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THE MECHANICAL DEVELOPMENT OF THE PICCOLO

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THE MECHANICAL DEVELOPMENT OF THE PICCOLO

A DOCUMENT APPROVED FOR THE
SCHOOL OF MUSIC

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This document is dedicated to my mother,

Sharon Powell,

for her constant sacrifice, devotion,

support, and encouragement

throughout my education.

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PITCH DESIGNATION AND TERMINOLOGY

The pitch designation method illustrated in Figure A is used consistently throughout this document. Pitches and piccolo keys are referred to in capital letters. When references are made to specific octaves, they are denoted as follows:

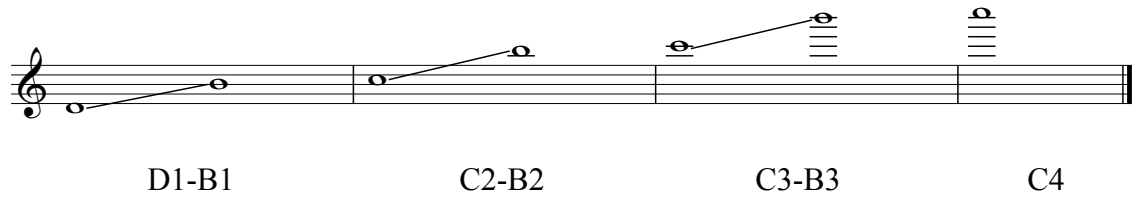


Figure A. Pitch Designation

The terminology for fingering abbreviations illustrated in Figure B are used throughout this document:

Th- Lefthand thumb

L1- Left index finger

L2- Left middle finger

L3- Left ring finger

L4- Left pinky finger

R1- Right index finger

R2- Right middle finger

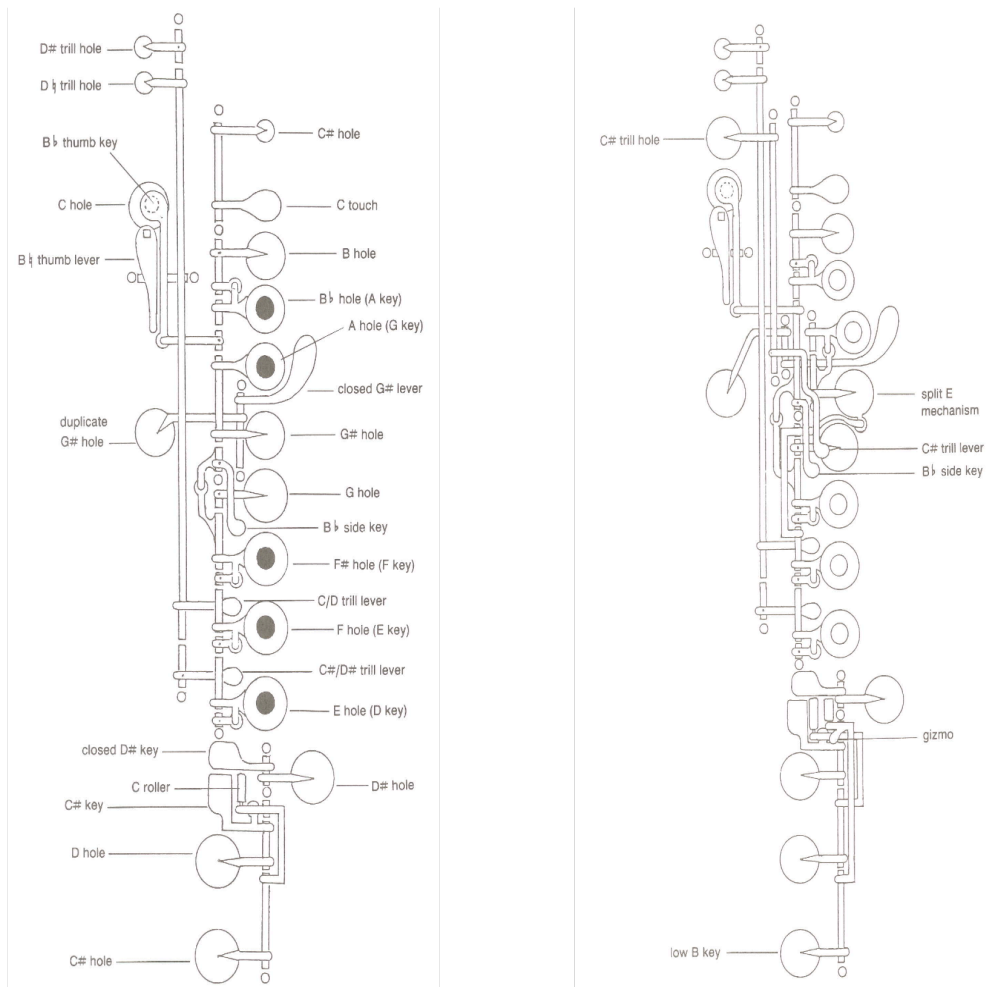
R3- Right ring finger

R4- Right pinky finger

Figure B. Terminology

MECHANICAL DIAGRAM

The following diagrams refer to specific keys and holes on the flute and piccolo:¹



¹ Diagrams from Nancy Toff, *The Flute Book*, 2nd ed. (New York: Oxford University Press, 1996), 10, 23.

ABSTRACT

The purpose of this document is to explore the mechanical development of the piccolo in relation to the flute. Although there have been several studies conducted about the mechanical development of the flute, the piccolo has never received this special attention and deserves to have its story told. The piccolo has gained prominence as an integral part of the orchestra and has also become a popular solo instrument. Mechanically, the piccolo has developed slowly in relation to the flute from a one-key instrument to the modern Boehm system in use today.

The first step in this project began with an investigation of the writings that already exist on this subject, such as dictionaries, encyclopedias, books, and dissertations. Next, interviews were conducted with museum curators, instrument makers, and performers, and historical instrument collections throughout the world were examined. After careful review of these materials, a complete mechanical development of the piccolo has been developed.

Each chapter of this document examines the mechanical improvements in terms of the tube and materials, the headjoint, and the mechanism during each stylistic period. With careful examination of the physical properties of each instrument, the reasons for these changes will become clear. The following chapters will include pertinent information regarding the similarities and differences between the piccolo and the flute, the role and importance of families of flutemakers, as well as shed light on reasons why composers became interested in scoring for these small flutes.

CHAPTER I: INTRODUCTION

In March 2006 while on a spring break trip with my parents to see Mount Rushmore, I requested that we make a stop at the University of South Dakota to see the National Music Museum (NMM) and Center for Study of the History of Musical Instruments in Vermillion, SD. I was amazed to see so many unusual flutes and piccolos, so I took a picture of each instrument to use for teaching and presentation purposes. (Yes, photography was allowed) After the tour I learned that the museum was founded in 1973 and is one of the greatest institutions of its kind in the world. The instruments on display only make up seven percent of the collection, which includes more than 14,800 American, European, and non-Western instruments from virtually all cultures and historical periods.

While performing at the International Piccolo Symposium (IPS) in 2007 and 2009 I had the opportunity to meet and befriend Stephanie Kocher, Instructor of Flute at the University of South Dakota and Dordt College in Iowa. She was the winner of IPS's 2009 "Call for Presentations" and gave a wonderful presentation titled "What Was He Thinking When He Wrote That?" sponsored by the NMM. The museum allowed her to bring a large piccolo collection to display during her presentation. After her presentation, I was sold! In the last ten years of university life, I have studied the history of the flute on countless occasions, and every time I wonder why historians just say, "The piccolo followed after the flute." That might be a true statement, but the piccolo has become a major orchestral and solo instrument, and I believe it deserves a little more attention.

Statement of Purpose

The purpose of this document is to explore the mechanical development of the piccolo in relation to the flute. Although there have been several studies conducted about the mechanical development of the flute, the piccolo has never received this special attention and deserves to have its story told. The piccolo has gained prominence as an integral part of the orchestra and has also become a popular solo instrument. Mechanically, the piccolo has developed slowly in relation to the flute from a one-key instrument to the modern Boehm system in use today.

This document is unique because there have been no studies to date that completely focus on the mechanical history of the piccolo. All studies conducted have encompassed the mechanical history of the flute. Due to the colorful role it plays, the piccolo has been a significant component to classical repertoire since the nineteenth century and deserves the same attention that the flute has received.

Historical writings show a lack of consideration for this instrument. Specialized method books for the piccolo are extremely rare and are often flute tutors adapted for this instrument. Thanks to the Piccolo Committee of the National Flute Association, modern performers and composers are making improved efforts to commission works and write tutors specifically for the piccolo. The limited amount of literature does not encourage teachers to promote the study of the piccolo in their studios. This study will strive to foster more discussion and make the instrument more accessible for performers, teachers, and scholars.

Procedure

The first step in this project began with an investigation of the writings that already exist on this subject, such as dictionaries, encyclopedias, books, and dissertations. Next, the author conducted interviews with museum curators, instrument makers, and performers, as well as examined historical instrument collections throughout the world. After careful review of these materials, a complete mechanical development of the piccolo has been compiled.

With careful examination of the physical properties of each instrument, the reasons for specific developments should become clear. The author will also discuss why certain mechanical developments remained and why others were abandoned. The word *flute* is used throughout this document to refer to the regular flute in C and the word *piccolo* is used to refer to the instrument pitched one octave above flute in C, unless specified otherwise. Instruments numbered with the prefix DCM are part of the Dayton C. Miller Flute Collection² at the Library of Congress in Washington, D.C., instruments numbered with the prefix NMM are part of the National Music Museum Collection³ at the University of

² Flutist, acoustician, and collector, Dayton C. Miller (1866-1941) gained interest in the flute as a young boy playing his father's fife from the Civil War and local fife and drum corps. In 1901 he made his first flute and by 1908 his translation of Theobald Boehm's *Die Flöte und das Flötenspiel* was published. As one of the most prolific collectors in the Western Hemisphere, Miller originally used eight categories when adding items to his collection: flutes, books, music, portraits, autographs, maker's price lists and catalogues, newspaper clippings, and patent specifications. Currently the Dayton C. Miller Collection has four separate, but related collections: flutes and flute-like instruments, books and music, works of art, and miscellaneous. Before his death in 1941, Miller was preparing to move the entire collection to the Library of Congress in Washington, D.C. and install them himself. The collection arrived in Washington D.C. right before the attack on Pearl Harbor and was evacuated to an inland point for safety purposes until the end of the war. In 1946, the collection was returned to the Library of Congress and unpacked.

³ The National Music Museum: America's Shrine to Music and Center for Study of the History of Musical Instruments (NMM) is a musical instrument museum on the campus of the University of South Dakota in Vermillion, South Dakota and was founded in 1973. The museum is fully

South Dakota in Vermillion, SD, and instruments numbered with the prefix PHM are part of the Powerhouse Museum Collection⁴ in Ultimo, Australia.

Related Literature

The following theses and dissertations have contributed to the study of the piccolo in some capacity. However, the primary focus of these sources is not necessarily the mechanical development of the piccolo. This document will combine and organize the knowledge imbedded in these sources in order to create a comprehensive discussion of the mechanical development of the piccolo.

Nancy Nourse's 1981 MM thesis, SUNY Potsdam, titled *The Piccolo: an Overview of Its History and Instruction*⁵ dedicates one chapter to the history of small transverse flutes in relation to the flute from ancient to modern times. This chapter will be used as foundation for a more detailed historical and developmental approach.

The 1994 thesis *The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847* by Carolyn Nussbaum, MA, University of North Texas⁶, explains the mechanical improvements of the Boehm flute and provides a timeline for these mechanical developments. This thesis reveals an

accredited by the American Association of Museums and is recognized as "A Landmark of American Music" by the National Music Council. It houses many of the earliest, best preserved, and historically most important instruments known to survive.

⁴ The Powerhouse Museum has had a long history of collecting instrument and acquired its first flute in 1884. The collection currently has twelve piccolos, the first of which entered the collection in 1976. These instruments were made in a variety of places including England, France, the U.S. and Australia.

⁵ Nancy Nourse, "The Piccolo: An Overview of Its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 4.

⁶ Carolyn Nussbaum, "The Flute: The Mechanical Improvements On The Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 1.

enormous amount of information that directly relates to the mechanical development of Boehm's piccolo design and will be useful as a model.

Susan Marie Beagle Berdalh's 1985 University of Minnesota Ph.D. dissertation, *The First Hundred Years of the Boehm Flute in the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers (Volumes I-III)*⁷ has established a record of all known Boehm system flutemakers in the United States up to World War II. Berdalh's document is intended as a reference for those trying to identify instruments by maker and date and provides an organized basis for further research.⁸ An entire chapter of this dissertation is dedicated to small and large Boehm flutes, including the C piccolo, D-flat piccolo, and A-flat piccolo. There is also a discussion of bore and material controversies for the flute that is applicable for the piccolo and will be extremely useful for this document.

The mystery of the D-flat piccolo and its adoption and use in amateur brass bands during the nineteenth century is the focus of the 1999 DMA dissertation *The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the Nineteenth-Century American Amateur Band* written by Heather Hall Coleman, University of Memphis⁹. In order to complete this study, Coleman examined instruments and photographs from the Dayton C. Miller Flute Collection at the Library of Congress and the Hazen collection of band ephemera at the

⁷ Susan Marie Beagle Berdalh, "The First Hundred Years of the Boehm Flute in the United States 1845-1945: A Biographical Dictionary of American Boehm Flutemakers. Volumes I-III" (Ph.D. diss, University of Minnesota, 1986), iii.

