget to put roses in the soundboards.
STRINGS FOR THE VIOLIN FAMILY
SUMMARY OF HISTORICAL INFORMATION
Ephraim Segerman

Gut String Types

Construction

Several sets of instructions for making gut strings survive. They involve taking the intestines of sheep (sometimes rams were preferred and sometimes castrated rams—wethers—were specified) and by means of a combination of soaking and rubbing, taking away all weak extraneous material, leaving the thin membraneous tube of exceptional strength which butchers use for sausage skins and string makers use for strings. Between two hooks the string maker then winds as many lengths of this membranous material (which when taut looks like a fine fibre) as is necessary for the final string diameter, and then turns one hook enough to twist the string into a cylindrical shape. When dried this is a normal (or what we call ‘plain’) gut string.

At this point the instructions stop. Further ways of constructing a gut string presented here are our surmises (demonstrated as viable, both theoretically and practically) of what was required for bass strings to provide the recorded ranges of the instruments used. These processes could have been considered to be trade secrets when introduced.

For increased flexibility one may put as much twist in a string as possible when wet (letting the hooks get closer together as the twisting contracts the string), and adding the further twist that the string can accept while it dries and gets thinner. We give the name “high twist” to such strings. For even more flexibility, one can twist two or more wet high-twist strings together in a kind of rope construction. In high twist and roped-gut strings the greatest contribution to the flexibility is made by the final few turns of twist; so proper effectiveness is usually associated with the maximum twist possible.

Any of the types of strings mentioned above could be polished when dry. Polishing not only makes a string more attractive by being smoother, but with the appropriate skill it also can improve the string’s vibrational true ness. A disadvantage of polishing is that it breaks the gut fibres on the surface and thus decreases overall strength. This is a problem only with the highest string of an instrument.

For added weight, a gut string may act as a core on which a metal wire is wound. The gut core is held taut between two hooks and rotated (either both hooks are mechanically coupled to rotate together or one is rotated and the other is on a free bearing rotated by the string) and the metal is tensioned while being fed onto the turning core. Names such as ‘wound’, ‘covered’ or ‘overspun’ are applied to such strings. If the windings touch one another, we call the string ‘close wound’ but if the windings are separated so that one can see the core between turns we call it ‘open-wound’. Early writers often called the latter ‘half-wound’.

Names and Availability

Before the 15th century, gut strings were probably made either by the players themselves or by tradesmen who made and sold various commodities for local use. In the 15th century we begin finding craftsmen specializing in making musical strings, presumably because the increased security and speed of trade allowed them routinely to service customers over a wider geographical region. The best of what players or local tradesmen could produce before now became more generally available, and the design of instruments reflected this late in the century by allowing about 2 octaves of
open-string range (about half an octave more than was usual before) on instruments with parallel bridge and nut. We associate this range with the availability of high-twist strings for the bass (where increased flexibility gives added range).

For a few years at the beginning of the 16th century, another half octave of range was briefly used on some instruments. This range appeared again permanently during the final third of that century. We associate this range with the use of roped-gut bass strings. There is evidence to suggest that these strings were made in Munich and that they were not in general use during most of the 16th century because they were exceedingly expensive. When string makers in Bologna started making them (probably in the late 1560's) they became much cheaper and their use spread rapidly.

English names for these strings in the 16th century were 'Katlyns', 'Cattelins', 'Catlings' or 'Catlins'. In the 17th century they were usually called 'Venice Catlins' or 'Venice Catlins', the 'Venice' part possibly was used to distinguish the genuine article (from Bologna shipped via Venice) from imitations. By the 2nd quarter of the 17th century, French rope makers were distributing gut strings and presumably making strings of this type. During the second half of that century, English musicians were usually using Venice Catlins for the strings tuned from about a 6th below the highest string to about an octave below that, and strings called 'Lyons' (from the French instrument and string making centre) for strings lower than that.

Lyons and Venice Catlins were different in appearance with the Venice Catlins having a smooth surface. This could imply that the Lyons retained the bumps of rope construction while other roped-gut strings were polished smooth to look like other types of gut strings. During the 18th century the terms Catlin and Catling devalued to represent well-polished thin gut strings, with the rope construction component forgotten, probably because it was never particularly obvious.

Overspun bass strings first became available in the 1660's. As for where it was invented, all we know is that it wasn't in France. We are aware of no evidence of international trade in such strings in the 17th and 18th centuries and suspect that the windings were put on by instrument makers and local dealers.

Concerning the plain or ordinary gut strings, a type available early in the 16th century was called 'ganzers'. These strings were not true since they were thicker on one end than the other, implying that if they were polished at all, it was only for cosmetic purposes. At the time there were strings made in Munich which were true, implying either that they were well polished or that the gut strands going into each string were so carefully selected that subsequent polishing was unnecessary. These strings were expensive. A 1542 English account lists 'menekins' (presumably meaning 'from Munich') which cost over 6 times more than 'bressels' (presumably from Brussels). The menekins were bought for lutes and bressels were for viols. Incidentally, a similar 1553 account shows 'Katlyns' costing over 5 times more than 'Mynikins'.

