



Festival della Scienza

Genova, 28 ottobre - 8 novembre 2004

Viola Organista

Revolutionary Keyboard Instrument

Invented by Leonardo da Vinci

Implementation effort still being continued

Akio Obuchi

Keyboard Instruments

- **Piano, Celesta, Carillon**
 - Hit with a hammer
- **Harpsichord, Spinet, Virginal**
 - Pluck with a plectrum
- **Clavichord**
 - Thrust (push) with a tangent
- **Organ, Harmonium, Melodeon**
 - Blow or suck

Hit with hammer

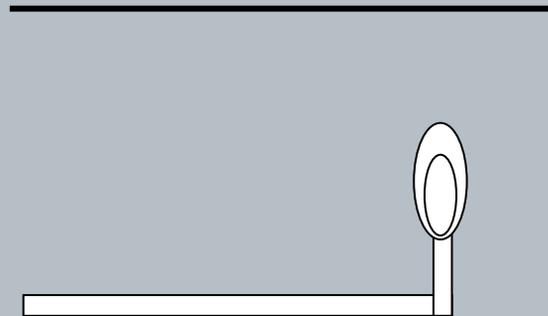
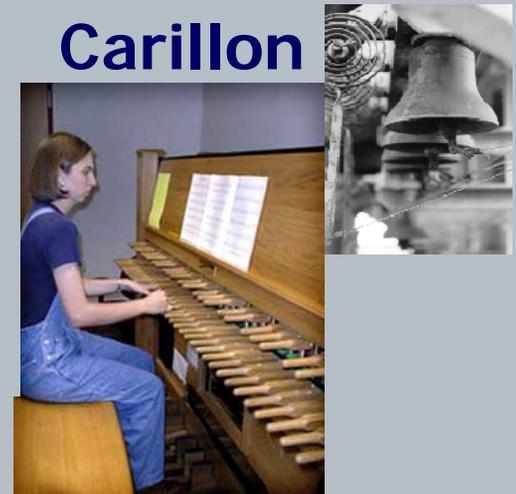
Piano