⁸ Ibid., iii.

⁹ Heather Hall Coleman, "The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the Nineteenth-Century American Band." (D.M.A. diss, University of Memphis, 1999), v.

Smithsonian Institution. She also conducted a systematic analysis of the piccolo parts in the band repertoire.¹⁰

The Piccolo in the Nineteenth Century, a 1987 D.M. document by Zartouhi Dombourian-Eby, Northwestern University¹¹, explains the history of the piccolo based on repertoire developments, but specific improvements to the instrument are not mentioned.

Early Small Transverse Flutes

Western Cultures

Archaeologists have discovered instruments from ancient times made of small bone with a varying number of finger holes, which are believed to be transverse flutes¹². Transverse flutes are instruments, which are held horizontally and played by blowing across a lateral embouchure hole. The development of the piccolo began in ancient times when it was in fact a small transverse flute, as well as part of a family of transverse flutes in various sizes.

The transverse flute emerged in Byzantine society in the eleventh century after a prolonged absence in western culture.¹³ Evidence of its existence during this period can be found in Italo-Byzantine images of flutes found on ninth and

¹⁰ Ibid., v.

¹¹ Zartouri Dombourian-Eby, “The Piccolo in the 19th Century” (D.M. diss, Northwestern University, 1987).

¹² Transverse flute refers to any variety of horizontally held instrument (also known as a ‘cross flute’) played by blowing across a lateral embouchure hole near the end, which is closed by any means ranging from a simple natural septum (as in bamboo) to a mechanical device that adjusts the position of a cork plug for tuning purposes. If that device incorporates a threaded rod design allowing the cork to be advanced or retracted by rotating the headjoint cap, the device is called the ‘cork-setting mechanism.’

¹³ Nancy Nourse, “The Piccolo: An Overview of Its History and Instruction” (master’s thesis, State University of New York at Potsdam, 1981), 10-11.

tenth century burial caskets.¹⁴ It is believed that the flute arrived in the west from Oriental cultures due to its striking similarity to the six finger hole flutes of China.

MEDIEVAL (c.476-1452)

During the Medieval period (c.476-1452), the transverse flute with six finger holes was made in families of several sizes, spread throughout Europe, and was used for various types of secular music. In thirteenth century Germany it was referred to as the *swegel* or *shin bone* and was used in secular courtly music along with harp, fiddle, and rote.¹⁵ By the fourteenth century it appeared as an outdoor military instrument with large bells, drums, bagpipes, and trumpets. Transverse flutes of all sizes, including the small transverse flute from the Medieval period had a side-blown embouchure hole and was made of a single cylindrical piece of hardwood, such as rosewood, cocus, or blackwood.¹⁶ This type of embouchure hole construction has remained while other aspects of the piccolo have developed over time. The small transverse flute was referenced in the repertoire for the first time by Henri d'Andeli (13th c.), who wrote a thirteenth century trouvère song called *La Bataille des VII Ars* (1224), which mentions *fleüteles*, or small flutes.¹⁷

RENAISSANCE (1452-1600)

During the Renaissance period (1452-1600) the transverse flute continued to be used in secular settings, such as the military and in consorts or instrument

¹⁴ Ibid., 11.

¹⁵ Ibid., 12-13.

¹⁶ Simon Hunt, *Learning to Play the Flute*, Vol. I. (London: Pan Educational Music, 1979), 10.

¹⁷ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 12.

families in the court. At this time ensembles of flutes were favored for playing the four-part consort repertoire of the period. The development of woodwind instruments was more prolific than any other instrument family from treble-to-bass sizes.¹⁸ The art of woodturning experienced tremendous improvements during this period, therefore leading to new developments in design. Most woodwind instruments were turned and bored on a lathe, and surviving instruments reveal this high standard of workmanship with smoothly finished bores and precisely drilled finger holes.¹⁹ Improvements in woodturning perfected the quality of sound, intonation, and the projection of each instrument.

The word *flute* was a generic term for both recorder and transverse flute during the Renaissance.²⁰ The small transverse flute of the Renaissance period was fairly simple with a cylindrical bore featuring six finger holes that were placed randomly, rather than by pitch. Performers with smaller hands might find the stretch between these randomly spaced holes a bit uncomfortable.²¹ Standard pitch was not established at this time, leading to intonation difficulties.²²

Military Fife

Along with small transverse flutes the military fife also acted as a predecessor to the piccolo in modern form and ranged in size from eight to twenty inches, each one larger by two-inch increments.²³ It was an un-jointed transverse

¹⁸ David Munrow, *Instruments of the Middle Ages and Renaissance* (London: Oxford University Press, 1976), 38.

¹⁹ *Ibid.*, 38.

²⁰ *Ibid.*, 53.

²¹ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 22.

²² *Ibid.*, 22.

²³ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 27.

flute with a cylindrical bore, six finger holes, a pair of slinging holes at the end, no keys, and brass ferrules or metal bands for protection at the ends.²⁴ The military fife was pitched in B-flat, F, D, A-flat or C, had poor intonation, a crude and shrill, piercing sound, and played only a diatonic scale.²⁵

The fife was used with the drum and was first introduced into the military in the sixteenth century by the Swiss for one of the earliest forms of military music.²⁶ These principal mercenary soldiers spread the instrument all throughout Europe.²⁷ The instrument was first used by Swiss troops in the Battle of Marignano (1515) and was known as the *Fistula militaris*, *Zwerchpfeiff*, *Schweitzerpfeiff* (swiss pipe), or *Feldpfeiff* (field pipe).²⁸ The fife was used for “regulating the movements of soldiers on the march”²⁹ and “to sound commands, using different calls, in order to signal to the army what their next move or position would be.”³⁰

Transverse Flutes in Consorts

In a book on consorts of instruments, *Syntagmatis musici* (1619), late Renaissance composer Michael Praetorius (1571-1621) shows transverse flutes and fifes in four sizes that were played by both amateurs and professionals before 1600 in secular repertoire.³¹ These sizes and specifications were experimental³²,

²⁴ Ibid., 28.

²⁵ H. Macaulay Fitzgibbon, *The Story of the Flute*, 2nd ed. (London: Williams Reeves Bookseller Limited, 1928), 79.

²⁶ Ibid., 73.

²⁷ Ibid., 73.

²⁸ Ibid., 73.

²⁹ Christopher Welch, *History of the Boehm Flute*, 2nd ed. (New York: G. Schirmer, 1961), 232.

³⁰ Therese M. Wacker, “The History of the Piccolo,” in *The Complete Piccolo* by Jan Gippo (King of Prussia, PA: Theodore Presser Company, 1996), 27.

³¹ Claudia Anderson, “The Flute in Early America,” *Flute Talk* 25, no. 2 (October 2005): 22.

³² Nancy Nourse, “The Piccolo: An Overview of its History and Instruction” (master’s thesis, State University of New York at Potsdam, 1981), 16.

although there were three principal sizes separated by a fifth: alto in A, tenor in D, and bass in G.³³ Renaissance nomenclature is one tone higher than the terminology in modern orchestral use. Transverse flutes in the Renaissance were named according to the pitch of the instrument when all six finger holes were closed.³⁴ For example, the modern flute pitched in C would have been referred to as the flute in B during the Renaissance, because the lowest pitch on the instrument is B.

Instrument makers normally supplied woodwind instruments in consorts. Due to the lack of standard pitch, buying an entire consort of flutes was the only way to ensure that the instruments would play in tune and balance one another.³⁵ Small transverse flutes were made with one cylindrical piece of boxwood³⁶ and had six finger holes, very small, round embouchure holes, and a stopped end after the embouchure hole.³⁷ Intonation was extremely poor requiring performers with an excellent understanding of pitch and intonation.³⁸

BAROQUE (1600-1750)

During the Baroque period (1600-1750) the fife was still used in the military, and the favorite of the family of transverse flutes retain a position in the

³³ David Munrow, *Instruments of the Middle Ages and Renaissance* (London: Oxford University Press, 1976): 54.

³⁴ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 21.

³⁵ David Munrow, *Instruments of the Middle Ages and Renaissance* (London: Oxford University Press, 1976): 38.

³⁶ Boxwood or palmwood (*Buxus sempervirens*) is a fine-grained, moderately heavy wood that was frequently used for baroque woodwind instruments. It is fairly easy to identify by its light color and its dense structure, which lends itself to finely detailed turnery.

³⁷ David Munrow, *Instruments of the Middle Ages and Renaissance* (London: Oxford University Press, 1976): 54.

³⁸ *Ibid.*, 54.

ensembles of the period, namely the Baroque version of today's C flute and piccolo. A piccolo with one key was developed at this time and became a necessity for court music. The addition of this closed key allowed composers to write in additional keys and with a wider range of notes. The military fife and small flutes from the period might have been capable of playing in these keys; however, the fingering combinations are extremely difficult and require exceptional technique. Another refinement of the piccolo and flute of this period was a choice of sections, varying slightly in length, or *corps de réchange*. The *corps de réchange* allows the performer to make subtle adjustments in pitch in order to correct intonation and match the prevailing pitch of that time and location.

Families of flutemakers also started to emerge during this period. By the seventeenth century, broken consorts replaced homogeneous wind consorts making intonation inconsistent.³⁹ Performers had to manipulate their embouchures in order to correct poor intonation. The role of the small transverse flute is difficult to examine during the Baroque period due to the ambiguous use of the terminology *flute*, *transverse*, and *recorder*.⁴⁰ The flute or *flauto* meant recorder and not transverse flute.⁴¹ Scholars are starting to agree that *flute* pertains to the recorder and *flauto transverse* or *German flute* pertains to the transverse flute.⁴²

³⁹ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 28.

⁴⁰ *Ibid.*, 29.

⁴¹ David Munrow, *Instruments of the Middle Ages and Renaissance* (London: Oxford University Press, 1976), 11.

⁴² Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 29.

When the question of size is involved, the term *flauti piccoli* becomes extremely important.⁴³ The names *kleine Flöte*, *oktavflöte*, *petite flûte*, *dessus de flûte*, *flautino*, *flauto piccolo*, and *ottavino* could describe similar or different instruments during the Baroque period.⁴⁴ According to Therese Wacker,

When one speaks of music of the sixteenth through eighteenth centuries, the instrument names denote instruments different from our modern ones. For instance, in Handel's time, *flauto piccolo* referred to a descant recorder, although from Christoph Willibald Gluck (1714-1787) onward, it represented the orchestral piccolo.⁴⁵

Fife

In 1683, German troops referred to the fife as the *Almain whistle*, *pfeife*, *trommelflöte*, or *drum-flute*.⁴⁶ The French fife spoke louder and was much more piercing than the German fife, because it was shorter and narrower.⁴⁷ For some time, the fife disappeared from the French army altogether but was restored by Napoleon.⁴⁸

According to Fitzgibbon, "The instrument [fife] was first used in the English army in the reign of Henry VIII who sent to Vienna for fifes."⁴⁹ The fife disappeared from the English army for a while and was replaced by the bagpipe and the hautboy during the reign of Charles I.⁵⁰ At Maestricht in 1747 the fife was re-introduced to the British Guards.⁵¹ This re-introduction was attributed to the

⁴³ Ibid., 29.

⁴⁴ Ibid., 29.

⁴⁵ Therese M. Wacker, "The History of the Piccolo," in *The Complete Piccolo* by Jan Gippo (King of Prussia, PA: Theodore Presser Company, 1996), 28.

⁴⁶ H. Macaulay Fitzgibbon, *The Story of the Flute*, 2nd ed. (London: Williams Reeves Bookseller Limited, 1928), 74.

⁴⁷ Christopher Welch, *History of the Boehm Flute*, 2nd ed. (New York: G. Schirmer, 1961), 234.

⁴⁸ H. Macaulay Fitzgibbon, *The Story of the Flute*, 2nd ed. (London: Williams Reeves Bookseller Limited, 1928), 76.

⁴⁹ Ibid., 76.

⁵⁰ Ibid., 78.

⁵¹ Ibid., 78.

Duke of Cumberland.⁵² British and colonial armies began enlisting nine and ten-year-old boys to serve as fifers.⁵³ In his opera *Almira* (1705), George Frideric Handel (1685-1759) pays homage to the military fife by writing for a band of cymbals, drums, and fifes.⁵⁴

One-Key Piccolo (c.1660)

It is difficult to trace the development of the eighteenth century piccolo, because there is little evidence from surviving instruments and developments at this time were experimental.⁵⁵ Boxwood and ebony⁵⁶ were the materials of choice for the piccolo; however, ivory⁵⁷ was occasionally used even though it was known to crack easily.⁵⁸ The equal-temperament tuning system was also employed toward the end of the Baroque period dividing the octave into twelve equally spaced chromatic half steps, which lead to further experimentation. Although this tuning system offered greater stability for the piccolo it lacked standardization from ensemble to ensemble and country to country. Pitch might range anywhere from A=415 to A=440.

⁵² Ibid., 78-79.

⁵³ *Music in Colonial Massachusetts 1630-1820*, Vol. I (Boston: The University Press of Virginia, 1980), 719.

⁵⁴ H. Macaulay Fitzgibbon, *The Story of the Flute*, 2nd ed. (London: Williams Reeves Bookseller Limited, 1928), 79.

⁵⁵ Therese M. Wacker, "The History of the Piccolo," in *The Complete Piccolo* by Jan Gippo (King of Prussia, PA: Theodore Presser Company, 1996), 28.