Around 1600 plain gut strings called 'gansars' were still used. Though we can expect that quality had improved, they still were not recommended for the highest course of the lute. At about that time plain gut strings from Rome started to develop a reputation for quality at the right price that lasted till the 20th century. French musicians from the 17th century onwards usually specified Roman thin strings and French thick ones. But the term 'munken' kept appearing in English sources. It is not clear whether the term had just acquired the generic meaning of 'thin gut string' (as import documents imply) or whether a preference for strings from Munich persisted in England.

In the third quarter of the 19th century unpollished but true violin 1st strings were available. It was particularly important then to have this string very strong since pitch standards had crept very high and traditions concerning the instrument were then too entrenched for violinists to consider shortening the
The skill in gut selection and twisting involved in making such strings is rather greater than the skill needed in polishing less carefully made strings to trueeness. It is possible that this type of string was a response to the special circumstances pertaining at that time and that previously it would not have been worthwhile to make it.

We know of no special early name given to high-twist strings. In the 16th century when catlines were too expensive for most, it is probable that string makers automatically put more twist into thicker strings.

**Violin Bass String Types**

Late in the 16th century the introduction of roped-gut strings and probably of the soundpost as well created a very strong g-string sound with a clear but not highly-focussed pitch and somewhat groggy tone quality. The earliest uses of the violin (1589 Intermédii and the 1597 Gabrieli pieces for fiddle and brass band) gloried in the strength of that sound. But it was relatively new and not to everyone’s taste. Praetorius stated that he didn’t like the sound and Monteverdi avoided it, at least in the early days (e.g. in Orphée). But as the 17th century progressed and soloist improvisers learned to use it effectively, the rough sound with some of the quality of a double bass became strongly associated with masculinity and was greatly appreciated by the Italians and their cultural followers. This bass quality even prompted the use of a violin for bass accompaniment to other instruments (Leopold Mozart complained about the ludicrous practice of using the violin to provide continuo for a cello solo).

The thickness of the violin fourth as indicated by Stradivari (ca 1700 - 2.5 mm) could only be that of an all-gut string. Italian paintings of the 16th century usually show a progressive increase in string thickness with no change of colour as we view from treble to bass. Overspun strings were usually wound with silver and that colour can often be seen on a cello 4th. An overspun string is thinner than the next-highest string, so progressive thickening implies all-gut stringing. German advocates for the all-gut violin fourth were Leopold Mozart (1756) (who mentioned progressive string thickening) and Gunzelheimer (1855). Mozart’s advocacy of an unwound gut 4th, though never explicitly stated, is also implied by his advice to bow that string further from the bridge.

When strings overspun with metal became available in the 1660’s, in Italy they were initially used on the lowest strings of smaller more agile bass instruments to lower and usurp the function of larger less agile bass instruments, and on the bass viol to give it the requisite bass projection for continuo duties. In France they were initially used on the bass viol associated with the introduction of a 7th string, but they seem soon to have been used on other strings as well. This latter extension of the use of overspun strings seems to have been the first example of their choice for aesthetic rather than practical reasons. The French violin soon followed, and by about 1700 the g-string was close-wound with metal and the d-string was usually open wound. We know of no surviving information of later 18th century French stringing practices. The German writers in that period (Mejer in 1732, Quantz in 1752 and Lohlein in 1774) mention only an overspun g-string. In England during the 1690’s, the Talbot ms indicates that violins still were all gut strung, though a wound lowest string was used on bass viols and bass violins.

An overspun g-string gives a sound that is more focussed and much richer in higher harmonics than an all-gut g-string. This overspun tone quality approaches that of the thinner strings and compresses the range of tonal qualities available across the instrument. It adds smoothness to playing at the sacrifice of variety of tone.

The French around 1700 were very interested in smoothness and the open-wound d-string gives the smoothest transition between the close-wound g- and the gut a-. The German users of a wound g- with a gut d- probably kept this smoothness by having
the g-open-wound. Only late in the 18th century was the use of an open-wound string as the next-lowest one to a gut string abandoned (the evidence here is in guitar stringing specifications). This could be associated with the growth of portamento as an important aspect of playing style. It is much more difficult to slide a finger (or bow) over an open-wound string than over either a gut or close-wound string.

To summarize, before the 1660's violin stringing had no choice but to use all-gut bass strings. By early in the 18th century and probably through most of that century, French violins used a close-wound 4th and open-wound third. There is some evidence to indicate that Italian violinists retained their preference for all-gut stringing for most of the 18th century. German (and probably English) violinists were divided between choosing the Italian type or a compromise stringing with a wound (probably open-wound) fourth. A minority of German players still retained an all-gut fourth going into the second half of the 19th century. In the upheavals of the second half of the 18th century (the growth of high-position and portamento playing, violin neck-angle modification, lengthening of the fingerboard, use of the Tourte bow, etc) most players in most countries probably changed to the type of stringing mostly used throughout the 19th century, i.e. gut with a close-wound fourth. Higher position playing increases control over tone quality and the tone discontinuity between the close-wound fourth and the gut third could then more easily be masked.

Violin String Tension Levels

Mersenne (1635) gave the diameter of the violin first string as that of a lute 4th. From his lute string diameters, we deduce that the violin first was about .75 mm thick. We have reason to believe that Mersenne's viols were tuned at a pitch standard about 3 1/2 semitones below modern, and if his violin was at the same standard, there would be about 7 1/2 kg of tension in that string. With an equal-tension stringing system as he prescribed, the total tension would have been about 30 kg.