Celesta



Carillon

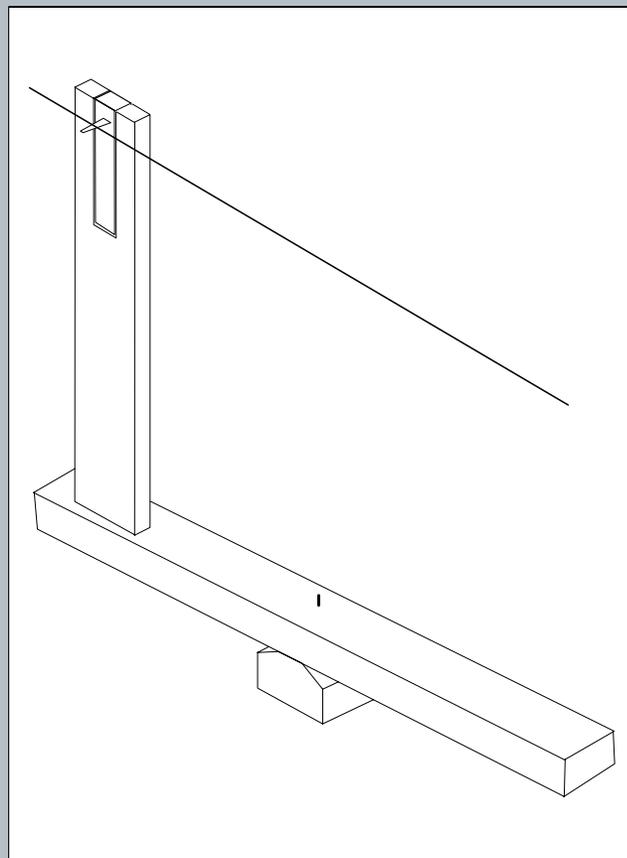


Pluck with plectrum

Harpsichord



Spinnet

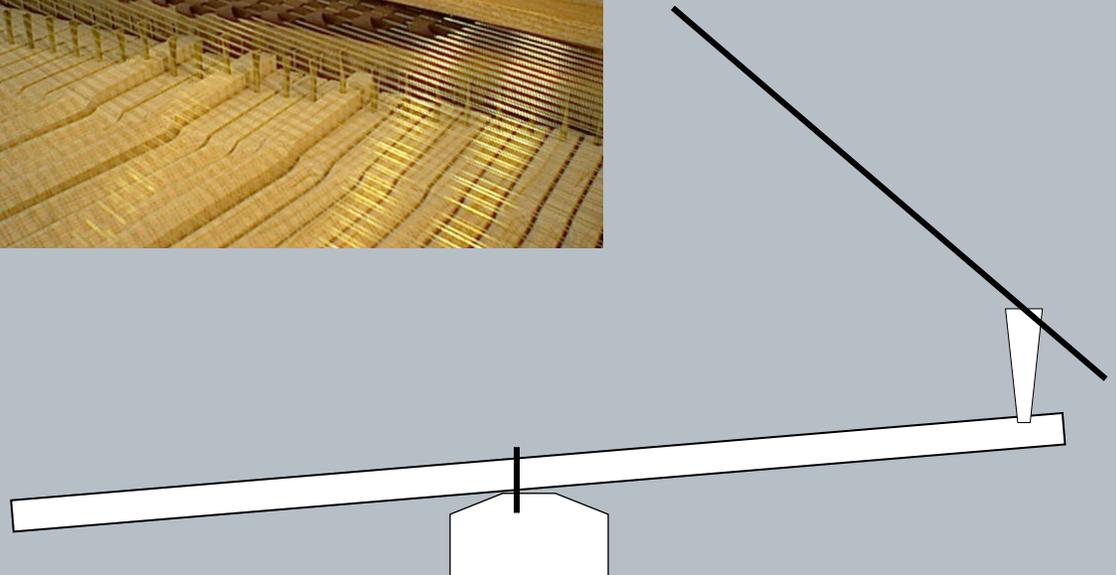


Virginal



Thrust (push) with tangent

Clavichord



Blow or Suck



Harmonium



Organ

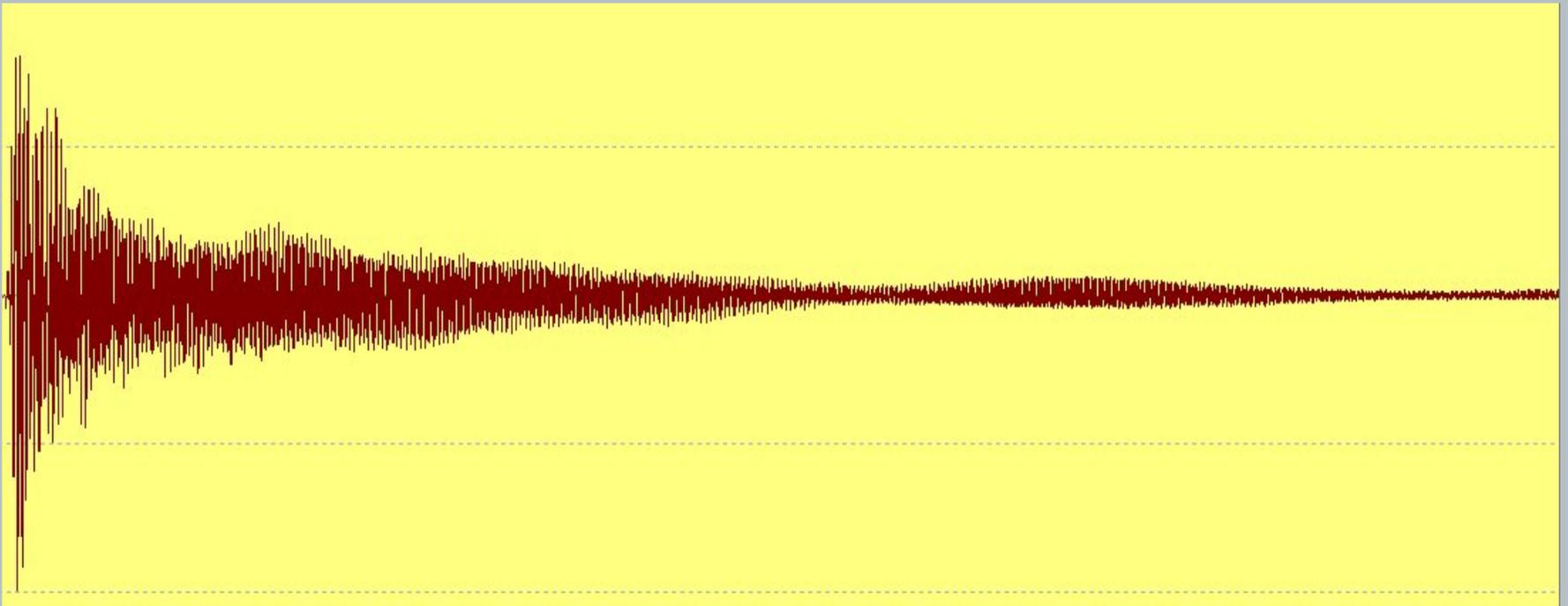


Melodeon



Limitation of Keyboard Instrument 1

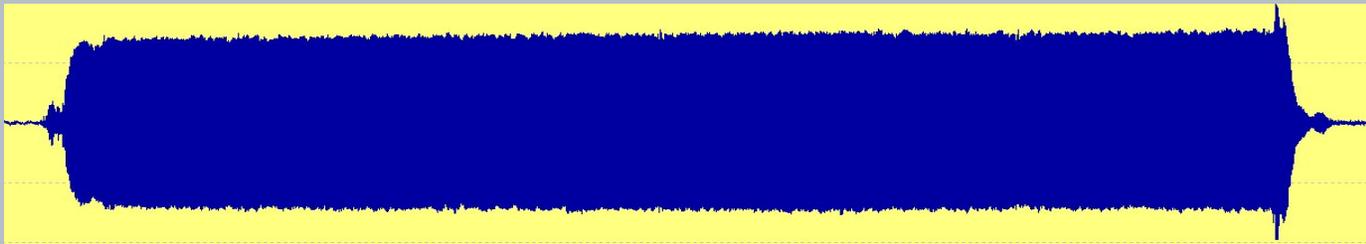
- **Sound only attenuates.**
(Piano, Harpsichord, Clavichord)



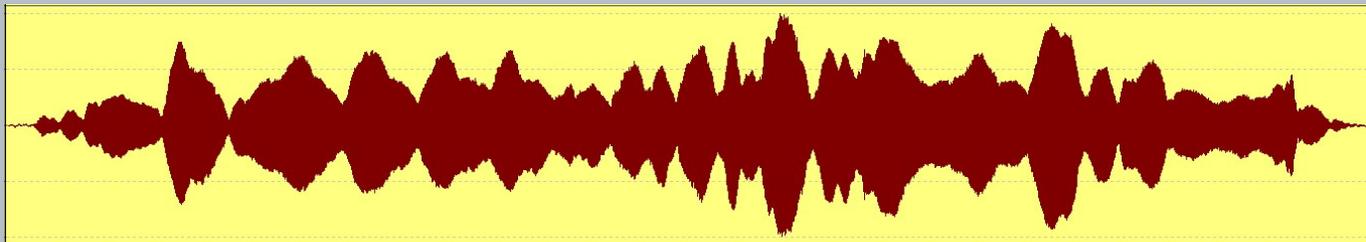
Limitation of Keyboard Instrument 2

- **Sound continues, but no musical expression can be added.**
(Organ, Harmonium, Melodeon)