⁵⁶ Ebony (*Diospyros spec.*), African grenadilla or blackwood (*Dalbergia melanoxylon*), and similar tropical woods range in color from dark-brown to black. A fairly large number of instruments are made of a dark, hard tropical wood, which in most cases is probably ebony from Asia.

⁵⁷ A few makers' surviving traversos are made entirely of ivory. Its quality, such as grain, color and state of preservation vary considerably, and is always defined as clearly as possible. Ivory comes from African or Asian elephants, sometimes from mammoths or for smaller beads from walrus teeth.

⁵⁸ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 23.

During the Baroque period, the piccolo became a separate instrument from the fife and other small transverse flutes with the development of one key operated by *R4*.⁵⁹ The flute first received the addition of the closed D-sharp key c.1660 and was used in Jean Baptiste Lully's (1632-1687) orchestra in Paris in 1670. One-key piccolos were used in order to perform music written in the keys of D Major, G Major, and E Minor, and it is referred to as being closed because its resting position is shut or sealed.

Beginning as a simple, cylindrical tube with six finger holes and made of ebony, glass, or even crystal, the flute and piccolo transformed into something a little more complex c.1660 with three sections, headjoint, body, and footjoint joined by means of tenon and socket construction and one key.⁶⁰ The D-sharp hole and closed key were added to the flute and piccolo to extend the musical scale, to provide a wider range of notes, and to enable the performer's reach of the lowest note with greater ease.⁶¹ This key opened and closed the lowest tone hole and was made of brass or silver.⁶² Jean Hotteterre (1605-1690/92) receives credit for this addition, although the exact date and maker are unknown.⁶³

The Hotteterre family was the most celebrated family of wind instrument makers, performers, and composers at the French court, and they were from the

⁵⁹ Therese M. Wacker, "The History of the Piccolo," in *The Complete Piccolo* by Jan Gippo (King of Prussia, PA: Theodore Presser Company, 1996), 28.

⁶⁰ Zartouhi Dombourian-Eby, "The Piccolo in the Nineteenth Century" (DM diss, Northwestern University, 1987), 4.

⁶¹ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 22.

⁶² Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

⁶³ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 22.

town of La Couture Boussey, in the Normandy region of France. Many members of the Hotteterre family conducted business as instrument makers in Paris.

Examples of eighteenth century piccolos with one key are scarce. The one-key piccolo in D in four sections in Figure 1.1 is No. 0667 in the Dayton C. Miller Flute Collection and an example made by Thomas Lot III (1708-1787). This instrument is made of boxwood with brass keys and animal horn ferrules⁶⁴. The single key is square or slightly trapezoid in shape and has a pin in block.⁶⁵



Figure 1.1. DCM 0667: Thomas Lot III Piccolo in D (1734-1787)

The Lot family was one of the most important families of French woodwind instrument makers. Their leadership dominated the history and the development of the flute and piccolo in Paris during the eighteenth and nineteenth centuries. Thomas Lot III built flutes for the most prominent Parisian flutists of the eighteenth century including Michel Blavet, Johann Baptist Wendling, and Jacques-Christophe Naudot. Louis Lot, one of Lot's descendants, modified the Boehm flute that became the official instrument at the Paris Conservatoire in 1860.

During this period the small transverse flute was referenced in method books and was used in classical literature. Many scholars question the instrument

⁶⁴ A ferrule is a narrow circular ring of metal or sometimes plastic used on piccolos to fasten, join, or reinforce.

⁶⁵ Anthony C. Baines, *The Oxford Companion to Musical Instruments* (Oxford: Oxford University Press, 1992), 263.

choice of Handel and Vivaldi while Bach's scoring for the small transverse flute remains unquestioned. In "The Piccolo: An Overview of its History and Instruction" Nancy Nourse explains,

The earliest reference in literature to an octave transverse flute [piccolo] is found in Michel Corrette's (1707-1795) *Méthod pour apprendre aisément à jouer de la flûte traversière*, Paris c.1735. The type of instrument that Corrette mentioned can be found in the Conservatoire National Supérieur de Musiue in Paris. It is an ivory, one-key piccolo that is pitched one octave higher than the ordinary transverse flute and is dated c.1730-1740.⁶⁶

It is quite possible that Handel wrote for the one-key piccolo in his opera *Rinaldo* (1711); however, there is debate whether the instrument used was a small transverse flute or a recorder. The instrumentation designation of three concerti by Antonio Vivaldi (1678-1741), Concerto in C Major, RV 443, Concerto in C Major, RV 444, and Concerto in A Minor, RV 445, still remains unanswered. Although these concerti might be suitable for sopranino recorder, descant recorder, flageolets, or the one-key octave transverse flute, they are easier to play on the piccolo.⁶⁷ Johann Sebastian Bach (1685-1750) included the piccolo in his Cantata *Ihr werdet weinen und heulen*, BWV 103 in 1725.⁶⁸

Hotteterre Bore (c.1680)

The Hotteterre family also transformed the all-cylindrical bore to a cylindrical bore head with a conical bore body c.1680. The new Hotteterre piccolo bore construction, which is still an important element of the modern piccolo, improved the projection of the low register, eliminated shrillness in the

⁶⁶ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 33.

⁶⁷ *Ibid.*, 30.

⁶⁸ Neville H. Fletcher and Thomas D. Rossing, *The Physics of Musical Instruments*, 2nd ed. (New York: Springer-Verlag New York, Inc., 1998), 11-12.

upper register, and also improved intonation in all registers. The size of the finger holes was reduced, therefore creating greater control of the upper octave and cross-fingered notes. This type of construction facilitated the shaping of the bore and made slight pitch adjustments possible by pulling out the headjoint.⁶⁹ This new development was also intended for the orchestra of Jean Baptiste Lully in France.⁷⁰

Corps de Réchange (c.1720)

Because pitch standardization was still unheard of at this time, flutemakers c.1720 developed transverse flutes with four sections and *corps de réchange*, or three to six upper-middle or left hand interchangeable joints of various sizes. These interchangeable joints differed in length by about a quarter of an inch. Performers used the upper-middle joint that was as close to the prevailing pitch level as possible and adjusted the cork plug at the end of the headjoint to change the length of the instrument and therefore manipulate the pitch of the instrument.⁷¹

The *corps de réchange* improved the intonation temporarily, but it did not solve the intonation problems that were caused by bore size and the finger hole placement.⁷² Performers were still required to make drastic changes with the embouchure in order to improve pitch.

When performers traveled from one location to the next and performed with various ensembles they could use these interchangeable joints to

⁶⁹ Zartouhi Dombourian-Eby, "The Piccolo in the Nineteenth Century" (DM diss, Northwestern University, 1987), 4.

⁷⁰ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 22.

⁷¹ *Ibid.*, 22.

⁷² Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 22-23.

accommodate the varying pitch standards, temperature, and repertoire.⁷³ As Johann Joachim Quantz (1697-1773) pointed out, shorter joints were used during quiet movements, so the lower velocity of the airstream would lower the pitch. Longer joints were used in allegro movements, so the air velocity would raise the pitch.⁷⁴

Figure 1.2 features an anonymous piccolo in C (low pitch) that was made in Dresden in the late eighteenth century. It is made of ebony with an ivory cap and ferrules and a silver key with a square flap. This piccolo is divided into four sections plus includes one *corps de réchange*.⁷⁵



Figure 1.2. DCM 0517: Anonymous Piccolo in C (low pitch) (18th c.)

⁷³ Robert E. Sheldon, "A Quantz Flute at the Library of Congress," Edited by Linda Marianiello. *Flutist Quarterly* 19, no. 3 (Spring 1994): 28.

⁷⁴ Jeremy Montagu, *The Flute* (Princes Risborough, England: Shire Publications Ltd., 1990), 63.

⁷⁵ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

CHAPTER II. CLASSICAL PICCOLO (1750-1825)

The Classical period (1750-1825) was a period of improvement allowing the piccolo to play in keys other than D Major, G Major, and e minor, giving the composer greater flexibility to set it in orchestral and chamber works and compose melodic lines that venture out of the simple diatonic modes, as compared to the attention to standardizing the pitch somewhat and improving intonation during the Baroque period. The tubes, materials, and headjoints made during this period have been condensed into one major section in this chapter due to similarities in the instruments. The military fife of this period was quite similar to the fife in the subsequent periods while the concert piccolo was rapidly changing to follow the development of the flute. Although these changes occurred rather quickly, the development of the piccolo still significantly lagged behind the development of the flute.

TUBE, MATERIALS, AND HEADJOINT

Two-Piece Piccolo

Although the two-piece piccolo is the standard instrument used today, it was not commonly made during this period. Perhaps makers preferred to use the design of the flute in three sections as a model for the piccolo. The two-piece piccolo catalogued DCM 0769 was made by Euler in Frankfurt am Main from 1810 to 1873. It features six nickel-silver keys with round, flat flaps⁷⁶, pin in

⁷⁶ Key flaps or flat key flaps refer to the flat, pad-retaining end of an early woodwind key that was padded with a piece of soft leather to cover its tonehole. The shape was usually square or round, with many decorative variations.

block⁷⁷, a tuning slide in the metal-lined headjoint, an ivory headjoint upper section, and nickel-silver ferrules. The nickel-silver sheet metal ferrule could possibly be original to the instrument, or it could have been added to repair a crack in the instrument.⁷⁸

Three-Piece Piccolo

The most commonly used piccolo during this period was the three-piece piccolo. For example, No. 0964 of the Dayton C. Miller Flute Collection is a piccolo in E-flat in three sections (head, body, and foot) by Bühner and Keller that was made in Strasbourg sometime between 1802 and 1844. This piccolo is made of boxwood with an ivory cap and ferrules and a single square flap brass key. The mortice⁷⁹ for the ivory ferrule has simply been re-cut upward, partly obliterating the maker name stamp. However, the ivory ferrules in that shortened location also seems to have taken part of the stamp “Keller” suggesting that this alteration was done at the maker’s shop. The footjoint is short beneath the E-flat tonehole and the key block is pre-pinned with a threaded iron pin. The footjoint appears to have been shortened either as a repair or as a way of disguising a manufacturing mistake.⁸⁰ Although the three-piece piccolo seemed to be the instrument of choice

⁷⁷ Pin in block refers to the early methods of including key mounts as an integral part of the tubing or body materials of woodwinds, whether carved from wood or ivory. Oversize ferrules or beads were left during the outer turning operation and designed to be channeled and drilled to mount one or more keys. The entire ferrule supporting such keywork either remained in place, partly as a decorative device, or had most of its circumference cut away, leaving only a block with a channel for the key. In either case, each key was usually mounted with a brass pin as the fulcrum or pivot.

⁷⁸ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

⁷⁹ A mortice is a woodworking term that refers to a recess cut into a piece of wood that accepts a tenon.

⁸⁰ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

during this period, it eventually fell out of favor by the majority of performers and makers.

Four-Piece Piccolo

While two- and three-piece instruments were common during this time, Thomas Lot III (1708-1787) was also responsible for making piccolos in four sections, such as DCM 0667 made of boxwood. This piccolo in D (C) was made in Paris from 1734 to 1787 with one square, or slightly trapezoid brass key, pin in block, and animal horn ferrules.⁸¹ Like the three-piece piccolo, the design of the four-piece piccolo was soon forgotten.

Ebony

In *On Playing the Flute* (1752), Johann Joachim Quantz (1697-1773) never mentions the octave flute, but there is a possibility that he was familiar with an instrument similar to the octave flute, because the list of instruments in his book includes *Quartflöten*, *flutes d'amour*, and little *Quartflöten*.⁸² Although Quantz never mentions the octave flute he does mention the use of ebony as a material for these instruments and writes, "Ebony produces the clearest and most beautiful tone."⁸³ Perhaps there is truth in this statement, because makers continued to use ebony for piccolos during the nineteenth century.

Cocus

Like ebony, cocus was also a popular material used to make piccolos during this period. Cocus is found mainly in South America and is closer grained

⁸¹ Ibid.

⁸² Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 36.

⁸³ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 23.

and lighter in weight than African blackwood. Therefore, many flutemakers thought it had a more brilliant sound when compared to grenadilla⁸⁴. There is a possibility that this is why some piccolo makers today, such as Philipp Hammig Company are still making piccolos from cocus wood. The two-piece piccolo in D-flat mentioned above uses this material for the body along with an ivory headjoint upper section and a metal-lined headjoint with a tuning slide.⁸⁵

Boxwood

Boxwood is a very light material and has a bright sound. This particular type of wood is easy to turn, because it did not wear down woodturning tools as grenadilla can. Despite the fact that boxwood often bends due to the instrument making process and weather changes, piccolos continued to be made from boxwood during this century as DCM 0964 demonstrates. The three-piece piccolo in E-flat, which is mentioned above, was made by Bühner and Keller in Strasbourg between 1802 and 1844.⁸⁶ Boxwood was a common material specifically used for headjoints during this time. Along with DCM 0964, the Thomas Lott piccolo labeled DCM 0667 was also made with a boxwood headjoint.⁸⁷

⁸⁴ Grenadilla or African Blackwood (*Dalbergia melanoxylon*) is a purplish brown core or heartwood of a thorny, scraggly-branched tree indigenous to the savannahs and tropical lowlands of East and Central Africa. It has been used for centuries in carving and turnery and is the most popular wood used to manufacture woodwind instruments. This hard, heavy, fine-grained wood machines well and is very durable. It contains an oily resin that naturally repels moisture and has a glassy smooth finish.

⁸⁵ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

⁸⁶ Ibid.

⁸⁷ Ibid.