From our analysis of Stradivari's stringing specifications (ca 1700) for a theorboed guitar which employ violin strings, we conclude that his string diameters are essentially the same as Mersenne's. We do not know for which pitch standard Stradivari's standard violin strings were intended, so we cannot calculate the tension with any confidence. If the Cremona standard was the same as Rome, the tension would be about the same as Mersenne's. If it was the same as that of Lombardy (about a tone higher), the tension would be a 1/4 again as high (about 38kg).

Mersenne (1635) wrote that "the violin has too much roughness insomuch as one is forced to string it with strings too thick for showing off in the subjects it is naturally suited, and if it is strung like the viol, it will be different only in that it has no frets". Later in the century when the viol was greatly favoured by the French nobility, the violin, for survival, followed Mersenne's prophetic advice and drastically reduced its string tension. This was to conform with the French tonal ideal which, as expressed by Le Blanc (1740), was "like the tone of the voice of an ambassador, delicate and even a bit nasal". This is probably why overspun bass strings were so attractive to French ears. In 1702 Raguenet, when writing of the Italians, remarked that "their violins are mounted with strings much larger than ours...".

We know of no evidence to indicate what tension was used on French violins then. The only clue as to how low violin tension at that time could go involves English practice. In England, there also was a strong aristocratic preference for the viol. The Talbot ms (c 1690) states that "Bass Viol Treble String = 2d of Violin." We presume that this means equal diameter. If the two instruments played at the same pitch standard, the string on the viol (with a 32 inch string stop) had 2.7 times the tension of the string on the violin (with a 13 inch string stop). If they each played at their highest practical pitch standard (i.e. with the violin standard a tone higher than the viol) this ratio would be reduced to 2.1. If we apply to different sizes of instruments the equal-"feel"
criterion (that leads to equal tension across one instrument) to instruments of different sizes in a family, we conclude that tension should be proportional to string stop. Mersenne wrote that "the thickness and length of the strings...ought to follow...the ratio of harmony". This rule works very well in practice. If, following Mersenne's suggestion, one considers the violin and bass viol as members of the same family from a tension point of view, the tension ratio would be about 32/13 or 2.5. Since violins sometimes played with viols and sometimes not, this seems like a credible compromise between the ratios of 2.7 and 2.1. The average tension per string on modern reproduction bass viols (6 kg) is about 1.5 times that of modern baroque violins (4 kg or 16 kg total). The comparison is not direct though, since modern bass viols are of 18th century or 17th century solo viol sizes with a typical string stop of about 27 inches. For such viols the ratio of viol to violin tensions would come down from Talbot's 2.5 to 2.1. To conform to this for c. 1700 English repertoire we should either raise the tension levels of our viols or lower those of the violin family or a bit of both.

Roughly speaking this one piece of information on English violin tension seems to indicate that it was about half that of Italy at that time. French violin tensions could easily have been similar to this English value.

There is one clue as to German string tension at this time. In 1698 Muffat, when comparing various French and German pitch standards, indicated that the German pitch standards were higher than the French ones, and that he preferred a lower German standard a tone above the usual French one "using strings that are a little stronger". This is ambiguous as to whether he was mentioning standard German strings for his preferred pitch standard or a non-standard personal stringing preference (and if it was the latter, whether the comparison was with French or German strings), or whether "stronger" meant greater diameter or greater tension. Our guess is that he was reporting standard German practice for that pitch standard and that the Germans used slightly thicker strings than the French. Raising the pitch of a string by a tone increases its tension by about 25%. A slightly thicker diameter could further raise its tension by perhaps 5% or 10%. This would lead to German string tensions being about a 1/2 again higher than French ones, or a total tension for the violin of about 20 kg. This is consistent with the German habit of trying simultaneously to exploit French and Italian cultural influences.

We have seen no direct measurement of violin string tension purporting to be from the 18th century. As reported by Fetis early in the 19th century, Tartini measured the total string tension on his instrument in 1734 and it was 63 livres or 31 1/2 kg.

There are a considerable number of 19th century sources which provide string tensions or other string measurements which can lead to calculations of tension. In Table 1 we list the information on total violin tensions we have been able to collect. In it, one can notice that at any time after 1800 it seems that there was general agreement on tension irrespective of tension system (equal or unequal) or nationality (German, French, Italian or English), or the ups and downs in tension fashion. This uniformity in expected power output from violins can perhaps be associated with local importance given to providing what would be considered as adequate support for the international traffic in instrumental and opera soloists.

As outlined above, at 1700 there was no such uniformity in violin tensions. English, French and perhaps German tensions were about half that of Italy. The fact that Tartini's 1734 tension figure is close to the early 19th century figure (which we assume was uniform throughout Europe) encourages us to expect that tensions in Italy did not significantly change during the 18th century, and that at some time during that century the countries at low tension came up to the Italian level. We suspect that this change occurred in the second half of the century when there was strong development in the internationalization of opera.
Nineteenth century tension information dominates Table 1. In it, one can notice that string tensions in the second quarter of the 19th century seem to have climbed from a previous value of about 30 kg up to from 35 to 45 kg, after which it came down again to from about 25 to 30 kg. Spohr (1832) wrote “Generally speaking in order to obtain a rich and powerful tone, a violin should be furnished with the largest set of strings it will bear...”. The period of very high tensions was remarked on by Hart (1875) who wrote “Vast improvements have been effected in the stringing of violins within the last thirty years, strings of enormous size were used alike on violins, tenors and double basses.” A leading figure in effecting these “improvements” seems to have been Paganini. It is possible that many Italians never participated in the 35 to 45 kg tension fashion, keeping a tradition of about 30 kg tension that was continuous from the beginning of the violin to late in the 19th century.

