# *Journal of the American Musical Instrument Society*

VOLUME XLVI • 2020

and Mark Tobey.

The end matter consists of notes, an extensive bibliography, a glossary of both musical and art historical terms (allowing the book to be more easily understood by scholars of either field), and an index of names. One regrets the absence of a thematic index, and most importantly one that comprises instrument types. This book is such a valuable resource for organologists that it is unfortunate that one cannot search for examples of particular instruments as they are depicted in paintings. One can only hope that if the book were to appear in English translation an instrument index could be added. In the meantime, if one would want to search for depictions of flutes or viols, for example, one would need to leaf page by page through the volume—but one could not imagine a more pleasant task.

Robert Adelson
Conservatoire de Nice

**Patrizio Barbieri. *Hydraulic Musical Automata in Italian Villas and Other Ingenia 1400–2000*. Rome: Gangemi Editore International, 2019. 544 pp.: 184 black-and-white and 106 color illus. ISBN: 978-88-492-3813-6. €50.**

This daunting volume, comprehensive and mostly well-organized, gathers written documents, visual representations, archaeological remains, modern restorations, and reconstructions of hydraulic musical automata and other *ingenia*, a mostly neglected genre in organology. These automata incorporate water falling from a height into engineered piping and "aeolian chambers," producing continuous air pressure that feeds organ pipes and, at times, other instruments or mechanisms. Some allow human control via a keyboard, while many are complex barrel organs. Others include singing birds and instrument-playing statues, all driven by the water organ's air pressure.

The quantity, depth, and breadth of the material collected, sorted, analyzed, and explained is no less than encyclopedic. For readers deterred by physics and technical drawings, there are marvelous descriptions of personalities, pranks, installations, paintings, photographs, and general-

ized workings of various automata installed in gardens of wealthy estates. The book's main focus is in Renaissance Italy, but it includes restorations and new installations to the end of the twentieth century. The publisher has provided fine paper and binding, cover art, and copious high-quality reproductions of images, diagrams, and engravings in black-and-white and color. All chapters include numerous original plans and drawings, plus new plans created by Barbieri, with detailed explanations. If you want to know how to frighten your friends with roaring monster heads, or soak visitors to your garden with water-spurting arquebuses this is your book.

The book draws on articles Barbieri published between 1981 and 2007, plus new research. Signs of this recycling are rare, with the exception of some randomly populated chapters and a few more that feel added on at the end. The preface's summary of contents is a harbinger of the density of material to come. This is not a quick read.

The book is organized into two sections with seventeen chapters (identified by letters, not numbers), followed by twenty-six pages of works cited. Ten chapters describe water organs plus other automata derived at least roughly from first-century CE writings by Hero of Alexandria, along with the writings of ninth-century Arab inventors such as the Banū Mūsā brothers. The last seven chapters address various other types of *ingenia*, generally activated by other means, such as sunlight or wind.

Chapter A discusses the history of the development and structure of two types of aeolian chambers: compression and emulsion, utilizing writings and diagrams going back to the ninth century. The large quantity of information in this chapter will either frighten readers or absorb them for some time. Document reproduction here and throughout the book is of high quality. Chapter B, though briefer, is populated with equations, excellent analyses of early quantitative theories, and some experimental data and calculations for functional flow rates that the non-scientific reader can harmlessly gloss over.

Chapter C introduces the reader to the *Fontana dell' organo* and *Fontana della Civetta* at the Villa d'Este installed at Tivoli in 1567 to 1571, complex water organ installations that inspired other nobles around Europe. The history of these places and their residents, as well as the designers, makers, and repairmen of the complex installations, is fascinating. Included are engravings, paintings, and frescoes of the original installations, as well as are many photos of remains.

Chapter D summarizes knowledge about the early existence of automata in the Western world, before and after those at Villa d'Este. Barbieri notes much uncertainty as to when the first was installed, and as to whether some were only plans or visions. Naturally, the great Italian inventor Leonardo da Vinci enters into this discussion. Barbieri accurately describes some of the designs as "not wholly comprehensible."

At Villa d'Este, a new water organ based on late Renaissance installations was introduced in 2003 as part of a general villa restoration. Chapter E describes its design and construction, directed by architect Isabella Barisi, as well as the original's remains, design criteria, and various issues arising from the deleterious effects of water and humidity on materials and functionality. The Villa d'Este water organ installation included a "Fountain of the Owl," based on a description by Hero. Various devices included singing birds, performing statues, simulated explosions, and artillery effects. Barbieri's excursion into *uccelliere* (artificial bird chirping devices) and *serinettes* (small hand-cranked barrel organs designed to teach canaries and blackbirds to sing) is delightful.

Chapter G is an overview of the historical and technical events surrounding the *organo ad acqua* in the Pontifical Quirinal Gardens from 1596 to 2013. Documents detailing failings and repeated interventions show why these remarkable installations did not survive; the ongoing repairs and rebuilds incidentally document changing ideas and technology, as well as the changing fortunes of the estate owners.