Ivory

The ivory headjoint upper section of the piccolo marked DCM 0769 suggests that ivory was also a common headjoint material during this century, although there is a possibility it was used primarily to decorate wooden piccolos. The ivory headjoint cylinder terminates at each end with a wide (17mm.) nickel-silver sheet metal ferrule.⁸⁸ These ferrules were possibly added in order to repair a crack in this headjoint.

Tuning Slide

Eventually, in the middle of the eighteenth century, a tuning slide was added to the headjoint.⁸⁹ This type of headjoint is used on many of the piccolos listed above. It is possible that Richard Potter (1726-1806), one of the most important flute makers in late eighteenth-century London, could be responsible for this addition to the piccolo giving the performer the option to manipulate the pitch of the instrument.⁹⁰ Although modern piccolos are not made with the tuning slide headjoint, headjoints on modern piccolos do have the ability to move in a similar fashion and therefore adjust pitch.

BODY AND MECHANISM

During the Classical period, the piccolo was well established in Europe and used for programmatic and military effects in orchestral and chamber music. Despite its occasional role as a reference to its military counterpart in concert

⁸⁸ Ibid.

⁸⁹ *Wind Instruments of European Art Music*. Horniman Museum and Library (London: Inner London Education Authority), 36.

⁹⁰ National Music Museum, "Two Flutes by Richard Potter, ca. 1750-1770," National Music Museum, <http://orgs.usd.edu/nmm/Potter1.html> (accessed May 1, 2010).

music, the piccolo evolved into a more sophisticated version of the fife in terms of mechanical design. Some piccolos from the eighteenth century, called miniature flutes, were made with additional keys, a footjoint, and a cylindrical bore like the flute, rather than a typical conical bore.⁹¹

Military Fife

During the American Revolutionary War (1775-1783), drummers and fifers formed a separate group of musicians in the American Continental Army.⁹² These musicians provided music for everyday military activities.⁹³ As the highest pitched instrument in the military concert band, the piccolo was used for doubling the melody in the extreme range and continuing passages that are too high for the flute.⁹⁴ According to iconography, diaries, newspaper accounts, and military records, the American Continental Army used fife and drum music in independent groups, as well as in regiments.⁹⁵ Fifers were also used in English cavalry regiments and in British Infantry in the Crimean War.⁹⁶ The D-sharp key was added to the fife c.1780, and soon after, the cylindrical fife was replaced by the small conical keyed flute.⁹⁷

⁹¹ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 29.

⁹² Carolyn Bryant, *And the Band Played On* (Washington, D.C.: Smithsonian Institute Press, 1975), 7.

⁹³ Zartouhi Dombourian-Eby, "The Piccolo in the Nineteenth Century," (D.M. diss, Northwestern University, 1987), 8.

⁹⁴ Lieut-Col. H. E. Adkins, *Treatise on the Military Band* (London: Boosey and Co. Ltd., 1945), 40.

⁹⁵ Carolyn Bryant, *And the Band Played On* (Washington, D.C.: Smithsonian Institute Press, 1975), 7.

⁹⁶ H. Macaulay Fitzgibbon, *The Story of the Flute*, 2nd ed. (New York: Charles Scribner's Sons, 1928), 79.

⁹⁷ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 61.

One-Key Piccolo

As previously mentioned, one-key piccolos were used in order to perform court music written in the keys of D Major, G Major, and E Minor. The Thomas Lot III piccolo in D (C), DCM 0667, found in Figure 1.1 also demonstrates the one-key piccolo of the Classical period. This particular instrument was made with one closed D-sharp key in Paris from 1734 to 1787.⁹⁸ Although the one-key piccolo simplified fingering combinations in the keys listed above, it still lagged behind piccolos with additional keys, which had a larger range and the ability to play in keys with multiple sharps and flats.

Four-Key Piccolo (c.1760)

In London, flutemakers Joseph Tacet (?-1801), Caleb Gedney (1754-1769), Richard Potter, and Pietro Florio (c.1730-1795) added three new keys nearly simultaneously to the existing fingering system in order to expand the range of the instrument and to eliminate awkward cross-fingerings.⁹⁹ According to Dombourian-Eby:

The three new keys included a lengthwise B-flat key for *Th*, a lengthwise G-sharp key for *L4*, and a crosswise F key operated by *R3*, which also had to operate the E finger hole. These three notes previously had the worst intonation and tone quality of any notes on the one-key piccolo. They were greatly improved by the addition of keys, and composers no longer had to avoid these pitches.¹⁰⁰

In 1791 Johann George Tromlitz (1725-1805) received credit for creating the first piccolo with multiple keys, though there is no evidence in Tromlitz's

⁹⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

⁹⁹ Tammy Evans Yonce, "The Flute in the Baroque Period," *Flute Talk* 24, no. 9 (May/June 2005): 23.

¹⁰⁰ Zartouhi Dombourian-Eby, "The Piccolo in the Nineteenth Century" (DM diss, Northwestern University, 1987), 5.

book *The Keyed Flute* to support this.¹⁰¹ In 1824, Michael Janusch, the flute teacher at the Prague Conservatory, claimed he was the inventor of the multi-keyed piccolo. He was quoted as saying:

It would be desirable to make the piccolo flutes in orchestras generally more useful by providing them with similar keys [to those of the six-keyed flute], and that the players practice with these modified instruments in order to be able to perform movements in more distant keys. The piccolo flute which is usually played by flutists in the orchestra [*historical source incomplete here*], I have had constructed with six keys in order to use them in more distant keys. Every flutist in the orchestra can easily practice on a piccolo with six keys, since there is no difference in the mechanics between this and the flute, and one will easily be able to play in tune in the keys of several sharps or even flats on a piccolo flute with keys.

Despite this claim, there is no evidence of a multiple-key piccolo before the 1820s.¹⁰² Although the fingering combinations for the four-key piccolo were perhaps much easier than those used to operate the one-key piccolo and the four-key piccolo played with less effort in keys with multiple sharps and flats, the six-key piccolo soon replaced both the one-key and the four-key piccolo.

Six-Key Piccolo (1782-1786)

The piccolo used during the time of Ludwig van Beethoven (1770-1827) was possibly an open-holed, ring-keyed Meyer system instrument with a tiny embouchure hole. However, it is believed that this instrument was unable to meet the demands of the scope and power of Beethoven's music.¹⁰³ His increasing deafness could explain his interest in including the piccolo in a great deal of his

¹⁰¹ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 29.

¹⁰² *Ibid.*, 29.

¹⁰³ Jan Gippo, "Beethoven's Mistake," *Flute Talk* 13, no. 1 (September 1993): 32.

orchestral music from 1805 onward. The instrument is not used to double the flutes but to add effects of its own.¹⁰⁴

In 1782 Dr. J.H. Ribock added a C key, which was operated by *R1* with a long shank. The second additional key was a duplicate F key operated by *L4* and created by Tromlitz in 1786. This key was known as the “long F” and was used to facilitate fingers alternating between D/F and D-sharp/F. Additional keys were initially used primarily for trills, shakes, and other ornamentations. As new systems developed the six-key piccolo is referred to as the “simple”¹⁰⁵ or “old” system instrument.¹⁰⁶ This instrument was popular well into the nineteenth and twentieth centuries as many performers switched to a Boehm system flute, but continued to play a six-key piccolo. Eventually though, as new generations of performers emerge, the Boehm system piccolo replaced the six-key piccolo.

Multi-Keyed Piccolo (1791)

As mentioned above, Tromlitz receives credit for the multi-keyed piccolo of 1791; however, Michael Janusch, claimed responsibility for introducing keys to the piccolo in the *Berliner Allgemeine Musikalische Zeitung* of 1824. Multiple keys made the piccolo more useful in the orchestra, allowed performance in more distant keys, and improved intonation in keys with several sharps and flats.¹⁰⁷

Like the six-key piccolo mentioned above the multi-keyed piccolo was replaced by Boehm’s piccolo in the nineteenth and twentieth centuries.

¹⁰⁴ James Galway, *Flute* (New York: Schirmer Books, 1982), 38.

¹⁰⁵ Simple system refers to any model of piccolo, conical or cylindrical, that is essentially a developed version of the early piccolo having six fingerholes plus a seventh E-flat or D-sharp operated by a closed-standing key and further mechanized by the addition of mostly closed-standing keys above the E-flat key.

¹⁰⁶ Zartouhi Dombourian-Eby, “The Piccolo in the Nineteenth Century,” (D.M. diss, Northwestern University, 1987), 6.

¹⁰⁷ *Ibid.*, 378.

CHAPTER III. ROMANTIC PICCOLO (1825-1900)

During the 1800s flute and piccolo makers tried to make the technical passages of that time easier to play by experimenting with different mechanisms. Many of the new mechanical developments were quite experimental during this period. Composers wrote more soloistically as the design progressed and the mechanism gained fluency.

While makers experimented with adding keys to the pre-Boehm flute, piccolos remained less developed.¹⁰⁸ Eventually these improvements were also introduced to the piccolo. Makers continued to experiment with the piccolo bore and added additional keys, which increased the chances of the body cracking. The eight-key piccolo was prominent during this period, but it was time for Theobald Boehm's (1794-1881) new improvements.¹⁰⁹ These new models used rods and axles eliminating much drilling and potential cracking of the wood body. As Boehm's developments started to catch on with many flute and piccolo makers, many decided to experiment with aspects of Boehm's original design and incorporated it in their own mechanical systems. The Boehm system however, was revolutionary and made a profound and lasting change in the design of flutes and piccolos.

¹⁰⁸ Ibid., 46.

¹⁰⁹ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

TUBE AND MATERIALS

Two-Piece Piccolo

Although the two-piece piccolo was not commonly made or used during the Classical period, makers during the Romantic period (1825-1900), favored this design. DCM 0355 from an anonymous maker is in the key of E-flat and was made in the late nineteenth century. This instrument was made with six nickel-silver keys and ferrules, post and rod¹¹⁰, direct mounts¹¹¹, and a tuning slide in a metal-lined headjoint. Another example with two sections also belongs to the Dayton C. Miller Flute Collection. DCM 0672 is a piccolo in D-flat and was made by A. Osmanek in Schönbach c.1850-1895. It has six keys with modern-style key cups¹¹², post and rod, a metal-lined headjoint with a tuning slide, brass keys and ferrules, and nickel-silver hinge tubes.¹¹³ Like the two-piece piccolo of this period, modern piccolos continue to be made today as a two-sectioned instrument.

¹¹⁰ Post and rod refers to the later mechanical method that employed all metal key work replacing the block mount with two posts, which would support one or more keys. Each pair of posts might be drilled to receive a fulcrum pin like the pin used in the pin in block method or, more commonly the posts were drilled and one taped to retain a steel screw that functioned as a pin. Instead of drilling a hole through the key for a pin, a larger hole was made to accommodate a hinge tube or hinge rod that was inserted and soldered through it to rotate either on a pin or screw, or between two short steeply tapered pivot screws in the posts. By increasing the effective width of the key pivot, the hinge tube improved stability and alignment. It also permitted easy repair of misalignment resulting from lateral wear by the technique of stretching the hinge tube over its pin with swedging pliers. If stretched too far, the original hinge tube or a replacement could be quickly adjusted with a hinge tube end cutter.

¹¹¹ Direct mount refers to the direct method of attaching a post whereby each post was threaded on the bottom and screwed into a hole tapped in a nonmetallic instrument body.

¹¹² Modern-style key cup refers to those early key designs having a modern-style pad retainer or cup. Early examples of this key cup design were similar to the modern recessed key cup form, which takes a disc-shaped stuffed pad, but were otherwise old-fashioned with respect to mounts and other elements.

¹¹³ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

Three-Piece Piccolo

While the two-piece piccolo proved to be successful, some makers experimented with three-piece instruments during this period. DCM 0268 is a piccolo in D-flat made by an anonymous English or American maker from the early nineteenth century. It has one brass key with a round flat flap, pin in block, bone cap and ferrules, and a separate footjoint. Another example, DCM 1629 piccolo in C was possibly made by an anonymous English maker in the early nineteenth century. This three-section piccolo (headjoint, upper body, lower body) has one silver key or square flap, pin in block, and ivory end cap and ferrules.¹¹⁴ As previously mentioned, although the three-piece design is standard for flutes today, it lost favor in piccolo design and was replaced by the two-piece piccolo due to its size and acoustics.

Materials

In the nineteenth century, piccolos continue to be made from different types of wood, including cocoawood, boxwood, and grenadilla. In some cases ivory parts were added to these instruments. Boxwood piccolos were the least expensive, and grenadilla piccolos were the most expensive, with cocoawood falling somewhere in between. Throughout the nineteenth century, piccolos were made with one, four, or six keys. With each additional key added, the cost of the instrument would increase dramatically. Boehm system piccolos were about ten times as expensive as those made with only four or six keys.¹¹⁵

¹¹⁴ Ibid.

¹¹⁵ Heather Hall Coleman, "The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the 19th Century" (D.M.A. diss, University of Memphis, 1999), 27.