The wide range of tensions reported by Weichold (1892) seems to be a transitional situation between the tension range of about 25 to 30 kg prevailing earlier in the second half of the 19th century and the tension of about 20 kg which seems to have been followed afterwards. (The 20th century information is not as extensive as the 19th century information only because we have not tried to research stringing in this century as well as that of previous times).

The main advantage of heavy stringing is the greater power of sound that one can produce. We suspect that the tension increase in the second quarter of the 19th century was an overreaction to the perceived need for projection in the large concert halls being built then. Reducing string tension reduces the effort in playing and makes clean quick articulation easier. We suspect that this is the basic reason for each of the two stages of tension reduction since that period of overreaction.

Equal and Unequal Tension Systems

Two basic systems of violin stringing coexisted in the 19th century. One system has all of the strings at approximately the same tension. The other has the second string at near to the average tension for the instrument, the first string at a considerably higher tension, the third at a somewhat lower tension than the second, and the fourth a bit lower still.

The equal-tension stringing system was first stated explicitly by Mersenne (1635) as a general principle for all fingerboard instruments. It was stated theoretically, which means that we can be less sure that this truly represented universal practice at the time than if he stated it as the results of measurements. Nevertheless, we have no evidence to suggest that this was not true. When Stradivari specified the stringing of a theorboed guitar (c1700) he drew the thickness of the lowest string (2.5 mm) stating it was a violin fourth. His specifications for the other strings include the use of a violin first for the lower octave of the fourth guitar course. From our experience with stringing guitars of this period according to the principle stated in guitar instruction books, we can estimate its thickness to be about .75 mm. The thickness ratio of 0.30 between the violin first and fourth string is just that which one expects from equal tension. Leopold Mozart (1756) clearly advocated equal tension on the violin and indicated how the musician can confirm this by hanging equal weights on them (presumably instead of the tailpiece fixing on a hanging violin) and noticing that they sound in fifths. Savart in 1840 specified equal tension for violin stringing. In the 1869 edition of Maugin and Maugne’s book on luthier crafts, the violin string tensions reported are approximately equal. The English authors Buggins (1883) and Hepworth (c1900) specified violin string diameters which are in equal-tension relationships.

The unequal-tension system of violin stringing (where tension increases progressively with tuning pitch) is evident in the stringing specifications of most 19th and 20th century writers on the subject. They include Spohr (1832) Ruffini (1888), Bishopp (1884), Heron Allen (1885), Schroeder (1887), Weichold (1892), Flesch (1923) and
The basic advantage of equal-tension stringing is that the 'feel' of each string is the same in the sense that the same force pushes aside (or depresses) each string the same amount. The basic advantage of increasing tension with increasing tuning pitch is that the difference in tone quality between adjacent strings is reduced because of a smaller difference in string weight. Another advantage is that there is less difference between strings in the maximum energy one can impart to a string with the bow, thus making it easier to cross strings at maximum loudness. The ratio of tensions between the first and fourth strings was between 1.8 and 2.3 during the 19th century and early in the 20th century (Spohr to Flesch) and came down to between 1.4 and 1.7 in the middle of the 20th century (Cadek).

In summary the equal-tension system has been used with both all-gut stringing and in overspun 4th over a time span from the 17th century to the very beginning of the 20th. Its advocates in the 19th century have been French and English authors. Since all of the French sources are here included we are encouraged to speculate that equal tension was continuously practised in France from Mersenne through the remainder of the 17th century and through the 18th century as well. The varying tension system has been the only one used throughout most of the 20th century and its use goes back at least to early in the 19th century. In the 19th century this system was specified by all German authors, some English ones and the sole Italian source.

A possible transitional stringing arrangement may be that specified by Stradivari in 1737 for a particular viola contralto he made. Snippets of the plain first and second strings and of the overspun fourth survive in an envelope in the Cremona Museum. From the measurements made for us by the museum, one can calculate that the second and fourth are approximately in equal-tension relationships (and so we would assume, would have been the missing third which was probably open-wound), but the first string would have 50% greater tension than any of the others. A similar envelope with snippets of strings for a violoncello made in 1741 does not include the first string, and there are not enough measurements from the Cremona Museum on the open-wound fourth string to calculate its tension. The measurements on the plain second and third strings are not accurate enough to distinguish between any of the different tension systems.

Another possible 18th century example of the use by a minority of players of a higher tension first string on a otherwise equal-tension stringing is in Stradivari's stringing specifications for a theorboed guitar, mentioned above. A "thickest possible violin first" was to be used for the lower octave of the fifth course, tuned a fourth lower than the usual violin first (which should be at the same tension), and so it would be 33% thicker. A thin violin first in the same specifications is only 6% thinner than the normal first. This perhaps better reflects normal variation amongst violinists. The very heavy violin first could possibly have been for the minority of violinists who insisted on even greater power on their first strings and a smoother tonal transition to the second.

Metal Stringing on Violins.