Organ waveform



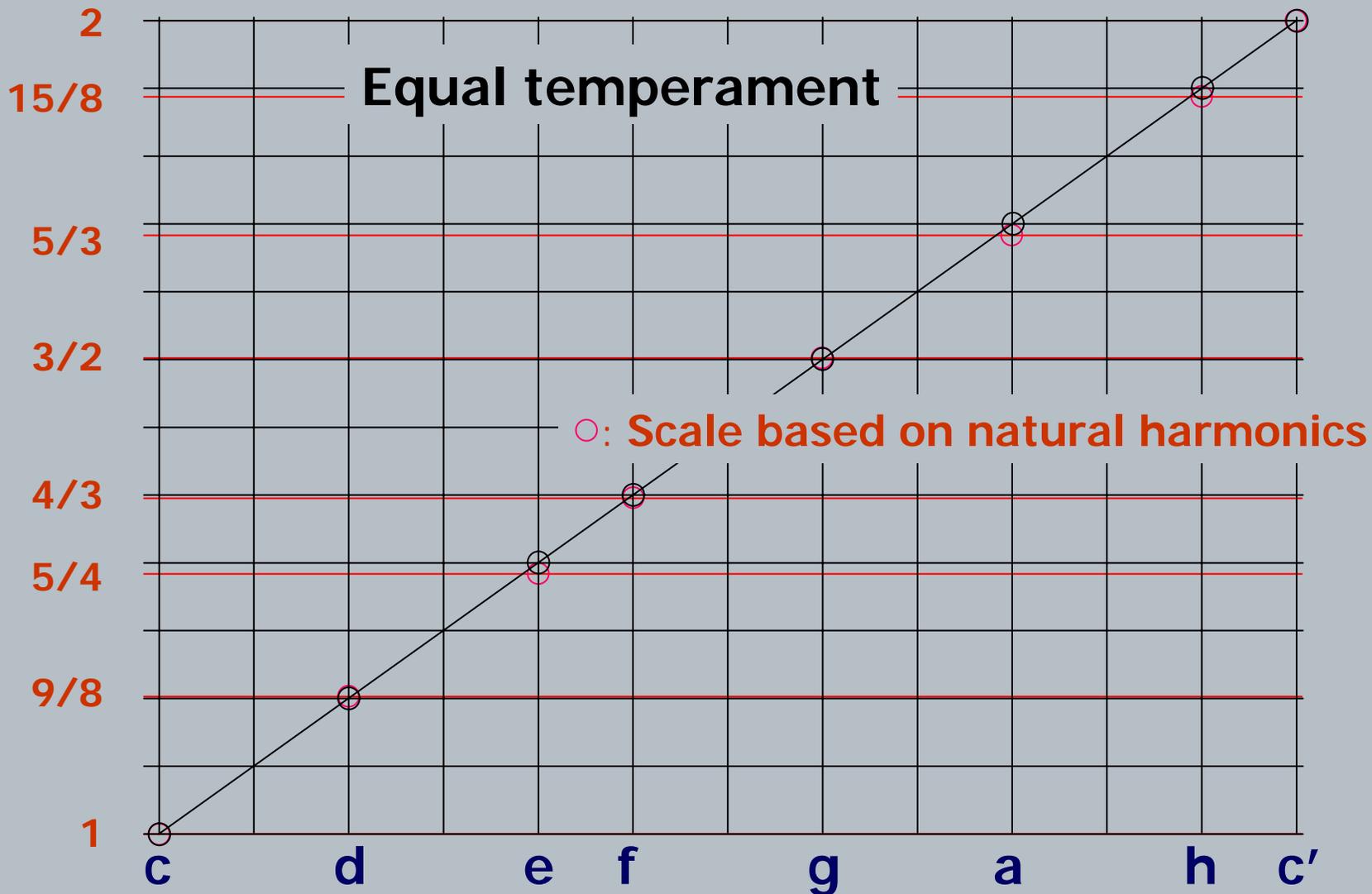
Recorder waveform



Limitation of Keyboard Instrument 3

- Contradiction in Temperament

Frequency ratio on a Log scale.



Keyboard Instruments

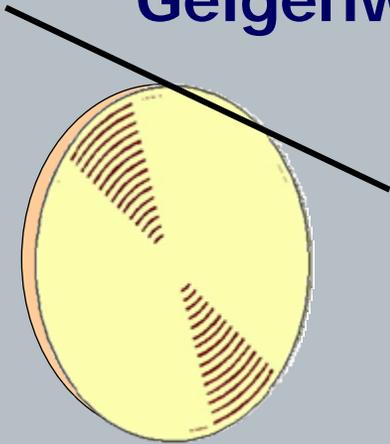


With most of the keyboard instruments, one can play a **complex music** like a symphony orchestra piece, with a **limited ability of delicate expressions** for each note.