Grenadilla

Grenadilla became a standard material for piccolos during this time and has remained the most popular material in use today because of its dense, rich, focused sound. Grenadilla has a reedy quality that can penetrating through a large ensemble. In the late nineteenth century, Heinrich Friedrich Meyer made a piccolo in D-flat, DCM 0086, in Hannover, Germany. This grenadilla piccolo has six nickel-silver keys with modern-style key cups, post and rod on flanges¹¹⁶, a tuning slide in the ebonite¹¹⁷ head, and a nickel-silver cap and ferrules.¹¹⁸

Cocus

Despite the success and popularity of grenadilla, many makers began making piccolos with cocus because of the slightly different overtone series it produces. Cocus also has a sweet, clear, and elegant sound. Many makers, such as Philipp Hammig continue to make piccolos from cocus today. In New York from 1859 to 1920 Theodore Berteling (1821-1890) made a piccolo in D-flat of cocus in two sections (DCM 0383) with six keys and ferrules, post and rod, direct mount, a tuning slide in a metal-lined ivory headjoint (upper section), an ebonite barrel, a nickel silver end cap cover, and name plate. In Paris, from 1812 to 1922 Lefevre was also making piccolos from cocus. DCM 0341 piccolo in C is made in

¹¹⁶ On flanges refers to cases in which only two posts were soldered or riveted to a single flange, often of a diamond, crescent, or other decorative shape, that was attached to the instrument body. The flange method applies almost exclusively to nonmetal instrument bodies that were sometimes mortised to have the flanges recessed to be flush with the surface.

¹¹⁷ Ebonite is a hard, vulcanized (a chemical process for converting rubber into a more durable material) rubber composition that resembles a dark wood. It gives the piccolo a sweet rich tone. It does not warp or crack and is absolutely stable and unaffected by temperature or humidity. The use of this material in piccolo construction has proved successful especially for beginner and school instruments because it is cheap and easy to machine.

¹¹⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

two sections with six nickel-silver keys with modern-style key cups, post and rod, ferrules, metal-lined headjoint socket (partial), and tenons on the body.

Alfred G. Badger (1815-1892) was one of the first makers to advertise a piccolo made of cocoawood, which is a similar material to cocus wood.¹¹⁹

However, an instrument made of this material is currently unavailable.

Boxwood

Even though boxwood is no longer used to make piccolos today, it was a favored material for piccolos made during this period. Jean-François Martin made a boxwood piccolo in C (low pitch) in La Couture in 1827 (DCM 0622). This instrument's embouchure hole has been crudely enlarged. It has one brass key, a round flap, pin in block, three sections, and black horn ferrules. DCM 0030 by Firth Hall and Pond piccolo in E-flat followed in New York in 1833-1847. This boxwood piccolo has one brass key, a round flat flap, pin in block, is made in two sections with a conical bore, and possibly has a bone cap and ferrules.¹²⁰

Ebony

Ebony was also a popular material for piccolos during this period, but is no longer used in piccolo manufacturing due to its scarcity. Wilhelm Liebel (1793-1871) made a piccolo in C in Dresden 1823-c.1886 (DCM 0789) from ebony. It has six nickel-silver keys and ferrules, round flat flaps, pin in metal-lined blocks, and two sections.¹²¹ I. Ziegler made a piccolo in D-flat with the same material in Vienna 1821-1895 (DCM 0221). This instrument also had six silver keys, a

¹¹⁹ Susan Marie Beagle Berdahl, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss, University of Minnesota, 1985), 184.

¹²⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹²¹ Ibid.

shallow saltspoon¹²², pin in metal-lined block, ferrules, a metal-lined headjoint, and a cork-setting mechanism in the headjoint as seen in Figure 3.1.¹²³



Figure 3.1. Cork-setting Mechanism¹²⁴

Ebonite (1899)

First introduced to the flute and piccolo in 1840, ebonite is a hard, rubberized composition resembling a dark wood, that does not warp or crack, but is said to produce a sweet, yet rich tone.¹²⁵ It is an ideal material for beginner or school instruments because it is cheap, easy to machine, and can stand abuse from amateur players.¹²⁶ Piccolos were made of ebonite more so than flutes due to their

¹²² Saltspoon refers to those later key flaps, actually key cups, that were concave—nearly hemispherical, like a saltspoon—to receive a stuffed leather pad for more convenient pad seating. The back of the pad was essentially the shape of the cup and would automatically swivel to seat itself over the tonehole when applied with a heated adhesive such as shellac.

¹²³ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹²⁴ J.J. Quantz, “Cork-setting mechanism,” <http://flutesbaroques.com> (accessed June 16, 2010).

¹²⁵ Ulric Daubeny, *Orchestral Wind Instruments: Ancient and Modern Being an Account of the Origin and Evolution of Wind Instruments From the Earliest to the Most Recent Times* (London: New Temple Press, 1919), 30.

¹²⁶ Jeremy Montagu, *The Flute* (Princes Risborough, England: Shire Publications Ltd., 1990), 44.

frequent use in outdoor military bands.¹²⁷ According to Susan Marie Beagle Berdahl in her Ph.D. dissertation,

In 1839 Charles Goodyear accidentally dropped a bit of sulfur and rubber on his kitchen stove. The lump charred and became tough and elastic in both hot and cold temperatures. The process of mixing rubber and sulfur was named ‘vulcanization’ after Vulcan, Roman god of fire, and the product, ‘vulcanite.’ Vulcanite is known by a number of different names such as ebonite, Indian-rubber, vulcanized rubber, gum-elastic, caoutchouc and gutta-percha. The term ‘ebonite’ is the one most often used in connection with musical instruments.¹²⁸

DCM 0380 piccolo in D-flat by A. Collard and Company was made of ebonite in London 1882-1891. It is a cylindrical Boehm system instrument with silver keys and ferrules, an open G-sharp key, and lacks a key for the small C-sharp hole.

This piccolo was made in two sections with a metal-lined headjoint (partial) and features a compact arrangement of hinges¹²⁹ and clutches¹³⁰.

By 1899 the C. G. Conn Company¹³¹ offered an all ebonite piccolo with a conical bore that was completely sheathed with metal, either silver or nickel, while the headjoint remained bare. Performers also had the option to upgrade to gold-plated keys. Around 1915 the company also offered metal cylindrical

¹²⁷ Zartouri Dombourian-Eby, “The Piccolo in the 19th Century” (D.M. diss, Northwestern University, 1987), 369-370.

¹²⁸ Susan Marie Beagle Berdahl, “The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers” (Ph.D. diss., University of Minnesota, 1985), 111.

¹²⁹ A hinge is a type of bearing that connects two solid objects, typically allowing only a limited angle of rotation between them. Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation.

¹³⁰ A clutch is a mechanical device, which provides driving force to another mechanism, typically connecting the driven mechanism to the driving mechanism.

¹³¹ C.G. Conn, the oldest continuous manufacturer of band instruments in America, lead the way in the U.S. band instrument manufacturing industry in Elkhart, Indiana. Today, C.G. Conn encompasses some of the greatest names in musical instruments; C.G. Conn, King and Benge brass instruments, Artley and Armstrong woodwinds, and Scherl and Roth strings.

piccolos with a headjoint made of ebonite or wood. All metal cylindrical piccolos made of nickel, silver-plated nickel, and silver followed.¹³²

The piccolo in D-flat by C. G. Conn (NMM 5348) in Figure 3.1 is a conical bore Boehm system instrument with an ebonite lined, nickel-plated headjoint and a nickel-plated body. In 1892 Conn served as a U.S. Congressman and introduced a bill for the reorganization of U.S. Army Regiment Bands. By 1899, the U.S. Army and Navy purchased over 100 Conn flutes and piccolos.¹³³



Figure 3.2. NMM 5348: C. G. Conn Piccolo in D-flat, c.1899

Ebonite is no longer used in the production of professional piccolos, but continues to be a material of choice for student model instruments perhaps due to durability.

Rosewood

Louis Lot (1807-1896), the official flute and piccolo supplier for the Paris Conservatoire, made piccolos from rosewood, like NMM 3210 piccolo in C c.1890. This conical piccolo has the Boehm 1832 Hybrid system with keys for A, F, E, and D. The donor of this instrument claims it was used for the Buffalo Bill

¹³² Susan Marie Beagle Berdahl, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers," (Ph.D. diss, University of Minnesota, 1985): 185.

¹³³ National Music Museum, "Piccolo," *Woodwind Instrument Collections*, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).

Circus.¹³⁴ Card also made piccolos from rosewood in London 1845-1862. DCM 1088 piccolo in C has five silver keys with modern-style key cups, post and rod, ferrules, and three finger rings. This piccolo has a combination of the simple system in the left hand with a closed G-sharp key and a Boehm system in the right hand. It is made in two sections with a tuning slide in the metal-lined head and a C-sharp/D trill key.¹³⁵ Rosewood piccolos are still available today upon request from the Philipp Hammig Company. This type of material is very stable and machines really well.

Mahogany

On rare occasions, nineteenth-century piccolos were made of mahogany. The DCM 1091 piccolo in C by R. Burghley (Burleigh) was made in Camden Town (Northwest London) c.1845. This piccolo was made in two sections and is an octave size of a group of experimental flutes from this inventor. It has one japanned, or lacquered wood key for the left thumb and ferrules.¹³⁶ Unlike many of the materials mentioned above, mahogany was used in piccolo production on an experimental basis and never became a common material used in the twentieth century.

Brass

Auguste Buffet made a piccolo in C in Paris 1830-1885 from brass with a cocus and metal cork-setting mechanism and end cap. Perhaps he was trying to match the tone quality of metal flutes. DCM 0677 also has an ivory or celluloid

¹³⁴ Stephanie Kocher, "What Was He Thinking When He Wrote That?" (Winner of the International Piccolo Symposium 2009 "Call for Presentations," Omaha, NE, June 13, 2009).

¹³⁵ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹³⁶ Ibid.

embouchure barrel with some cocus, which will be explained later in the discussion of headjoints during this century. This conical, two-piece piccolo has five keys with modern style key cups, post and rod, rib-like flanges, and the principal rank¹³⁷ of finger holes is slightly elevated.¹³⁸ Although brass would be an ideal material for student model piccolos, many makers prefer to use silver.

Combinations of Materials

During the nineteenth century, silver or German silver became a popular material choice for both key work and ferrules.¹³⁹ Many makers experimented with the most common materials in use at this time and made piccolos that combined two or more different materials. For example, the headjoint might be made with one material, while the body was made with another. DCM 0495 in Figure 3.3 is an example of this combination. This piccolo in C in two sections by C. G. Conn was made in 1905 with a silver plated body, an ebonite head, and gold-plated key work. It uses the Boehm system with an open G-sharp key.¹⁴⁰



Figure 3.3. DCM 0495: C. G. Conn, Piccolo in C, 1905

¹³⁷ Principal rank refers to the six principal front fingerholes or key-covered toneholes common to all Western and many other woodwinds regardless of any added keywork, however complex, and/or the presence of any duplicate venting toneholes functioning as part of that principal rank. Flute described as Boehm-system are understood to be of the later cylindrical-bore design with three sections unless stated otherwise. The numerical designation discussed above for back and front fingerholes does not apply to such instruments or to others having elaborate named or patented key and venting systems.

¹³⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹³⁹ *The Ridley Collection of Musical Wind Instruments in Luton Museum*. [Now housed at The Royal College of Music.] The Corporation of Luton Museum and Art Gallery, 1957.

¹⁴⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

The anonymous piccolo in C from the late nineteenth century in Figure 3.4 uses a different combination of materials. The body is made of grenadilla, and the headjoint has a nickel-silver sleeve over the wood, and it is metal-lined with a tuning slide. This two-piece piccolo has eight keys down to C1, although the amount of tubing beneath the C-sharp hole is curiously short and would appear insufficient to produce a low C. It also has modern-style key cups, posts and rods, and nickel-silver ferrules and end cap.¹⁴¹ Makers of student model piccolos still experiment with combining these materials today.



Figure 3.4. DCM 0181: Anonymous, Piccolo in C, late 19th c.

Glass (c.1889)

Paris piccolo maker A. Charly experimented with making piccolos of glass with silver fittings c.1889. Perhaps this material was used for its visual appeal rather than its functionality. DCM 0387 piccolo in D-flat was made with these specifications. This cylindrical piccolo is in one piece made of two parts, which appear to be cemented together beneath the center silver ferrule. The single key, which is now missing, covered two bored vent holes. During World War II, Charly's factory was hit by a German bomb. This piccolo and its case were thrown into the street, and the piccolo was cracked between the post of D-sharp

¹⁴¹ Ibid.

and the E finger hole. It was about the only thing to survive in Charly's entire factory and stock. Dayton C. Miller saw this piccolo for the first time at the Paris Exposition in 1889 and acquired it on October 30, 1923.¹⁴² Glass has fallen out of use on modern piccolos leaving grenadilla, cocus, and silver as the preferred materials of choice.



Figure 3.5. DCM 0387: Ad. Charly, Octave Flute in C, c. 1889

HEADJOINT

Throughout the nineteenth century piccolo headjoints were made in a variety of materials, such as ivory, grenadilla, cocus, boxwood, ebony, ebonite, and rosewood. Makers also experimented with metal lining, the size and shape of the embouchure hole, an embouchure barrel, the addition of a lip plate, and a perpendicular embouchure. As the orchestra grew in the nineteenth century, makers experimented with a variety of materials and mechanics, in all probability to create a sound that would penetrate through a large ensemble.

Metal-Lined Headjoint

Many of the headjoints mentioned throughout this section are metal-lined. Wood and ivory headjoints have a tendency to crack from the breath if preventive measures are not taken, such as frequent swabbing. Since metal is not affected by moisture, headjoints were lined with metal to reduce cracking, increase the

¹⁴² Laura E. Gilliam and William Lichtenwanger, *Dayton C. Miller Flute Collection: A Checklist of the Instruments* (Washington: Library of Congress, 1961), 29.

brightness and power of the tone, and allow for a tuning slide.¹⁴³ The piccolo in E-flat (DCM 0349) made by an anonymous, possibly Continental European maker from the nineteenth century, has four nickel-silver keys, saltspoon and long F, ferrules, post and rod, and direct mount. The cocus headjoint is metal-lined with a tuning slide and the body is cocus with an ivory cork-setting mechanism. Paolo Maino made a boxwood piccolo in D-flat in Milan 1836-1880 with a brass-lined headjoint and tuning slide (DCM 0222). It also has five brass keys with modern-style key cups, animal horn ferrules, and a post and rod.¹⁴⁴ Metal-lined headjoints have become a thing of the past as many makers and performers seem to prefer grenadilla or even cocus.