In the last quarter of the 16th century when the violin (more or less) how we now know it first appeared, a very new type of very strong steel for musical strings first appeared. It was the first material that could be tuned to a higher pitch for a given string stop than gut. By the early years of the 17th century, new instruments such as the small English cittern and orpharion were developed to exploit it, and recently developed instruments which were primarily gut strung (ie, those without thoroughly entrenched stringing traditions) such as the chitarrone, archlute, and violin experimented with it as well.

Praetorius (1619) wrote that the violin was so well known that he needn't write about it. But he added in parentheses that if one strung it in steel and brass strings it had a
beautiful soft sound. (Since loudness depends on string tension and violin string tension then was half again higher than today, metal strings at modern tension could have been considered as soft-sounding then.) The extent to which violins used this stringing is not clear, but it could have been considerable since when this steel became unavailable around 1620, a letter by Heinrich Schutz in 1621 (complaining about the Nuremberg wire-making guild not allowing it to be made any more) stated that these steel strings were essential for his ensemble.

From that time till late in the 19th century (when piano manufacturers offered prizes to wire makers for stronger steel) there was no metal string material available that could be tuned as high as gut. Flesch (1923) wrote that at the beginning of the 20th century two violinists pioneered the use of a metal 1st string when playing in public. This practice became widespread during the First World War. The use of a gut first gradually diminished until it disappeared by the middle of the century. Fritz Kreisler was the most famous violinist who preferred a gut first till the end of this period.

When metal firsts became widely used, the other strings made of metal windings on metal cores also became available. Flesch praised them in principle but found them inadequate in some ways. It was only by mid century with the introduction of more flexible rope-metal cores that all-metal sets of strings became fully acceptable to professionals.

The Stringing of Violas

There is much less surviving information of the stringing of violas than there is for violins. The Talbot ms. (c 1690) has the statement "1st String Tr = 2d Treble" just below "Tenor 5 below Violin Treble". This most probably means that the viola (tenor) a-string has the same diameter as the violin a-string. No dimensions are given for the viola but we can expect it to be of the contralto type with about 10 - 12% longer string stop than a violin. With the same diameter strings at the same pitch, the string tension on the viola would be 20 - 25% greater than the violin. This tension is 10 - 13% greater (5 - 6% greater in diameter) than what we would expect from our equal-feel criterion for families of instruments. Such a difference is about the minimum detectable by a player and may easily be within the range of variability from instrument to instrument or even string to string that was considered acceptable. Slightly greater tension on a viola could have the advantage of partially compensating for its lower innate resonance than a violin. This is because it is much smaller than a family member at its pitch should be and because instrument makers have traditionally taken rather less trouble in getting maximum resonance out of the violas than of the violins they make.

This practice of using violin strings for the upper three strings of a viola could well have been very widespread for a very long time. Maugn and Maigne (1869) gave the number of guts that went into each plain-gut string of the violin, 'cello and double bass, omitting the viola probably for this reason.

The packet of bits of strings labelled in Stradivari's handwriting "Adi 10 agosto 1727 queste quattro corde sono la groseza per finire la viola a quattro corde il contraldo" (Exhib N.222 Museo Civico, Cremona) now only contains 3 pieces of gut. According to the measurements provided two are plain with diameters 1.0 and 1.2 mm and the third has a diameter of 1.7 mm with a winding of 5 turns per mm. We assume that the winding wire is of silver, has a diameter of .2 mm, and that it is close-wound around a gut core of 1.3 mm diameter. From these figures one can calculate that this wound string is equivalent in weight to an all-gut string of about 2.8 mm diameter. As stated before, this is approximately in equal-tension relationship with the 1.2 mm diameter string assuming the latter is the second and the wound string is the 4th. But the 1.0 mm diameter string, as a first, is 50% greater in tension than the others. This could be appropriate if the contralto viola mostly played on the first two strings (perhaps reading from a C clef on the bottom line), but if this were not the case, an alternation
possibility is that the missing string is the first and that the 1.0 diameter piece of gut is the core of the third string from which the open-wound silver wire has at some time been pulled off. This possibility has the attraction of possibly representing an equal-tension German type of stringing using violin strings, with the violin open-wound 4th becoming the viola 3rd.

Irrespective of this uncertainty, there is little doubt that the 1.2 mm string is the second, and we can compare it with Stradivari's violin stringing. With Stradivari's violin 4th having about 2.5 mm diameter, the violin's third at the same tension would have a diameter of about 1.7 mm. Comparison with the 1.2 mm viola 2nd string at the same pitch (assuming the same pitch standard), taking the difference in string stops into consideration, leads to the viola string tension being about 2/3 that of the violin. According to the equal-feel criterion a contralto viola string should have a tension of about 12% greater than a matching violin. If normal violin strings were used on the viola each string would have even greater tension than on a violin. The difference between such tensions and the relatively light strings of this viola set cannot be compensated for by any realistic higher pitch standard that the viola was made for, so this set of viola strings was intended for a lower tension tradition than Stradivari's violin stringing was.