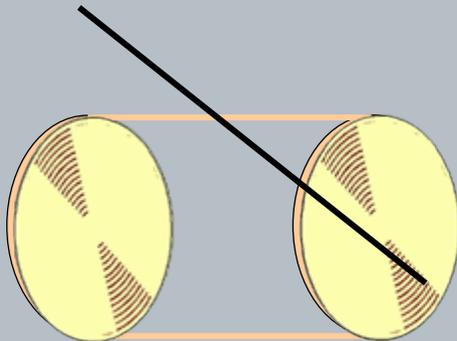


Variations of Viola Organista

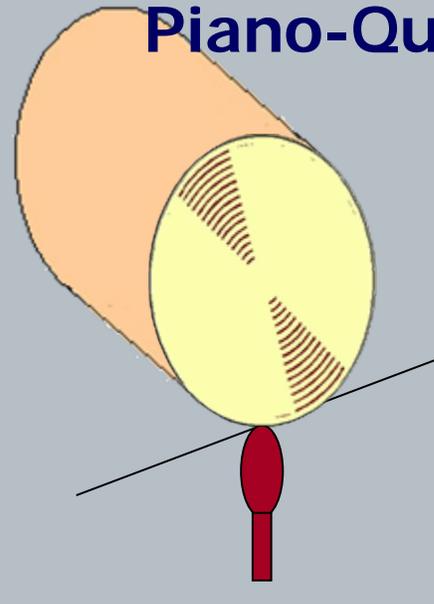
Geigenwerk



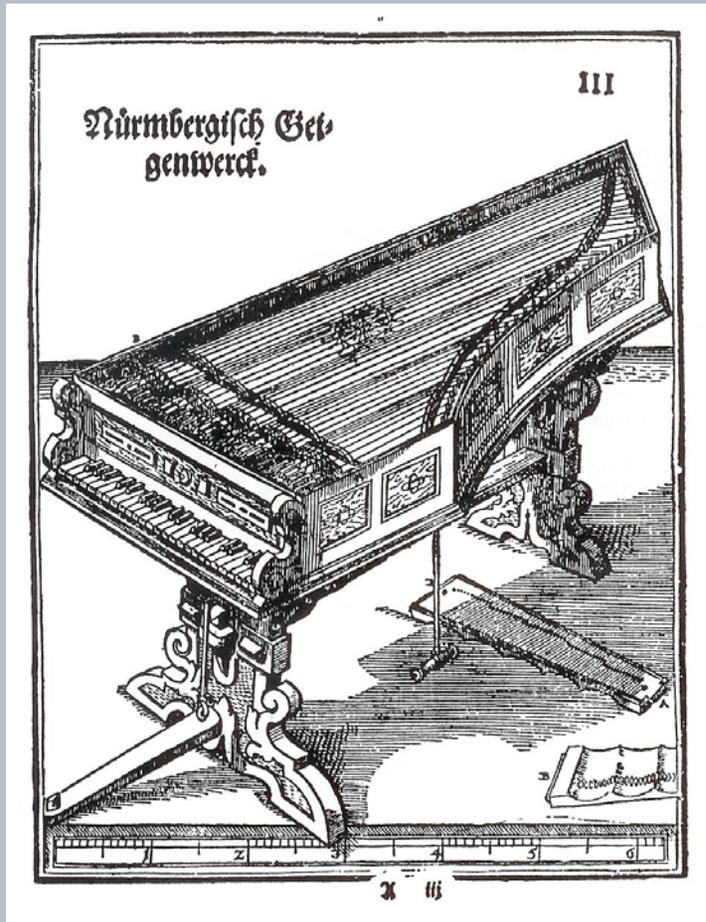
Streichklavier



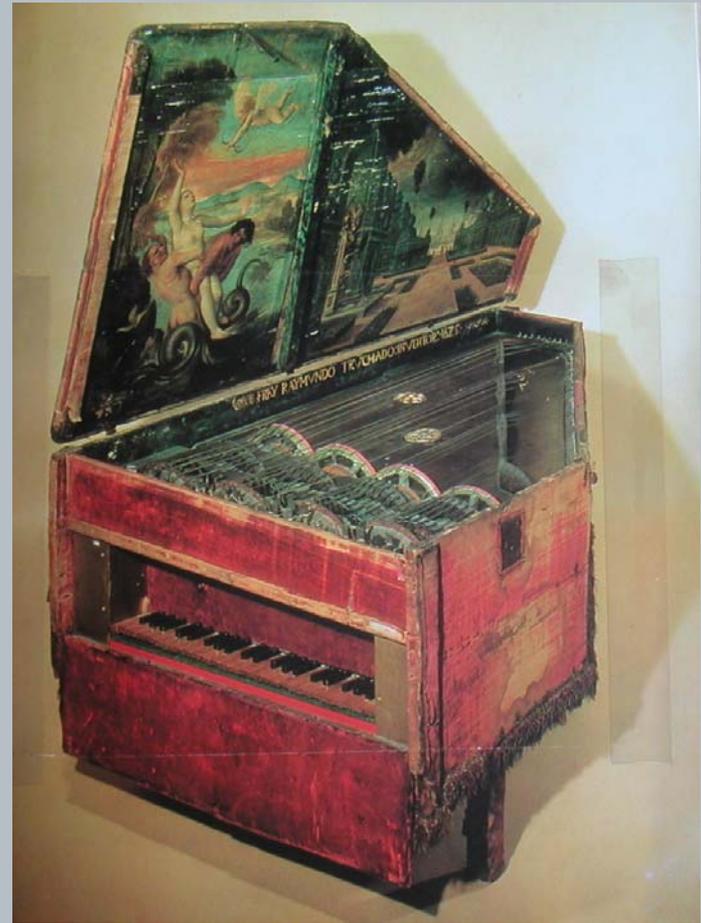
Piano-Quatuor



Geigenwerk



Hans Haiden 1600



Raymundo Truchado 1625

Streichklavier



Anonymous 1800?