Ivory

During the Romantic period, some piccolo headjoints were made of ivory. Perhaps this material was used for visual appeal, rather than for durability, quality of sound, and projection. The anonymous piccolo in C (c.1880), labeled DCM 0002, is just one example of a cocus piccolo with an ivory headjoint and a metal tuning-slide. This two-piece conical piccolo has six keys with modern-style key cups and ferrules, post and rod, and a nickel-silver cap. Dayton C. Miller used this piccolo in the Schubert Orchestra in Chamberlains, Berea from 1880 to 1886.¹⁴⁵ In Hannover between 1848 and the early twentieth century, Heinrich Friedrich Meyer (1814-1897) also made a piccolo with an ivory headjoint (upper portion) that is fully lined with metal. DCM 0924 has six nickel-silver keys, end

¹⁴³ John Solum, *The Early Flute* (Oxford: Oxford University Press, 1995), 64-65.

¹⁴⁴ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁴⁵ *Ibid.*

cap, and ferrules. This two-piece grenadilla piccolo has round flaps, post and rod on oval flanges, and a tuning slide in the headjoint.¹⁴⁶ Ivory eventually fell out of favor with makers and has been replaced with more durable materials, such as grenadilla and cocous.

Grenadilla

Grenadilla was a popular material for headjoints during this time and remains so today. Although the headjoint of DCM 1553 is metal-lined with a tuning slide, it is made of grenadilla in two sections. This anonymous piccolo in C from the nineteenth century has six nickel-silver keys and ferrules, post and rod, direct mount, a headjoint cap, and cork-setting mechanism, which is now missing.¹⁴⁷

Cocus

In Brussels Victor-Charles Mahillon (1841-1924) made a piccolo in C from cocus (DCM 0809). This two-piece piccolo has five nickel-silver keys, post and rod, and direct mount. Samuel Arthur Chappell (1834-1904) followed with a piccolo in C in London 1871-1901 (DCM 0912). This cocus two-piece piccolo has six nickel-silver keys, round flaps, and post and rod.¹⁴⁸ Many modern piccolo makers, such as the Philipp Hammig Company continue to make piccolo headjoints from cocus for its elegant, clear sound.

Boxwood

In Bayreuth, Germany from 1805 to 1902 Stengel was making a piccolo in C (low pitch) from boxwood. DCM 0664 was made in four sections, has one

¹⁴⁶ Ibid.

¹⁴⁷ Ibid.

¹⁴⁸ Ibid.

brass key, a square flat flap, pin in block, and horn ferrules. From 1812 to 1837, Dobner and Consort of Strasbourg also made a piccolo in C (DCM 0963). This three-piece (head, body, foot) piccolo also has one brass key with a modern key cup, a post and rod mounted on flange, an ivory end cap, and ferrules.¹⁴⁹

Although some makers experimented with boxwood during this period, it has fallen out of favor with modern piccolo makers.

Ebony

Ebony was also an optional headjoint material in the nineteenth century. Ubaldo Luvoni made a piccolo in C in Milan 1826-1847 with an ebony headjoint and metal-lined tuning slide. DCM 0220 has six nickel-silver keys and ferrules, round flat flaps, pin in metal-lined blocks, and cross keys for G-sharp, short F, and D-sharp. These keys were skillfully engineered with interval pad seat blocks.¹⁵⁰ Ebony is no longer used to make modern piccolos.

Ebonite

Heinrich Friedrich Meyer created an ebonite headjoint with a tuning slide for a grenadilla and possibly cocus body piccolo in the late nineteenth century. This piccolo in D-flat, DCM 0086, has six nickel-silver keys with modern-style key cups, cap, ferrules, and post and rod on flanges.

From 1850 to 1914, instrument dealers Brizzi and Nicolai sold a piccolo in C with an ebonite headjoint made by Emilio Piana in Florence. DCM 1336 has silver ferrules and seven silver keys, five standing closed, and two finger ring keys. The G-sharp, short F, and D-sharp keys are modern post and rod each

¹⁴⁹ Ibid.

¹⁵⁰ Ibid.

mounted on a rib. The B-flat key is the same, except mounted on an oval flange. The upper C key is mounted in a metal saddle¹⁵¹, and *L1* operates a perforated key closing the C-sharp hole while *L2* operates a ring key, which also closes the *L1* hole as an alternate C, both mounted on a rib. *R2* and *R3* have a similar rib mounted pair of ring keys, which close an F-sharp vent hole similar to the B/F-sharp vent on simple system clarinets.¹⁵² Although ebonite is rarely used to make modern piccolos, it would be an ideal material for student model piccolos due to its durability.

Rosewood

The August Anton Euler (1808-1873) piccolo in C (DCM 0779) made in Frankfurt am Main 1810-1873 has a rosewood headjoint, a metal-lined tuning slide, and an ivory headjoint cap. The piccolo in two sections has six nickel-silver keys and ferrules, a round flat flap, pin in block, and a metal cork-setting mechanism.¹⁵³ Although the majority of modern performers purchase instruments made from grenadilla or cocus, modern piccolos can be made from rosewood upon special request.

Embouchure Hole

Nineteenth century makers also experimented with the cut of the embouchure hole as perhaps another method to meet the projection needs of a

¹⁵¹ The saddle or key saddle is a metal version of the pin in block key mount but also shares aspects of the post and rod mount. The key saddle was made from fairly heavy-gauge sheet metal, usually brass, most often rectangular, which was bent, cast, or forged into a form, staple-like (or U-shaped) in cross section, to duplicate in metal the pin in block key channel principle. It was sometimes mounted on a flange, and usually took a steel or brass screw rather than a pin for the fulcrum. Like the post and rod mount, it was a separate piece, and was usually attached mechanically using flat-head wood screws.

¹⁵² Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁵³ Ibid.

larger ensemble. The cocus piccolo in C (DCM 0344) attributed to Boehm and Mendler in Munich (1862-1881) has a headjoint that carries the tenon. Modern piccolos use the opposite design where the body of the instrument carries the tenon. In his ledger, Dayton C. Miller wrote, “The original blow-hole has been filled, and a new hole for sharper pitch has been cut.” This cylindrical piccolo in two sections was made with the Boehm system, and a silver open G-sharp key.¹⁵⁴ Overall, the embouchure hole of nineteenth and twentieth century piccolos is much larger than those on earlier instruments.

Embouchure Barrel

Some piccolos of the late nineteenth century came equipped with an embouchure barrel. It remains uncertain whether these embouchure barrels were added for cosmetic appeal or to improve the sound or intonation of the instrument. This section of the headjoint surrounding the embouchure hole was made from a completely different material. For example, the piccolo in C made by August Buffet (DCM 0677) in Paris 1830-1885 has an embouchure barrel made of ivory or celluloid¹⁵⁵ with cocus. According to the DCM ledger, “This instrument was gilded at some point or at least appeared to be gilded when received by Dayton C. Miller.” This conical piccolo made of brass in Figure 3.6 has five keys, including upper C with modern-style key cups, post and rod on rib-like flanges, and the principal rank of finger holes is slightly elevated. The piccolo was made in two

¹⁵⁴ Ibid.

¹⁵⁵ Celluloid is commonly used today in table tennis balls and guitar picks and is the name of a class of compounds created from nitrocellulose and camphor, plus dyes and other agents. It is generally regarded as the first thermoplastic and can be easily molded and shaped. Celluloid was first widely used as an ivory replacement. Unfortunately it is highly flammable and easily decomposes, so it is no longer widely used.

sections was a metal cork-setting mechanism and end cap.¹⁵⁶ The barrel-style embouchure was also used on some of Alfred G. Badger's piccolos. Modern piccolos no longer come equipped with an embouchure barrel. Instead, modern headjoints are usually constructed from a single piece of wood or metal.



Figure 3.6. DCM 0677: Auguste Buffet Piccolo in C (1830-1885)

Lip Plates

Many piccolo makers chose to use a headjoint with a lip plate in order to make the switch from flute to piccolo an easier adjustment. For example, the anonymous piccolo in D-flat labeled DCM 0080 was made in the late nineteenth century with a cylindrical bore in two sections. This headjoint had an unusually large, concert flute-sized embouchure plate. It features a simple system with six nickel-silver keys with modern-style key cups, post and rod on ribs¹⁵⁷, and a principal finger hole rank applied as a continuous rib.

Henry Wylde's (1822-1890) piccolo in C, made in London from 1838 to 1852 (DCM 0515) also has a silver lip plate. Although this piccolo has been severely damaged and many of the keys are missing or have been replaced, it originally had six keys, including a saltspoon key, and ferrules. This cocus piccolo is divided into three sections, has a pin in block, and a tuning slide in the

¹⁵⁶ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁵⁷ On ribs refers to the indirect method of attaching posts whereby the posts are silver-soldered to long, narrow metal (often nickel silver) ribs and are either screwed to a nonmetallic instrument body or soft-soldered to a metal instrument body.

metal-lined headjoint.¹⁵⁸ Some modern piccolos come equipped with a lip plate. However, the majority of these instruments are used as student model piccolos.

Tuning Slide

Many of the instruments already mentioned were made with a tuning slide in the headjoint. This tuning slide gave each individual performer a little more pitch flexibility and the opportunity to adjust intonation. The piccolo in D-flat by an anonymous maker of the late nineteenth century (DCM 0069) also has a tuning slide in the headjoint. This particular instrument is made of an unidentified wood and is completely veneered with nickel-plated copper or brass. The bottom ferrule and cap are also nickel-plated sheet metal over wood. This instrument in two sections has six keys with modern style key cups and a post and rod.¹⁵⁹

Buffet Crampon and Cie made a conical piccolo in D-flat in three sections c.1880 with a telescoping tuning slide and a metal-lined headjoint. This African blackwood piccolo uses a Boehm 1832 Hybrid System with ring keys for the A, F, E, and D.¹⁶⁰ The headjoint on modern piccolos can be pushed in or out for fine intonation adjustments, which vary from performer to performer.

Perpendicular Embouchure

One of the most unique and experimental designs of the late nineteenth century is the perpendicular embouchure. Joseph Wallis, a prominent London maker of “Giorgi” flutes and piccolos designed this piccolo in C in London 1848-1928 (DCM 0402). The body of the piccolo is made with six nickel-silver keys

¹⁵⁸ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁵⁹ Ibid.

¹⁶⁰ National Music Museum, “Piccolo,” Woodwind Instrument Collections, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).

and ferrules, except the D-sharp and short F keys are bent to conform to the slanting position of the fingerings. This cocus instrument is conical, has modern-style key cups, post and rod, two sections, a tuning slide in the headjoint, and is made with the Giorgi system. The ebonite headjoint is of the same model as the Giorgi flute and consists of a standard barrel with a tuning slide, and the tenon is attached to a Giorgi-style perpendicular embouchure.¹⁶¹ This particular instrument was never accepted by a large number of makers and performers.

BODY AND MECHANISM

Some nineteenth century composers sought expression in music that called for new instrumentation and orchestration.¹⁶² According to Dombourian-Eby, “The piccolo of the nineteenth century followed the same line of development as the flute, only technical developments of the piccolo happened later than on the flute.”¹⁶³ There were many forms of the piccolo in use during the nineteenth century.¹⁶⁴ According to the thirty-four catalogs Dombourian-Eby examined for her dissertation there were piccolos used in the nineteenth century in over forty different fingering systems, seven different tonalities, and out of six different materials.¹⁶⁵ Because new instruments did not gain acceptance right away, older instruments continued to be used, made, and written about for many years.¹⁶⁶ The

¹⁶¹ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁶² H.W. Schwartz, *The Story of Musical Instruments* (New York: Garden City Publishing Co., Inc., 1938), 32.

¹⁶³ Therese M. Wacker, “The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works” (D.M.A. diss, The Ohio State University, 2000), 28.

¹⁶⁴ *Ibid.*, 28-29.

¹⁶⁵ *Ibid.*, 29.

¹⁶⁶ *Ibid.*, 29.

following piccolos discussed introduce individual keys to the instrument, rather than keys operating on rods and axles, such as the Boehm system piccolos.

D-flat Piccolo

The D-flat piccolo was first introduced to the orchestra in Louis Spohr's (1784-1859) *Jessonda* (1823).¹⁶⁷ Spohr was willing to write for the relatively unknown D-flat piccolo because he loved the color of the instrument. However, he allowed the flute to play in E-flat minor, but not the piccolo, which gives confirmation that the piccolo generally in use at this time was a one-key piccolo and less developed than the concurrent flute. When writing for the D-flat piccolo, Spohr used a restricted range from G1 to G3 and only used the piccolo in "favorable" tonalities.¹⁶⁸

Robert Schumann's (1810-1856) music also provides proof that the development of the piccolo lagged behind the development of the flute. In his *Das Paradies* (1843) Schumann wrote for the D-flat piccolo in the sixth movement but used a C flute in the other movement with distant tonalities.¹⁶⁹

One-Key Piccolo

Despite all of the advancements that took place into the nineteenth century, one-key piccolos were still produced. According to Dombourian-Eby,

Once a maker had the tooling for a certain system instrument, he often listed that instrument in his catalogue until the demand for that model ceased. As seen in the discussion of tutors, amateurs were particularly fond of old system instruments, and most flutemakers were content to supply them with these instruments. The flutemakers were more motivated by profit than were the treatise

¹⁶⁷ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 53.