The type of stringing in this viola set is consistent with violin stringing with all-gut except for the 4th which is open-wound with metal. The evidence for such stringing that survives is all from Germany (Majer, Lohlein and Quantz). At the lowest German pitch standard, A-Kammerthon, this viola second string would be at a tension of about 6.1 kg. As a violin's 3rd, this string would have a tension of 5.4 kg. At a higher pitch standard the tensions would be greater. With 5.4 kg being the minimum expected tension, and that being rather greater than Talbot's violin (which we expect represented French practice) we conclude that either the player came from someplace else (perhaps Bohemia) where the pitch standard was lower, in which case he could be following the low French tension traditions, or he was operating at a tension tradition intermediate between the low French and high Italian ones. That this viola stringing was not normal in Italy (or at least in Cremona) is argued for by Stradivari's need to keep a record of it, presumably for duplication by his string maker whenever required.

Bass Violin or Violoncello Stringing

The surviving information on bass violin or violoncello stringing is just as sparse as that on viola stringing and even more beset with special problems. In the baroque, the playing of the bass violin was rarely considered as an art that one cultivated from an early age, so its practitioners were thus usually people trained and still performing on the violin. We would then expect the equal-feel criterion to be applicable to string tensions in the violin and bass violin. We suspect that this was often the case, but there is no surviving data to support this supposition.

Talbot

The Talbot ms (c1690) contains the statement "Smallest of Bass Violin = 1st of treble". This makes the bass violin stringing thinner than the tenor violin (i.e. the viola). Before attempting to interpret this statement let us consider what Talbot wrote about size and tuning:

When tunings of the three members of the violin family are given, all have 4 strings tuned in fifths throughout, with the first strings being e", a' and g. This set of tunings, including the usual French bass tuning, appears also in the editions of Playford's "Introduction to the Skill of Music" in the final quarter of the 17th century. The French bass tuning would be appropriate for the "24 violins" transplanted from France by Charles II. But the measurements for a bass violin given in the ms are for an Italian bass with 24 1/2 inches (62 cm) string stop and not the French bass which was 20%
Further information on stringing and pitch is given in Talbot's comments about a special 6-string bass violin tuned as a bass viol where "the treble string is of the same sound and size with the 3d of B Violin (or B viol) (!) it is louder than either." The equality of sound between the bass violin and bass viol can lead to an estimate of the tuning. The bass viol third is tuned to e, but since the violin family pitch standard could be a tone higher (assuming first string highest pitch without breaking) it would be d for the bass violin. This pitch of the bass violin would then be just an octave lower than the treble violin, as Bauchieri (1609) stated its tuning was.

The equality of diameter and pitch between the 3rd strings of the bass viol and bass violin allows us to calculate that the bass viol's string tension would be .59 times that of the bass viol. But we have some information from Talbot relating the bass viol with the treble violin: "Bass Viol Treble String = 2nd of violin". Making the same relative pitch standard assumption as above, we can then calculate that the string tension of the treble violin would be .46 times that of the bass viol. It is now possible to calculate the relationship between the treble and bass violins. The string tension of the bass violin would then be 1.20 times that of the treble.

This relationship can be calculated directly from the statement of diameter equality between the treble and bass violin 1st strings given at the beginning of this discussion. Assuming the octave difference in tuning we can calculate that the string tension of the bass violin would be .89 times that of the treble. The ratio of these two estimates of the tension relationship is 1.44, which corresponds to a string diameter difference of 20%. Each of Talbot's estimates of equality between string diameters could easily be subject to 10% error.

While the above calculations assume strict equal tension amongst the strings of each of the three instruments involved, in actuality this could only have been approximate. Thus as overall difference of 20% between the two calculation routes argues much more for than against the truth of Talbot's various statements. Our assumptions about tuning and relative pitch standards are not directly at test in this comparison between the two routes since they cancel out in the calculation, but they represent the best way we can make sense of the individual statements. (A competing assumption we considered was that the bass violins would nominally be tuned an octave higher than the French bass and the violin family was tuned down to play with viols, but to make the bass third string equal in pitch to the 3rd of the bass viol, three semitones instead of the preferable two would be required; this assumption makes the bass violin string tension to be 1.3 times that of the treble by the direct route and 1.8 times by the route via the bass viol.)

A possible reason why the strings on Talbot's bass violin could have had such a low tension (approximately the same as the treble violin) could be that it played a rather important low tenor part but being such an innately resonant instrument made unusually light stringing necessary for balance with other members of the family. In Talbot's circles it is likely that the double bass violin (or violone) performed the true bass function for the family, as in Italy. When players deliberately played in Lully's French style, they hired the appropriate bass violin rather than owning it themselves.

Concerning string types, on the same page as the information on the special 6-string bass violin, Talbot wrote "Bass Violin all Venice Catlin's." This is all-gut stringing appropriate for the special bass violin or perhaps the French bass, but not for the tuning an octave below the violin deduced above. We suspect that it referred to the special bass violin which incidentally achieved its extra loudness by having each string tuned to 1.8 times the tension of the bass viol or 3.6 times that of the usual bass violin.

On another page Talbot wrote "Liners used on Consort Basses III twisted with Copper.
or Sylver Wyre in Lowest Str of Bass Violin or Viol". This is the only mention of
overspun strings in the ms and most probably represents an alternative which was
rapidly growing in popularity in England at the end of the 17th century. An overspun
BPT string would allow this small bass violin to have French tuning and perform the
bass function in the family.

