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The final four chapters follow the development of wind instrument acoustics from the late nineteenth century up to the present. In Chapter H Barbieri identifies the crucial step as the adoption by Webster in 1919 of the electro-acoustic analogy, in which musical instrument components are represented as elements of an electrical circuit. This approach has continued to be fruitful up to the present in describing the influence of bore profile and tone-hole parameters on the intonation and timbre of woodwind instruments. The modelling of mechanical and lip reeds is also explained in Chapter H. In Chapters I and J the ideas of input impedance, mode frequencies and acoustic filtering by tone holes are applied in more detail to the clarinet and the flute respectively. In Chapter K the acoustics of brass instruments is briefly but comprehensively summarised. This chapter includes a section on early brass instruments, but does not consider labrasones with side holes.

This is a book of immense and outstanding scholarship, with a bibliography containing more than 1200 references. A large number of quotes from original sources are presented with parallel translations into English. The volume is beautifully printed and bound, and the excellent illustrations are for the most part reproductions of the original diagrams from the books or papers cited. For anyone interested in the history of science, and particularly the development of scientific ideas and theories about musical instruments, this book will be an indispensable resource.

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Stewart Pollens, *The Manual of Musical Instrument Conservation*. Cambridge: University Printing House, 2015. ix, 448 pp. 54 black and white photographs, approximately 123 tables, bibliographical references, bibliography, index. ISBN 978-1-107-07780 – 5. \$150 (hardbound)

Most artistic and historic objects of importance have the luxury of a dedicated population of conservation professionals to see to their preservation and restoration. With graduate degrees in the science and methods of conservation and specialties in particular object types (paintings, sculpture, etc.) or material (wood, textile, paper), these practitioners number in the hundreds and can be found in larger museums and in private practice in most regions. If there are similarly trained conservators specializing in musical instruments, however, they are so rare as to be unavailable to the thousands of instruments in need of professional

care. Into that void comes this new book promising to serve as *The Manual*.

The opening sentence of the author's introduction, however, is explicit about the actual content of the book and is more telling and more accurate than the book's title. Pollens writes, "Much of the information included in this manual is derived from a shop notebook that I compiled while serving as the musical instrument conservator of the Metropolitan Museum of Art between 1976 and 2006, and it is a reflection of the range of tasks that confronted me on a day-to-day basis." In fairness, it could have been the publisher who, for marketing reasons, insisted on the immodest title with its promise of authority, comprehensiveness, balance, and grounding in the best practices of professional conservation.

Pollens does, indeed, touch on some of the tenants of conservation, concisely pointing out, for example, that "as conservators, our task is not to improve upon instruments but rather to preserve their characteristics" (p.4). He provides a rigorous agenda for treatment documentation (45–46) and a summary of ethical principles widely hailed by conservators (104), both earmarks of the conservation discipline. The book is also sprinkled with practical tips for preventive conservation, warning for example about the corrosive potential of vulcanized rubber in proximity to vulnerable materials (p. 137 and 217). However, this review will treat the book in its much more successful role as Stewart Pollens' self-described personal shop notebook.

As the author suggests in various indirect ways he is, after all, more restorer, instrument maker, and organologist than conservator, and at times reveals (p. 1, 288, 396) a skeptical attitude about today's specialized, graduate-school-trained conservators who lack grounding as instrument makers. Unfortunately, this reviewer knows of no examples of conservators with extensive training in both disciplines—at least in the USA—and as a consequence, many musical instrument players and historians will share Pollen's concern about the musical instrument credentials of formally trained conservators. The absence of conservators fully trained in both disciplines has a solution that is unaddressed in the book but will turn up repeatedly in this review. Simply put, the specialized knowledge and skills of conservators and of instrument makers are two halves of a whole, and that musical instruments will get the best care when restorers work in collaboration with knowledgeable conservators.

Taken as the shop notebook of an experienced restorer and organologist, the volume delivers a terrific selection of solid information, restoration tips, and reference material Pollens has collected over the years.