¹⁶⁸ *Ibid.*, 58.

¹⁶⁹ *Ibid.*, 117.

writers, and they needed to produce instruments that incorporated all the features available at the time in order to fulfill their customers' desires.¹⁷⁰

Around 1890 makers ceased production of one-key piccolos. The works of Beethoven, Weber, Rossini, and Spohr were possibly performed on these one-key piccolos initially.¹⁷¹

Long F Key (Right Hand)

On the right hand, the finger that operated the F key also had to cover the sixth hole of the piccolo immediately to the right of the F key, which makes the keys impractical to use if the preceding or following notes require the finger to cover the sixth hole and slide to and from that key, which was awkward. In his book *Kurze Abhandlung vom Flötenspielen* (1786) Johann George Tromlitz mentions his invention of an alternative F key, usually called the long F key. This key is operated by the little finger of the left hand. Originally the long F key required a hole separate from the regular F hole, but in another book, *Ueber die Flöten mit mehrern Klappen* (1800) Tromlitz explains how he modified the long F key to eliminate the duplicate F hole, which allowed the long F key to engage the short F key directly.¹⁷²

J. Ziegler's piccolo in E-flat (1821-1850/51) in Figure 3.7 was made in Vienna and features a long F key for the right hand. This cocus piccolo (DCM

¹⁷⁰ Ibid., 368.

¹⁷¹ Ibid., 218.

¹⁷² John Solum, *The Early Flute* (Oxford: Oxford University Press, 1995), 62.

0356) is made in two sections with alignment dots, four nickel-silver keys, animal horn ferrules, round flat flaps, post and rod, and direct mount.¹⁷³



Figure 3.7. DCM 0356: J. Ziegler Piccolo in E-flat (1821-1850/51)

The piccolo in E-flat (high pitch) by V. Kohlert Sons, NMM 4609, was made in Graslitz c.1900-1918 and has a long F key. This conical piccolo in three sections is made of African blackwood, has a metal-lined headjoint with a telescoping tuning slide, post and axle supports, and German silver ferrules and six German silver closed keys, including a long C, B-flat, G-sharp, short F, and D-sharp.¹⁷⁴ Once Boehm's design was applied to the piccolo, the long F key was no longer used.

Short F Key

The piccolo in C in Figure 3.8 features the short F key lever to operate the long F key. DCM 0413 piccolo in C was made by J. Ziegler in Vienna (1821-1895). It was made of ivory with an ivory end cap, a cork-setting mechanism, a gold-plated shaft, six gold-plated keys and ferrules with modern-style key cups on flanges, post and rod, a gold-plated metal body tenon including the shoulder plate, a metal-lined headjoint (partial), and the tone holes have been brushed with

¹⁷³ Heather Hall Coleman, "The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the 19th Century" (D.M.A. diss, University of Memphis, 1999), 33.

¹⁷⁴ National Music Museum, "Piccolo," Woodwind Instrument Collections, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).

rosegold.¹⁷⁵ Like the Long F key, once Boehm's design was applied to the piccolo, the Short F key was no longer used.



Figure 3.8. DCM 0413: J. Ziegler Piccolo in C (1821-1895)

Long C Key

During this period piccolos also came equipped with the long C key. NMM 4608 piccolo in D-flat (low pitch) by V. Kohlert Sons was made in Graslitz c.1900-1918 with this key. This conical piccolo in three sections was made of African blackwood with six German silver closed keys, including the B-flat, G-sharp, long F, short F, and D-sharp keys, German silver ferrules, and post and axle supports. The headjoint is metal-lined with a telescoping tuning slide. The Long C key remained an important addition to simple system piccolos, but was soon forgotten as Boehm's new mechanism is applied to the piccolo.

Four-Key Piccolo

The date of the first four-key piccolo cannot be determined; however, Michael Janusch claimed to have added keys to the piccolo in 1824.¹⁷⁶ Like the four-key piccolo previously mentioned, the keys on this instrument consisted of a D-sharp key operated by *R4*, a B-flat key operated by *Th*, a G-sharp key operated by *L4*, and an F key operated by *R3*. By 1890, the four-key piccolo was featured

¹⁷⁵ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁷⁶ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 400.

in primarily English makers' catalogues.¹⁷⁷ Although Hector Berlioz (1803-1869) does not mention the Boehm system in his treatise, he was likely familiar with the four- and six-key piccolos. In the final movement of *Symphonie Fantastique* (1830), the flurry of trills and grace notes imply that he was familiar with an improved piccolo and made great technical demands.¹⁷⁸ Compositions from this time forward by Berlioz and Wagner were probably written for a four- or six-key piccolo.¹⁷⁹

DCM 1222 is a perfect example of the four-key piccolo. Tebaldo Monzani (1762-1839) made this piccolo in C in London c.1822-1833. The instrument appears to have had five keys originally, and the current key work seems to be a replacement of an earlier key replacement attempt involving non-integral blocks. This three-piece piccolo is made of cocus stained brown and has round flaps, modern post and rod, screw mounted on oval flanges, ivory upper headjoint, ivory cork-setting mechanism with a silver stud, and silver keys and ferrules. It is possible that the instrument is a composite possibly cut down from a longer band flute.¹⁸⁰

Five-Key Piccolo

Five-key piccolos appeared in the majority of French maker's catalogues until roughly 1905. For example, in Louis Lot's catalogue of 1889 both five- and six-key piccolos were included in addition to Boehm system instruments. The

¹⁷⁷ Ibid., 387.

¹⁷⁸ Ibid., 83.

¹⁷⁹ Ibid., 218.

¹⁸⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

simple system instruments did not appear again after 1928.¹⁸¹ Henry Potter made a piccolo in E-flat, DCM 1677, in London 1841-1951 with five brushed nickel-silver keys, the B-flat key for *Th*, the G-sharp key for *L4*, the F key for *R3*, and the D-sharp/E-flat key for *R4*. This cocus piccolo in two sections has modern-style key cups, pin in block, and brushed nickel-silver ferrules.¹⁸²

Six-Key Piccolo (1824)

The four-key piccolo introduced in the 1820s was soon followed by the six-key piccolo c.1824, which was not mentioned in treatises until 1843.¹⁸³ The six-key piccolo was the most popular piccolo in the nineteenth century, was used extensively throughout the twentieth century, and was featured in nearly every maker's catalogue from 1878 to 1930, especially German and English piccolo makers. As flutists converted to the Boehm system flute, many still played six-key piccolos.¹⁸⁴ The earliest extant six-key piccolo dates from around 1825 and features the addition of a closed long C key and a long F key.

Seven-Key Piccolo

The less common seven-key piccolo was first featured in Italian and German maker catalogues in 1905 and was produced into the early twentieth century.¹⁸⁵ Rampone made a piccolo in C with seven nickel-silver keys and ferrules in Milan c.1850-1912 and is labeled DCM 0067. The seventh key operates the D3 trill. This conical cocus piccolo was made in two sections with

¹⁸¹ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 371.

¹⁸² Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁸³ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 394.

¹⁸⁴ *Ibid.*, 387-388.

¹⁸⁵ *Ibid.*, 387.

post and rod and a tuning slide in the headjoint. The cocus wood was stained dark and varnished.¹⁸⁶

The piccolo in C featured in Figure 3.9 was made by Rampone in Milan and also has seven silver-plated keys with modern-style key cups. DCM 0280 is made in two sections of silver with a double wall. The headjoint cap and cork-setting mechanism are both made of cocus wood with a silver dome exterior. This conical piccolo in two sections has post and rod on flanges soft soldered to the body of the instrument, a tuning slide (short) in the headjoint, and an embouchure engraved with a lyre, sunburst, floral motif. The six principal finger holes are engraved around the finger hole and the seventh key operates the D/E trill.¹⁸⁷



Figure 3.9. DCM 0280: A. Rampone Piccolo in C (1850-1912)

Eight-Key Piccolo

Eight-key piccolos were also available during the nineteenth century. DCM 0181 piccolo in C was made by an anonymous maker in the late nineteenth century. This instrument plays down to low C and has modern-style key cups, post and rod, and nickel-silver ferrules and end cap. It is made of grenadilla in two sections and has a metal-lined headjoint with a tuning slide. DCM 0747 piccolo in C was probably made by an anonymous German maker and plays down

¹⁸⁶ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁸⁷ Ibid.

to a low C. It has nickel-silver keys, ferrules, and end cap with a cork-setting mechanism, round flaps, post and rod, and is made in two sections. The upper headjoint section is made of ivory with a metal tuning slide headjoint.¹⁸⁸

Multi-Keyed Piccolo

A multi-keyed piccolo was first mentioned in the 1843 orchestration treatise, *Grand traité d'instrumentation* by Berlioz. He never specified how many keys this instrument had, but he was obviously referring to an instrument with more than one key.¹⁸⁹ The multi-keyed piccolo was invented in the 1820s and became widespread by the 1850s.¹⁹⁰ This piccolo received many different names. According to Dombourian-Eby,

The terms *old system*, *simple system*, and *Meyer system* all refer to the pre-Boehm system piccolo of eight or more keys and/or the six-keyed piccolo. Meyer system instruments also often included an ivory headjoint. If only the instrument's number of keys is listed, the instrument is built on the pre-Boehm system. Schwedler, Schwedler and Kruspe, and Reform system instruments are basically old system instruments with some modifications in the key work and with raised cusps on both sides of the embouchure hole. All other models mentioned are slight variations on either the simple system or the Boehm system. Those that are based on the simple system also list the number of keys or state old System; all others are based on the Boehm system.¹⁹¹

The multi-keyed piccolo had ease of fingering and venting of veiled notes that the one-key piccolo could not offer.¹⁹² This instrument was soon followed by the

¹⁸⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

¹⁸⁹ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 395.

¹⁹⁰ Zartouri Dombourian-Eby, "A History of the Piccolo," [A brief summary of her doctoral dissertation.] *Flutist Quarterly* 26, no. 1 (Winter 1991): 16.

¹⁹¹ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 380.

¹⁹² Zartouri Dombourian-Eby, "A History of the Piccolo," [A brief summary of her doctoral dissertation.] *Flutist Quarterly* 26, no. 1 (Winter 1991): 13.

Boehm system piccolo, which drastically changed the way the keys operated with rods and axles.

Theobald Boehm

Goldsmith and flutist Theobald Boehm eventually combined these two skills in 1812 to build flutes and piccolos for his own use and for others for a thirty-five year span. Boehm heard Charles Nicholson (1795-1837) perform in Paris and in London in 1831 and was impressed with his unusually powerful tone. He felt this was a result of the large tone holes on Nicholson's flute.¹⁹³ Years later Boehm stated in a letter, "Had I not heard him [Nicholson], probably the Boehm flute would never have been made."¹⁹⁴ By the early 1830s, Boehm system piccolos were being made by several French flutemakers.

Boehm 1832 Model

Boehm's 1832 design used a system of ring keys, which required players to learn new fingerings.¹⁹⁵ Mechanically, ring keys are attached to flutes and piccolos and other woodwind instruments, such as the clarinet, in the same way that closed keys are attached. However, the ring keys lack the center cup allowing the player to press directly on the tone hole while transmitting the motion of the fingers to remote tone holes. Although there are no piccolos produced by French makers to survive from this time, evidence of their existence can be found in instrument maker catalogs as early as the 1830s. A silver cylindrical Boehm

¹⁹³ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

¹⁹⁴ *Ibid.*, 18.

¹⁹⁵ *Ibid.*, 18.

system piccolo was first offered in American maker Alfred G. Badger's 1865-1885 catalogue.¹⁹⁶

There are three piccolos available today that were made by Boehm himself, one of which was constructed for Kapellmeister Pott in October 1850. According to the ledger from the Boehm Mendler workshop, four more piccolos were made between 1876 and 1879.¹⁹⁷ Three Boehm or Boehm and Mendler piccolos are still extant: a silver Boehm system piccolo located in the Karl Marx University Collection in Leipzig, which is probably the Pott piccolo, and two grenadilla piccolos in the Dayton C. Miller Flute Collection, DCM 0053 and DCM 0344.¹⁹⁸

Boehm conducted his first scientific study of the acoustical principles of the instrument in 1846.¹⁹⁹ Sandra Graef describes this study as follows:

To study tone differences, he [Boehm] made several cylindrical wooden tubes of varying lengths and diameters and experimented with the size and placement of tone holes, which resulted in a diagrammatic presentation for the best tone hole placement and size for an optimum scale and sound. The price for this new scale was a completely new fingerings system, in which performers could press more than one key with just one finger. He also concluded that metal was better than wood, because the sound was louder, projected more easily, and the tube could vibrate more freely.²⁰⁰

¹⁹⁶ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 380.

¹⁹⁷ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 29.

¹⁹⁸ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 377.

¹⁹⁹ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

²⁰⁰ *Ibid.*, 18.