Stradivari

The packet of strings labelled in Stradivari's handwriting: "Questa sono le mostre del
tre corde grosse quella mosta che sono, di buiello va filata e vidalba" (exhibit N 302
Museo Civico Cremona) apparently contains pieces of all three of the promised strings.
According to the measurements provided by Prof. Mosconi, two are plain with diameters
1.2 and 1.7 mm and the third has a diameter of 1.4 mm with a metal winding having a
helix pitch of one winding per mm. The museum classifies these strings as for
violoncello. Frisoli (JSI XXIV (1971) p46) is more specific and writes that these
strings were for the 'cello made in 1731 called "The Pawle". The nature of the intended
instrument is certainly not clear from the inscription on the packet. The evidence that
these are 'cello strings is not given, but for the time being, we will assume that this
evidence exists and is convincing.

The information on the wound string given by the museum is not enough to calculate
its weight. It is clearly open-wound, and assuming it is the 4th, we can guess what the
wire diameter would have to be to give a reasonable tension balance. If 1.4 mm is the
overall diameter the diameter of the core would be about that of the first string and the
wire diameter would be about half of the core. As string makers, we find this string
structure is rather unlikely since the tone quality would be much too metallic to balance
with the other strings. If 1.4 mm is the diameter of the core, a winding with diameter
1/10th of the core would give tension balance. This gives a very 'gutsy' sound which is
consistent with the choice of an all-gut third, an aesthetic approach that would use an
all-gut 4th string on a violin.

The highest pitch standard such an instrument could have been intended for is early
18th century German Chorton, about 1 1/2 semitones higher than modern. The lowest is
low French chamber pitch which was about 3 1/2 semitones below modern. The 1.2 mm
diameter 'cello 2nd tuned to d on a 68 cm string stop would have a tension of about 7.4
kg at the highest standard and 4.2 kg at the lowest. Assuming the equal-feel criterion,
a matching violin would have about half of the 'cello's tension. Such tensions are much
more reasonable at a high pitch standard than at a low one (we know of no violin
stringing tradition that has ever involved a string with less than 3 1/2 kg tension).

High-pitch standards were prevalent in Germany and in other places such as Venice.
An all-gut stringing attitude towards violins existed widely both in Italy and in
Germany. But the low tension points to Germany as the probable home of the player this
set of strings was designed for. Perhaps it was a German centre under strong French
influence since the tension is so low.

Maugin and Maigne

In the middle of the 19th century, violoncello playing was an art in itself and did not
usually involve players who were also very active in violin playing. There would
therefore be no motivation to maintain an equal-feel relationship between these two
instruments.

This expectation is realized when we consider the diameters of the 1st and 2nd
strings of the violoncello that can be estimated from the number of guts that goes into
making each as reported by Maugin and Maigne. These are 1.2 mm for the first and 1.7
mm for the second. We presume that the third and fourth were close-wound with metal
at a tension close to that of the second. The tension of each string on this instrument.
is about 13 kg. At equal-feel relationship with the violin, the violoncello string tension would be about 16 1/2 kg. Excluding all-metal stringing, average violoncello string tension nowadays is about 11 kg, and this happens to be approximately in equal-feel relations with the same type of violin stringing.

Closing Comments

This is an early draft of a paper to be submitted to some periodical where it could reach a wider audience of people interested in historical performances on members of the violin family. That paper should include all of the references which regretfully were omitted here because of lack of time. There will also be extended footnotes giving the data, assumptions and arguments behind many of the perhaps novel assertions made here. Requests for such information beforehand would be most welcome. How long these footnotes will have to be is disturbing, and it could be performing a service if such requests induced Comms to be written here, which then would only be referred to in the projected paper. Of course, further information on the subject which perhaps we may not be aware of would be particularly welcome. So also would be alternative analyses and speculations.

Table 2 is offered as a summary of data and speculations on the history of violin stringing. It is the best advice we can currently offer to players who seek the guidance of original types of stringing in attempting to develop historically accurate performances.

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Total Tension (kg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1635</td>
<td>Mersenne</td>
<td>30</td>
</tr>
<tr>
<td>1700 (ca.)</td>
<td>Stradivari</td>
<td>30 or 38</td>
</tr>
<tr>
<td>1734</td>
<td>Tartini</td>
<td>31.5</td>
</tr>
<tr>
<td>1806</td>
<td>L'Abbe Sibire</td>
<td>29</td>
</tr>
<tr>
<td>1832</td>
<td>Spohr</td>
<td>45</td>
</tr>
<tr>
<td>1835</td>
<td>M. Fetis</td>
<td>36</td>
</tr>
<tr>
<td>1840</td>
<td>Savart</td>
<td>40</td>
</tr>
<tr>
<td>1869</td>
<td>Maugin and Maigne</td>
<td>31.5</td>
</tr>
<tr>
<td>1883</td>
<td>Ruffini</td>
<td>26</td>
</tr>
<tr>
<td>1884</td>
<td>Bishopp</td>
<td>24-28.5</td>
</tr>
<tr>
<td>1885</td>
<td>Heron Allen</td>
<td>31</td>
</tr>
<tr>
<td>1887</td>
<td>Schroder</td>
<td>28</td>
</tr>
<tr>
<td>1892</td>
<td>Weichold</td>
<td>21-30</td>
</tr>
<tr>
<td>1900 (ca.)</td>
<td>Hepworth</td>
<td>20</td>
</tr>
<tr>
<td>1923</td>
<td>Flesch</td>
<td>22</td>
</tr>
<tr>
<td>1952</td>
<td>Cadex (metal and gut)</td>
<td>18.5-22</td>
</tr>
<tr>
<td>1952</td>
<td>Cadex (all metal)</td>
<td>22-26</td>
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### Table 2