Barbieri moves in Chapters H and I to the Villa Aldobrandini at Frascati, where three hydraulic devices were installed in 1617 to 1619: "Mount Parnassus," "Cyclops," and "Centaur." At a Roman villa, the Belrespiro, the Pamphilj family, owners from 1683 to 1769, radically restored all the water organ constructions, adding features including an "echo organ" to mimic the story of the Faun and the nymph Echo. Barbieri discusses the architectural layout, the devices prior to and after their reconstruction in 1759, and the music. Who would not love statues of a neighing Pegasus and Apollo playing the psaltery? Regarding the type of music played, Barbieri offers letter and diary entries of visitors, along with educated conjectures.

Chapter J introduces Jean Baillou, an internationally popular engineer, mathematician, and hydraulics expert, who created a water organ made for the Farnese Royal Palace at Parma (1619), as well as hydraulic musical automata for the Farnese Summer Palace in Colorno, the *corni da*

*caccia* at the Villa Visconti-Borromeo, and other barrel organs in Milan. Baillou's *Grande grotto incantata* showed the magician Circe, Vulcan at his forge, Apollo with his cithara, and flute-playing shepherds in an array of decorated grottos populated with moving figures, singing birds, flutists, falling water, and lighting effects.

In "harmonic fountains," water falls into containers that resonate on their respectively tuned notes. Chapter K describes these, as well as statues based on acoustical *ingenia*, which echoed what they heard or appeared to answer questions. Similarly based modern devices include a "House that Plays with the Rain" in Dresden, and an organ powered by sea waves to produce sounds at a Croatian tourist resort.

Chapter L discusses the improbable designs (sometimes unrealized) of harpsichords, organs, and other devices activated by thermal effects. Blowers in the shapes of human heads, for example, when heated emitted a violent jet of steam and sounds. The quirky Dutch engineer Cornelis Drebbel built a "virginal" powered by the sun for James I of England. A statue described by Athanasius Kircher (1653) had moving eyes and a voice activated by the morning sun. Kircher, a Jesuit scholar who lived and taught in Rome, also set up a famed museum that included such *Magia artificialis* as automated organs, harpsichords, and various popular monster devices. In chapter M, Barbieri traces the history and incarnations of the Museum Kircherianum and its holdings. Visitors leaving the museum were doused by four water jets emerging from behind a mechanical barking dog. Noisy monster heads, depicted in photos and engravings, would "vomit fire and smoke."

The Italian architect Giambattista Aleotti (1546–1636), who translated Hero's *Pneumatica* and *Automata* via Latin into Italian, proposed an elaborate automaton based on Vulcan's Forge (1589), discussed in chapter N. Different versions of the forge spread about Italy, along with other types of hydraulically powered automata that included flute players, drummers, and horn players, some shown in photos of extant remains. Kircher proposed an automaton based on the legend of Pythagoras listening to smiths pounding on anvils and calculating pitches based on hammer weights. Barbieri includes diagrams of the automaton, as well as a score of appropriate music, composed by Kircher.

A fascinating turn in Chapter O describes musical automata, mostly non-hydraulic, introduced from Italy to India, China, and Japan, in the service of diplomacy. While some instruments were shipped from

Italy, others were designed and constructed by various talented Jesuits in China. Lengthy period writings are included, both original texts and translations. The chapter ends with a good summary of purely mechanical automata driven by clockwork mechanisms that came to dominate automata, primarily made by Bavarians. Diagrams of weight- or spring-driven and conoidal actions for automated chamber organs are beautifully reproduced and explained.

Chapter P introduces mechanisms that combine various musical instruments under the control of one keyboard with a human player. The focus in on Michele Todini, a master performer and maker in Rome. The tale of his *Galleria armonica* (which survives in the Metropolitan Museum of Art, New York), its demise, and Todini's own woes makes for fascinating reading. Barbieri offers detailed descriptions and documentation of the workings, makings, repairs, and evolution of the *Galleria* and its components.

Chapter Q is a bit of a patchwork add-on. Barbieri finally offers details about the Graeco-Roman hydraulic organ, drawing a clear distinction between it and the original Greek hydraulis described by Hero. He also describes devices intended to augment organ sound with effects emulating human singers, including dynamics, vibrato, *messa di voce*, and *portamento*. Organists may be interested in the production of desired tone color in Italian Renaissance organs, as opposed to earlier European tastes. Barbieri discusses the *Vox humana* and short-lived efforts such as dynamic variation by changing the pressure on the key. After 500 pages the book ends abruptly.

Overall, this book is a tremendous resource. The audience served is wide, as the book covers topics related to physics, engineering, art, music, organology, culture, history, fantasy, and humor. Who knew some highly placed clerics found it hilarious to soak their guests unexpectedly? We always need reminders of great inventiveness of the distant past. I hope individuals with an engineering bent will be inspired to recreate some of these marvels. There is enough information here to do so.

Anne Acker
Savannah, Georgia