There are many entries with detailed instructions for such skills as gold leafing, French polishing, heat treating of steel edge tools, harpsichord voicing, and mold making for resin or lost-wax casting, among others. Some of the methods for investigative organology are described in detail, such as revealing latent markings on old instruments using ultraviolet and infrared imaging.

Information on specific topics would have been easier to find if they were arranged topically, putting investigative methods in their own section, for example. Because the text is arranged alphabetically, however, one must find how to examine latent pencil markings under “I” for “*Inscriptions, faded*.” Looking for restoration of harpsichords? That topic is under “S” for Stringed-keyboard restoration. *Wheat paste* has its own brief entry, but if you want to find any other adhesive, look under *Glues, pastes, and other adhesives*. Hide glue, mentioned fifty-six times in many articles throughout the book, has neither its own entry, nor a cross reference entry, nor any mention in the index.

The book is particularly generous with tables, of which there are about 123, more than double the number of photos. Of special interest to musical instrument conservators are charts of string gauges and actual stringing schedules for several instrument types. Many of the tables include arcane data, such as the speed at which sound travels through twenty different materials, including helium, brick, and diamond. Some readers will appreciate not having to go online for tables relating to general shop practice, such as screw sizes, tap drill bit sizes, taper reamer sizes, melting points of various solders, drill bit sizes (nine pages), and two full pages of abrasive grit sizes. A voluminous thirty pages are devoted to a frequency chart for equal temperament giving the pitch in hertz—to five decimal places—for every note from octave zero to octave seven at one-cent intervals.

Anyone who has followed Pollens’ career will know what strengths are to be found in his shop notebook. The word “violin” appears 539 times under numerous subject entries, and “piano” appears 357 times—reflective of his personal interests and expertise. On the other hand, “clarinet” appears only nineteen times and “French horn” is not mentioned at all. The entry on *historical metrology* (“the study of the units of measurement that were used in various locales prior to and including the introduction of the metric system”) is surprisingly detailed, filling twenty-four pages, while the very next article on one of the most important subjects in conservation, *humidity control*, receives less than one page. Only under the pretense of the book’s title is this balance of

subject matter problematic. For readers interested in best practices in musical instrument conservation, consider the Pollens book as a musical instrument supplement to a more complete and authoritative conservation text, such as *Conservation of Furniture* by Shayne Rivers and Nick Umney, Butterworth-Heinemann (2003).

Pollens does include a great deal of specific treatment advice, but it is here that the book can mislead. A central tenant of conservation goes virtually unsaid in the book: *most conservation treatment methods are situation-specific*. As any conservator's notebook would have, this one has rules of thumb for treating particular condition issues. It is between that starting point and any final decision about how to proceed in any particular case that the expertise of trained conservators come to bear, since any final treatment necessarily considers other materials and variables in the context. The entry on stain removal on page 285, for example, lists ten types of stain, along with a chemical for removing each. There can be no doubt that Stewart Pollens in his post at the Metropolitan Museum would either have been familiar with the science or sought advice from conservation specialists if he did not, in order to progress from his notebook's rule of thumb to a safe treatment in the current situation. Yet, in the stain removal entry, no mention is made about how the recommended solvents, bleaches, acids, and soaps could damage or otherwise interact with all the possible substrates and coatings that might be present in the same spot.

The best treatment plans can come from a co-equal collaboration between instrument maker/restorer and conservation specialists, regardless of who ultimately conducts the treatment. This book will help each understand the other, and so should be on the shelf of every musical instrument collector, restorer, and conservator who might be called upon to plan or participate in conservation interventions.

In short, this book is analogous to a pharmacology primer in which many types of medications and their dosages are given without noting possible side effects and without designating which are "over the counter" and which are "prescription." Ask your conservator what's right for you.

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Alberto Cuéllar et al. *La Escuela Granadina de Guitarreros = The Granada School of Guitar-Makers*, ed. John Ray, [Granada]: Diputación de Granada, 2014. 305 pp., many color illus., Spanish/English edition. ISBN 978-84-7807-537-9. €40 (hardbound).