**Violin stringing**

<table>
<thead>
<tr>
<th>Country</th>
<th>Early Baroque</th>
<th>Middle Baroque</th>
<th>Late Baroque</th>
<th>Classical Early</th>
<th>Late Romantic</th>
<th>Modern 1st half</th>
<th>Late Romantic</th>
<th>Modern 2nd half</th>
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<tr>
<td></td>
<td>1st half 17th c.</td>
<td>2nd half 17th c.</td>
<td>1st half 18th c.</td>
<td>1st half 18th c.</td>
<td>2nd quar 19th c.</td>
<td>1st half 19th c.</td>
<td>2nd half 19th c.</td>
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</tr>
<tr>
<td>Italy</td>
<td></td>
<td>A</td>
<td>A</td>
<td>&lt;A&gt; D</td>
<td>D</td>
<td>E, (D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tension profile</td>
<td>[e]</td>
<td>[e, (u)]</td>
<td>[u, (e)]</td>
<td>u</td>
<td>u</td>
<td>u</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pitch standards</td>
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<td>-4to-1</td>
<td>-3to+1</td>
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<td>-1to 0</td>
<td>0</td>
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<td>France</td>
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<td>A</td>
<td>A</td>
<td>C</td>
<td>[D]</td>
<td>D</td>
<td>E, (D)</td>
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</tr>
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<td>[e]</td>
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<td>e</td>
<td>e</td>
<td>u</td>
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<td>15</td>
<td>29</td>
<td>36-40</td>
<td>31</td>
<td>[15-25]</td>
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<td>-2to 0</td>
<td>-1to 0</td>
<td>0</td>
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<tr>
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<td></td>
<td>A</td>
<td>A</td>
<td>[B]</td>
<td>[D]</td>
<td>&lt;D&gt;</td>
<td>D</td>
<td>E, (D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tension profile</td>
<td>[e]</td>
<td>[e]</td>
<td>[e, (u)]</td>
<td>&lt;u&gt;, [(e)]</td>
<td>u, (e)</td>
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<td>[30]</td>
<td>[35-45]</td>
<td>24-31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pitch standards</td>
<td>&lt;3to 0&gt;</td>
<td>-3to 0</td>
<td>-1to 0</td>
<td>-1to 0</td>
<td>-1to 0</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td>A, (F)*</td>
<td>A</td>
<td>&lt;B&gt;, A</td>
<td>&lt;D&gt;, [A]</td>
<td>D, (A)</td>
<td>D</td>
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<tr>
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<td>Pitch standards</td>
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<td>-1to+1</td>
<td>-1to 0</td>
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</tbody>
</table>

*: before 1620
Key to Table 2

Information Status

No surrounds: This information exists with no serious ambiguity in interpretation and there is no reason to doubt whether it represents general practice.

( ): Same as above but it seems to represent a minority practice.

(< ): Interpretation of the information is ambiguous and this is our best guess.

( ): We are aware of no direct information and this is an educated guess.

String Types

A: Plain gut 1st and 2nd, high-twist or roped gut 3rd, roped gut 4th.
B: Plain gut 1st and 2nd, high-twist or roped gut 3rd, open-wound 4th.
C: Plain gut 1st, plain gut or high-twist 2nd, open-wound 3rd, close-wound 4th.
D: Plain gut 1st, plain gut or high-twist 2nd, high-twist or roped-gut 3rd, close-wound 4th.
E: Steel 1st, plain gut 2nd, high-twist 3rd, close-wound 4th.
F: Steel 1st, steel or brass 2nd, twisted-brass 3rd and 4th.

Note: All-metal modern stringing is not included in this Table.

Tension Profile

The Table listings refer to equal-e- or unequal-u- tension profiles.

Total Tension

Figures are given in kilograms of tension. Estimates are to the nearest 5 kg. Measurements are to the nearest whole number.

Pitch Standards

Figures represent the number of semitones less than (minus -) or greater than (plus +) modern pitch (a' = 440 Hz). When the data involves fractions of semitones, the listed ranges show the outer whole numbers.
| Acrylic, casting | C237 | Drawings, requirements | C42, 46, 68, 85, 166, 273, 293 |
| Adhesives, instrument | C247: 249 | * rods for lutes | C293 |
| "Titebond" | C248: 17, 22 | * of Cornamuses | 17, 8 |
| water resistant | C335 | * Division viol & Viola d'Amore | 17, 9 |
| Arcades, key board | C292: 293 | * Flute obaas ex Brussels music | 22, 19 |
| Authenticity | C51: 216, 217, 218 | * Flute, Stanheby | 10, 41, C119 |
| Bagpipe drones | C305 | * Horasichord | 2, 7 |
| valves, blowpipes | C338 | * Hohns, David | 9, central |
| Bandoneon construction | C16 | * Hurdy-gurdy | 14, 21, C31 |
| Bass strings (gut) | C413 | * Lute, Hans Reis | 8, 0 |
| Benches, work | C256 | * Poetia, Fidde, | 0, 00 |
| Banding irons | C62 | * Hurdy-gurdy | 8, 0 |
| Ball-valves, forming | C356 | * Lute, Hans Reis | 8, 0 |
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