Courtesy of Carolyn W. Simons

Piano-Quatuor



F. de Romden 1867

Courtesy of Carolyn W. Simons

Review of historical works 1

1488-89	Leonardo da Vinci		Viola Organista, sketch only
1575	Hans Haiden	Nuremberg	Geigenwerk, arched viol(E), archiviol(F)
1579	Landgrave Moritz	Hesse	Copy of Geigenwerk
1590	Georg Kretsch	Dresden	Copy of Geigenwerk
1608	Vincenzo Bolcione	Florence	Copy of Geigenwerk?
1625	Raymundo Truchado		
1650	Athanasius Kircher		Machinamentum No.6, rosined horsehair
1673	Michele Todini	Rome	Archicymbalum symphonicarum
1674	Claude-François Millet Dechaies		Not built but theoretical work
1708	Cuisiné	Paris	Clavecin-vielle, one hand played keyboard and other turned crank handle
1722	Johann Georg Gleichmann	Ilmenau	Claviergamba
1730	Wahlfried Ficker	Zeiss	Claviergambas
1741	Levoir	Paris	Archiviole, weight driven pinned cylinder
1741	Roger Plenius	London	Lyrichord (15 wheels)
1745	Renaud	Orléans	Épinet á archet
1749	Levoir	Paris	Enlarget archiviole
1750	Daniel Bertin		
1750	Georg Matthias Risch		
1750	Johan Michael Pachelbel		
1750	Renaud	Paris	Épinette a orchestre
1753	Johan Hohlfeld	Berlin	Bogenflügel, band of horsehair
1760	Le Gay	Paris	Two manual, combination of bowed and plucked
1765	Nils Söderström	Nora, Sweden	Clavier-gamba, imitation of Haiden's
1769	De Lasine	Paris	Combination of bowed and plucked
1772	Adam Walker	London	Delestina, violin bow by left hand
1778	H. Schmidt	Rostock	Improvement made on Hohlfeld's
1779	Johann Carl Greiner	Wetzlar	Bogenclaviere

from "A Survey of Musical Instruments": Sibyl Marcuse

Review of historical works 2

1782	H. Schmidt		Harmonica, with continuous bow by treadle
1783	Gottlieb Friedrich Riedeln		
1789	Gerli	Bonn	
1790	Garbrecht / C. Wasiansky	Milan	
1790	Chladni	Königsberg	Euphone, friction bar piano
1795	von Mayer	Görlitz	Gut string, horsehair bow, flageolet register
1799	Thomas Anton Kunz	Prague	Improved von Mayer's instrument
1800	Carl Leopold Röllig	Vienna	Xenophica,
1801	Huebner / Pouleau	Moscow	
1801	John Conrad Becker		Patent for setting piano strings in motion by means of wheel(s)
1802	John Isaac Hawkins	Philadelphia	Claviola
1803	Tobias Schmidt	Paris	Patent the piamo-harmoniocon
1806	Johann Christion Dietz		Organo-diapazo
1817	Isaac Henry Robert Mott		Patented the sostenente piano forte
1820	Taconi	Milan	
1820	Abbate Gredgorio Trentino	Venice	
1823	Thomas Todd	Swansea, Wales	Patented an instrument with endless rosined band and drwo rollers
1827	Johann Christian Dietz	Paris	Polyplectron, continuous bow for each string
1828	Gama	Nantes	Plectro-euphone
1830	H. Lichtrnthal	Brussels	Patented piano-viole
1830	Archotti	Rome	
1833	Heinz	Toelz	Two namual, hammered and bowed
1838	H. Lichtrnthal	Brussels	Improved piano-viole called piano a sons soutenus
1861	Robert Thomas Worton		Patented his vis-pianoforte
1871	Stead		Improved Mott's sostenente piano
1909	Karl Beddies	Gotha	Streichharmonium
19....	Piatkiewicz	Poland	

from "A Survey of Musical Instruments": Sibyl Marcuse

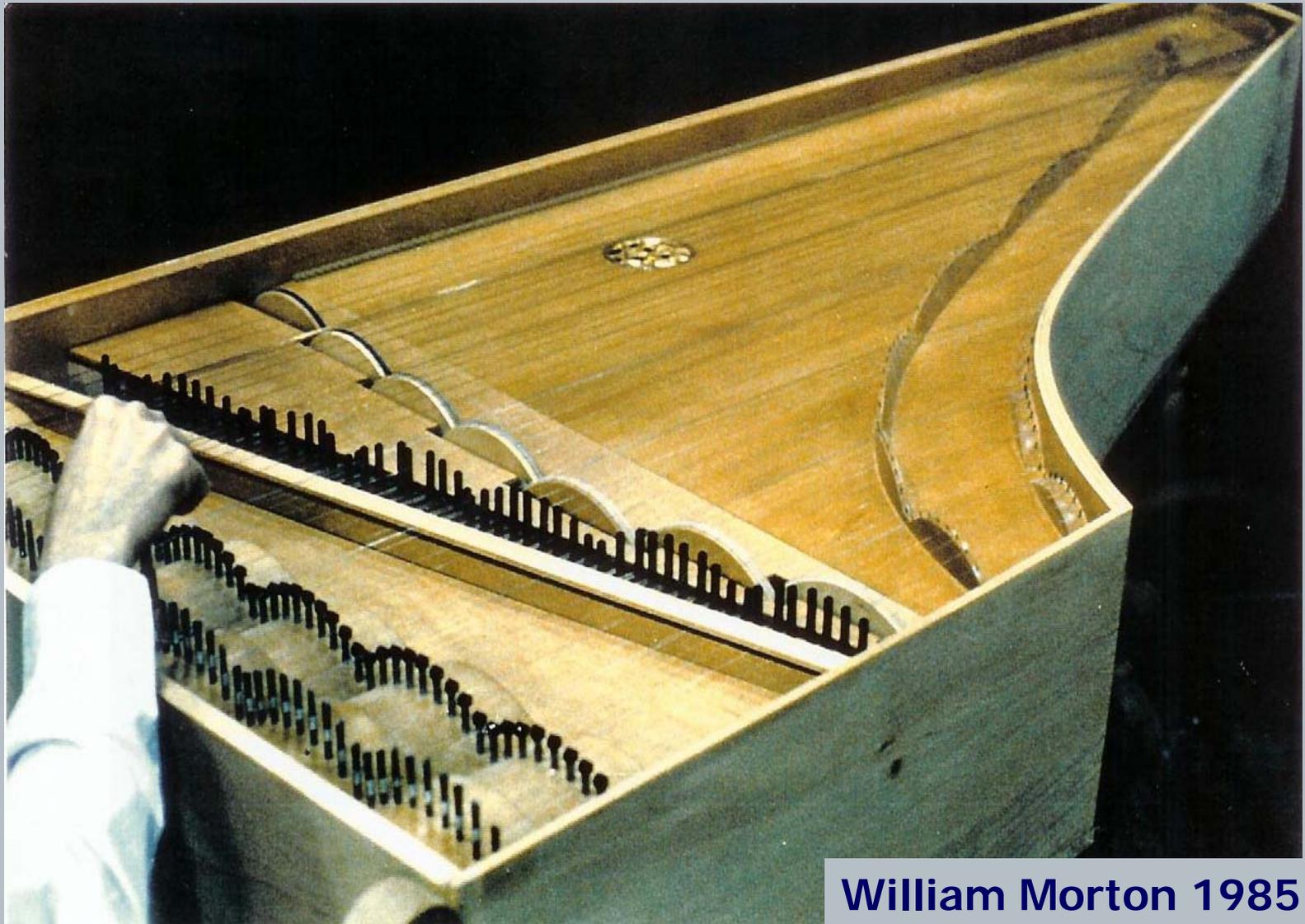
Late 20th-Century Geigenwerk



Kurt Reichmann 1985

Courtesy of Carolyn W. Simons

Late 20th-Century Geigenwerk



William Morton 1985

Courtesy of Carolyn W. Simons

Late 20th-Century Geigenwerk



Akio Obuchi 1993

21st-Century Geigenwerk



Jon Jones 2003



Courtesy of Jon Jones

21st-Century Geigenwerk



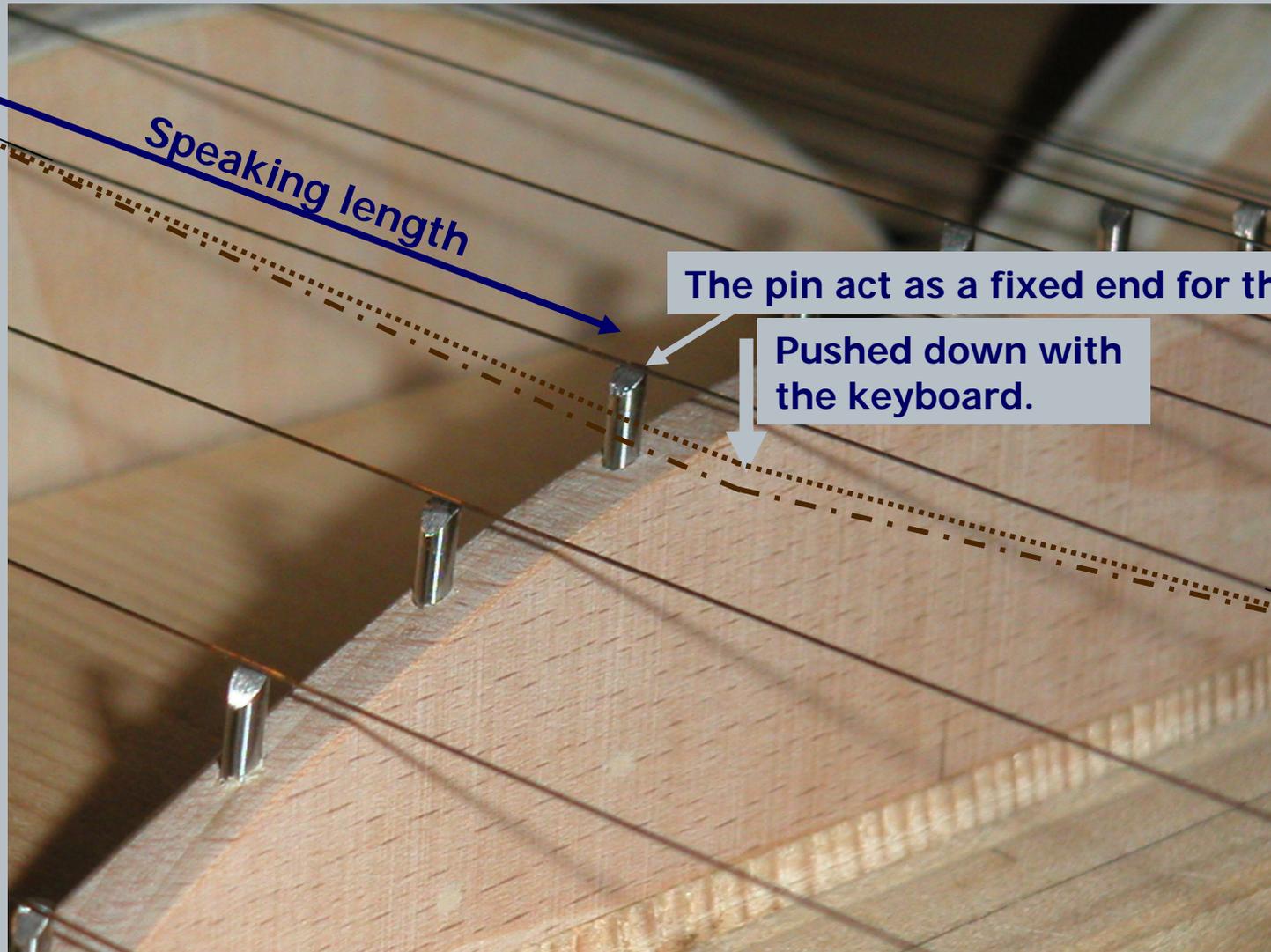
Courtesy of Jon Jones

21st-Century Geigenwerk



Akio Obuchi 2002

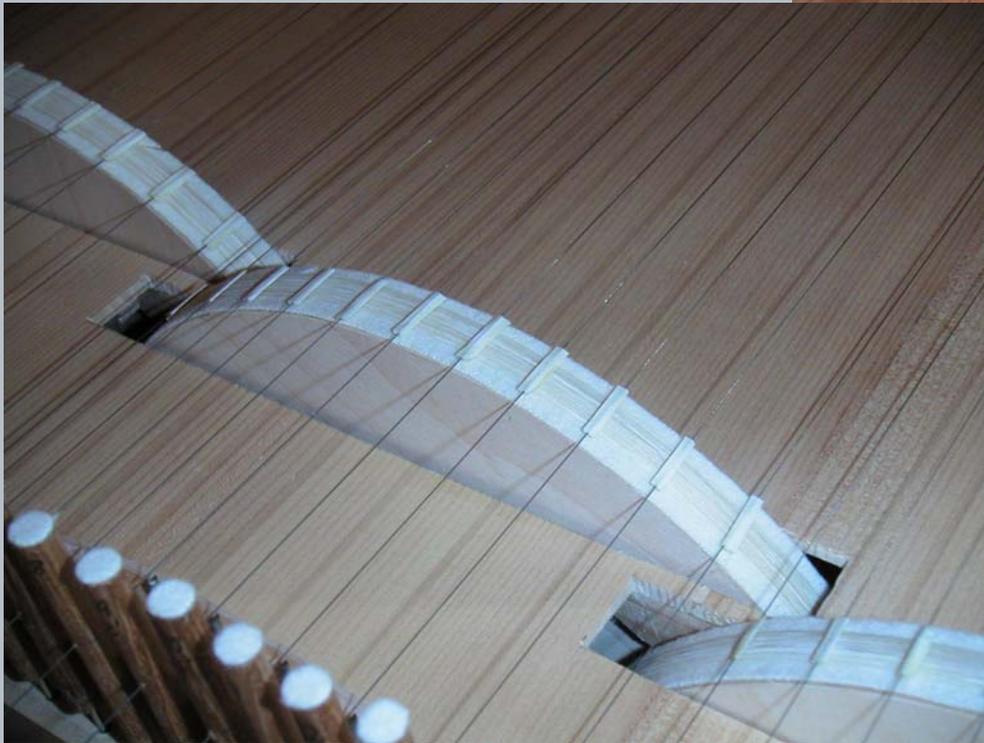
Slide nut pins



The pin act as a fixed end for the string.

Pushed down with the keyboard.

Horsehair on circular disks



Findings

- **With the slide nut pins, both dynamics and tone pitch can be modulated by a player, changing a finger pressure.**
- **Together with the tone modulations, vibrato is also available.**
- **For most of keyboard players, it was too much freedom to be given an ability to control tone pitch for each note.**
- **There are noticeable difference in loudness between tones for strings at higher and lower portions of the soundboard bridge.**

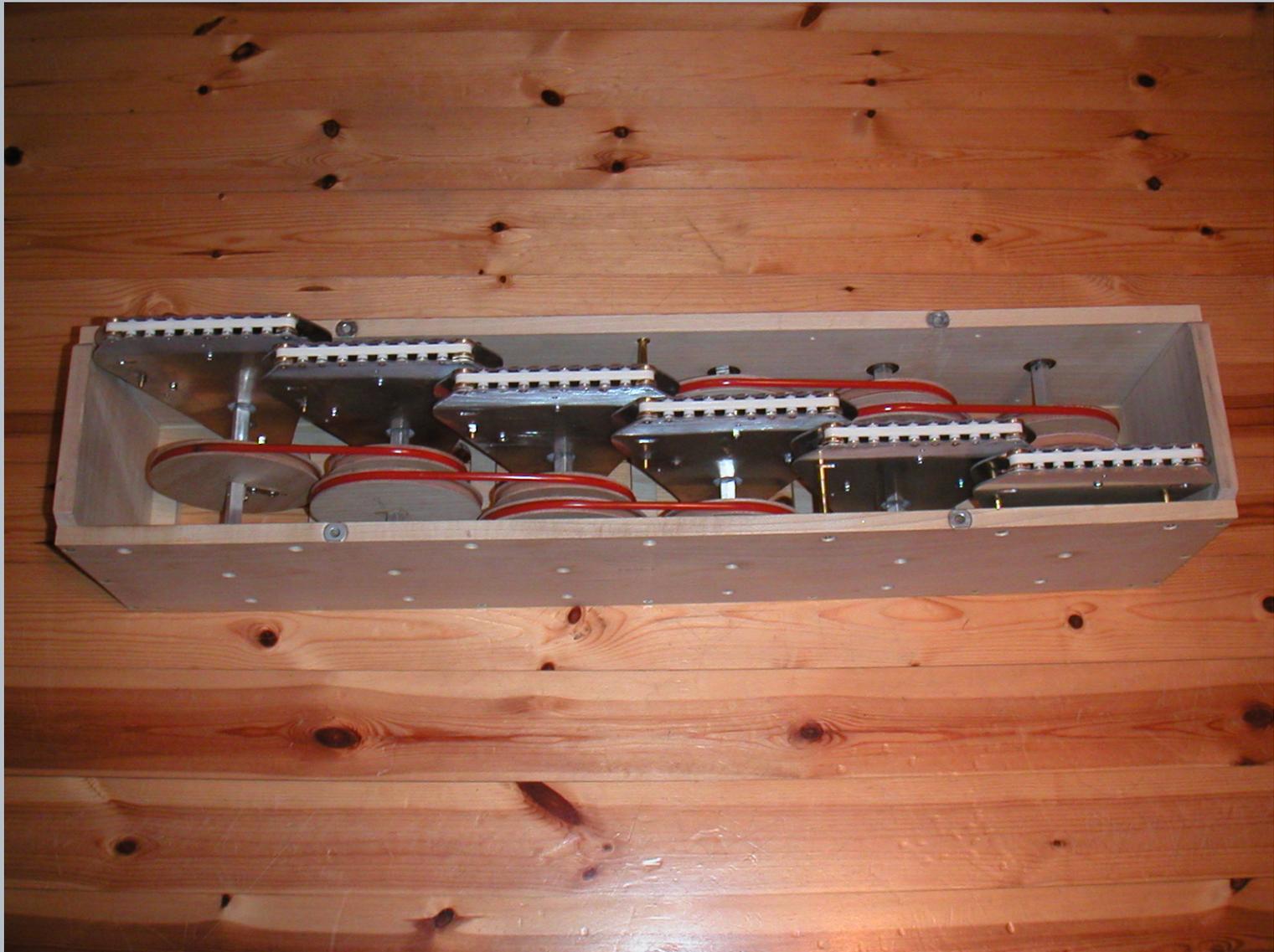
Newly built Streichklavier



Interior of the case



Friction belt sub-assembly



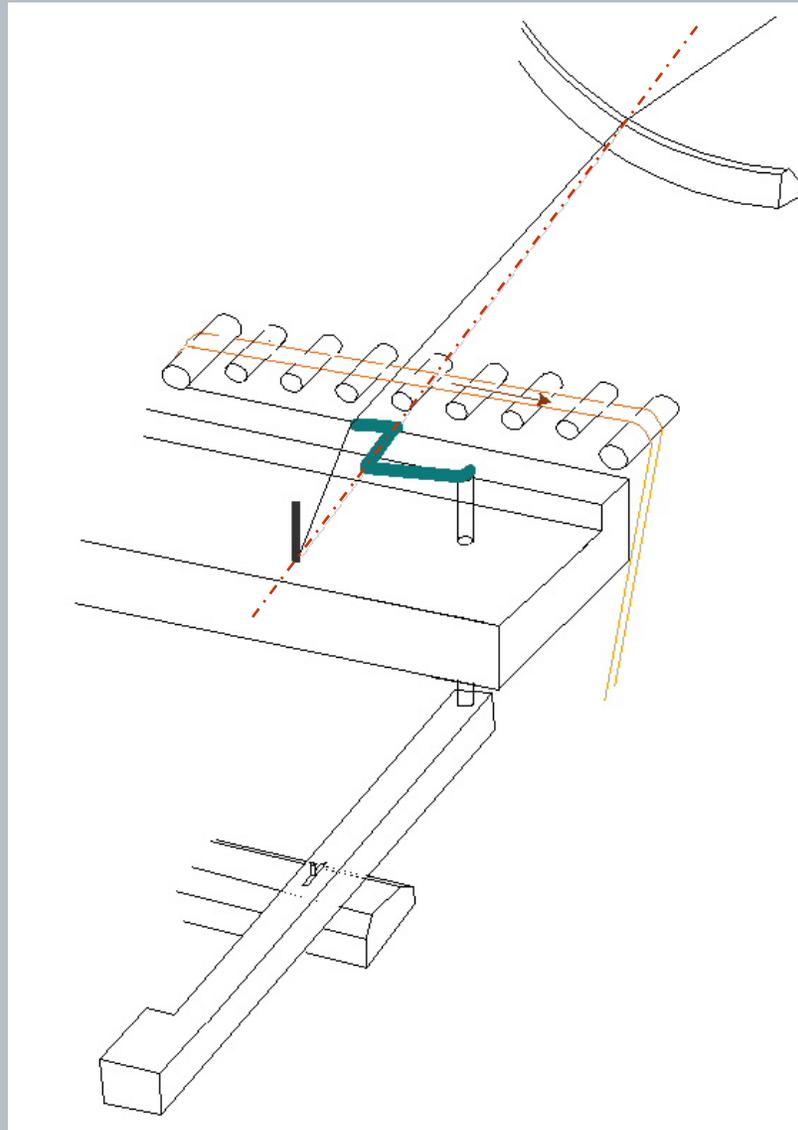
Hollow to accommodate friction belts



Treadle to drive the friction belts



Rotating lever mechanism



Implemented rotating lever



Findings

- **With the rotating lever mechanism, tone pitch modulation can be controlled within a limited (can be nearly zero) range.**
- **Dynamic expressions, corresponding to the finger pressure without changing tone pitch, are available.**
- **Flat soundboard bridge helps even loudness and tone character over the whole range.**
- **Speed of friction belt contributes a little for loudness and tone character.**

Conclusion

- **Viola Organista aims to provide both complexity and delicate expressions at a time.**

With most of the keyboard instruments, one can play a complex music like a symphony orchestra piece, with a limited ability of delicate expressions for each note.

- **A number of instrument makers have been trying to implement the idea of mechanically bowed keyboard instruments in the last >400 years.**
- **New instruments are still being developed.**
- **Challenges for instrument makers and keyboard players will continue.**



Thank you!

Further information can be found at:

<http://homepage1.nifty.com/obuchi/index-e.htm>

or