Boehm 1847 Model

Boehm's final 1847 model surpassed all previous piccolo types and was far more advanced than the music being composed at that time.²⁰¹ Prior to 1847, Boehm used a conical bore for his flutes and piccolos, but further experiments proved that a cylindrical bore for the flute would produce the most accurate scale. His piccolo design, on the other hand, is still made with a conical headjoint.²⁰² It also features the piccolo's modern fingering system. He used a chromatic ordering of the tone holes instead of the diatonic principle used on instruments of the past.²⁰³ The new tone hole placement improved intonation and subsequently tone. The complex mechanism opens and closes several tone holes with one key.²⁰⁴

Boehm revealed his design innovations with a geometrical diagram known as the Schema.²⁰⁵ These diagrams found in Figures 3.10 and 3.11 show how calculations based on the laws of acoustics were used to determine the position of the holes on the body of the flute and piccolo. They also show the exact measurements and divisions of the air column based on vibrations in equal temperament. The divisions are represented on the Schema by horizontal and vertical lines. The diagonal lines represent the geometrical progression.²⁰⁶ In

²⁰¹ Linda, Marianiello, "Baroque and Historical Flutes: Peter Thalheimer at the Minneapolis Convention," *Flutist Quarterly* 16, no. 1 (Winter 1991): 47.

²⁰² Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 19.

²⁰³ Linda, Marianiello, "Baroque and Historical Flutes: Peter Thalheimer at the Minneapolis Convention," *Flutist Quarterly* 16, no. 1 (Winter 1991): 46-47.

²⁰⁴ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

²⁰⁵ Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994) 2.

²⁰⁶ *Ibid.*, 3.

order to fully understand the bore of the flute and piccolo, Boehm studied at the University of Munich with physicist Carl von Schafhautl.²⁰⁷ Boehm's 1847 flute became well known in the flute world immediately. By 1851, the Boehm flute won first prize in the Industrial Exhibition of All Nations. In 1855, it won gold medal at the Paris Exhibition and first prize at the General German Industrial Exhibition in Munich.²⁰⁸

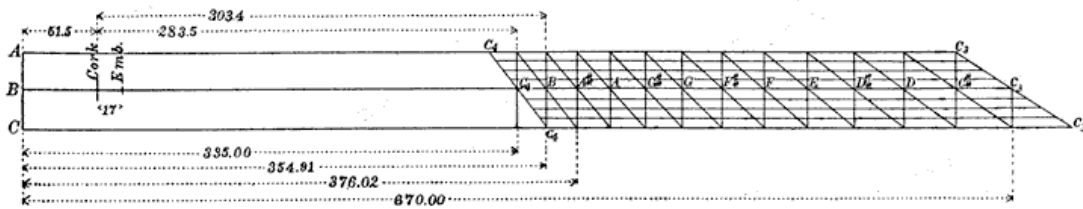


Figure 3.10. Theobald Boehm's Schema²⁰⁹

²⁰⁷ Ibid., 4.

²⁰⁸ Ibid., 4.

²⁰⁹ Diagram from "Boehm's Schema" <http://www.mcgee-flutes.com> (accessed May 4, 2010).

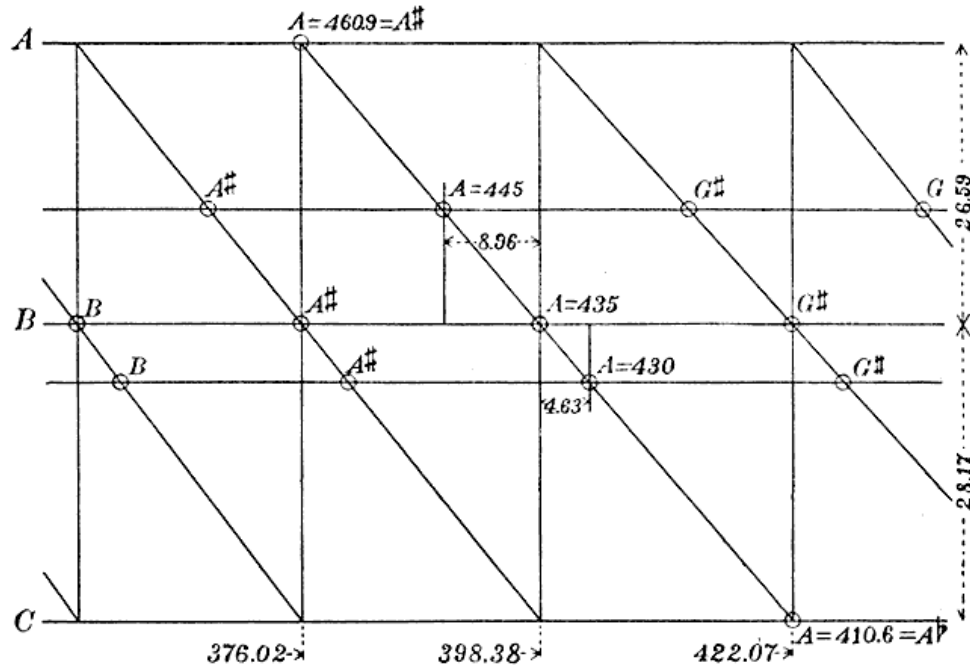


Figure 3.11. Theobald Boehm's Schema (to scale)²¹⁰

Boehm flutes and piccolos became extremely popular; however, because of their timbre and new fingering system, they were avoided by older players and therefore banned from many orchestras in countries such as Germany, Italy, and Russia. As younger players learned the new Boehm system, they created heavy competition for older players causing professional playing to decrease temporarily. As younger professionals brought Boehm's system to the orchestra, composers were encouraged to write for this new extended range.²¹¹ After some minor modifications, Boehm's 1847 flute and piccolo soon became the preferred instruments for performers and audiences.²¹²

²¹⁰ Ibid.

²¹¹ Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 4.

²¹² Ibid., 5.

Although acceptance of the Boehm system was slow, especially for the piccolo in Germany and Austria, perhaps the new system made the highly modulatory works of Mahler and Strauss easier to perform. It is possible, however, that these pieces were first performed on non-Boehm piccolos.²¹³ The major benefit of the Boehm piccolo was the ease of fingering in all keys. There was very little difference in tone quality and projection between the Boehm and pre-Boehm piccolos. When discussing which type of instrument a late nineteenth-century work was written for, tonality and specific fingering requirements should be considered.²¹⁴

There were two major principles of Boehm's construction of the 1847 flute and piccolo. Boehm wanted the keyholes made equal in size, and he wanted the keys to remain open when they were not in use. He also changed the bore to cylindrical, rather than conical, with the exception of the headjoint, which has a slight taper to improve projection of sound and high register facilitation.²¹⁵ According to Marieniello, "His mechanism proved to be so technically perfect that any attempts to improve a single feature gave rise to a series of new problems."²¹⁶

Before completing the 1847 model, Boehm discovered that the height of the tone holes affected intonation. Pitch could also be corrected by changing the size and placement of the tone holes. Lower octaves could be corrected, therefore maintaining or improving the high octave.

²¹³ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 219.

²¹⁴ Zartouri Dombourian-Eby, "A History of the Piccolo," [A brief summary of her doctoral dissertation.] *Flutist Quarterly* 26, no. 1 (Winter 1991): 13.

²¹⁵ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 29.

²¹⁶ Linda Marianiello, "Baroque and Historical Flutes: Peter Thalheimer at the Minneapolis Convention," *Flutist Quarterly* 16, no. 1 (Winter 1991): 47.

Today, the construction of tone holes on the flute is much different than the construction of tone holes on the piccolo. Two types of tone holes are constructed for the flute: drawn or soldered. Drawn tone holes are produced by extruding metal directly from the flute tube. This process is efficient and economical for most standard student model flutes.²¹⁷ Soldered tone holes are made separately and then soldered onto the instrument. These tone holes are more expensive than the drawn and are found primarily on professional flutes. The advantage is that the metal tubing remains the same for soldered tone holes, but unfortunately drawn tone holes take metal away from the body.²¹⁸ On wooden piccolos, the tone holes are drilled into the bore. The instruments that follow feature modifications to the simple system piccolo and the Boehm system piccolo in chronological order.

Saltspoon Key (1842)

The saltspoon key was another type of key, which appeared on the piccolo in the nineteenth century. This type of key looks like the back of a spoon and has a cupped or hemispherical shape.²¹⁹ Several of the piccolos already mentioned in this document have this type of key. DCM 1421 piccolo in E-flat made by Alfred Binyon in London 1842-1852 has one brass key that is a saltspoon key. This boxwood piccolo in two sections also has a pin in block.

A late nineteenth-century piccolo made by an anonymous, possibly American maker (DCM 1674) was made with four nickel-silver keys, one being a

²¹⁷ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 19.

²¹⁸ *Ibid.*, 19.

²¹⁹ John Solum, *The Early Flute* (Oxford: Oxford University Press, 1995), 64.

saltspoon key. The two parts of this instrument could possibly be a composite of other instruments. It is made of boxwood stained dark brown, has a pin in block, and a bone or ivory headjoint ferrule.²²⁰ Saltspoon keys are no longer used on modern piccolos.

Giorgi System (1848-1928)

Carlo Tommaso Giorgi (1856-1953), an Italian flutist and acoustician, made a piccolo with a perpendicular embouchure hole and a mouthpiece with a tuning slide c.1866. This system was experimental and does not find an important place in mainstream piccolo history or performance practice, because the instrument is played vertically, rather than horizontally.²²¹ Joseph Wallis made a piccolo in C in London 1848-1928 (DCM 0402). In his ledger, Miller wrote,

The head is of same model as for the Giorgi flute. The body of the piccolo is of the same pattern as ordinary 6-keyed instrument, except that the D-sharp and short F keys are bent to conform to the slanting position of the fingerings.

This Giorgi system piccolo is conical with modern-style key cups, post and rod, has two sections, and a tuning slide in the headjoint with a perpendicular embouchure. The headjoint consists of a standard barrel, like a clarinet barrel, and is made of ebonite.²²² As previously mentioned, the Giorgi system and perpendicular embouchure were never applied to the modern piccolo.

²²⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

²²¹ Rick Wilson's Historical Flutes Page, "Giorgi Flutes (1886)," <http://www.oldflutes.com/articles/giorgi.htm> (accessed May 4, 2010).

²²² Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

Giulio Briccialdi B-flat (c.1849)

In 1849, Italian flutist Giulio Briccialdi (1818-1881) added the B-flat thumb key to the Boehm system flute and piccolo. Before this addition, the 1847 Boehm piccolo required *Th*, *L1*, and *R1* to operate B-flat. Briccialdi improved the technique for flat keys by adding a lever over the B key to close the B-flat key as seen in Figure 3.12.²²³ This allowed for two fingering options.²²⁴ An additional trill lever, known as the B-flat side key, provides another alternate fingering option and helps facilitate chromatic and fast technical passages that include B and B-flat. It also simplifies trills.²²⁵

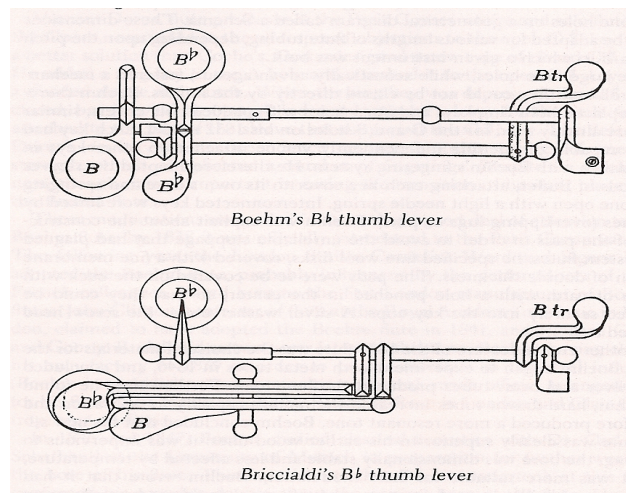


Figure 3.12. Boehm and Briccialdi B-flat Keys

At Briccialdi's request, the Rudall and Rose Flute Company added the first Briccialdi lever on a cocuswood flute built by Clair Godfroy. After seeing

²²³ Diagrams from Nancy Toff, *The Flute Book*, 2nd ed. (New York: Oxford University Press, 1996), 56.

²²⁴ Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 10.

²²⁵ *Ibid.*, 10-11.

Briccialdi's invention, Boehm designed his own version of the B-flat thumb key, but Briccialdi's version prevailed and is still used today on modern piccolos.²²⁶

Open and Closed G-sharp Keys

There have been four different styles of G-sharp keys: one is an open G-sharp key preferred by English piccolo performers and the remainder are closed G-sharp keys preferred by American piccolo performers. The open G-sharp key was developed by Boehm, who felt it was tonally and theoretically better than the closed G-sharp keys. Not to mention it only requires one hole in the tube to produce the frequency.²²⁷ Because the open G-sharp required greater technical skill when using *L4*, many flutists rejected this key.²²⁸ There are several disadvantages to playing an instrument with the open G-sharp key, such as resale value, availability, and access to other instruments in emergency situations.²²⁹ When flutemakers attempted to reclose the G-sharp key, many intonation problems arose due to the Schema and the other keys, which required the open G-sharp.²³⁰

The Dorus G-sharp Key was developed in 1838 by the flute professor at the Paris Conservatoire, Vincent Dorus (1812-1896). According to Carolyn Nussbaum,

The closed G-sharp operates by *L3* lowering the A key, which simultaneously covers the G-sharp and produces a G-natural."²³¹
Dorus applied the closed G-sharp mechanism to the pre-Boehm

²²⁶ Ibid., 10.

²²⁷ Ibid., 5.

²²⁸ Ibid., 5-6.

²²⁹ Ibid., 9.

²³⁰ Ibid., 6.

²³¹ Ibid., 5.

fingering system by “adding a ring key to the A hole and attaching it to the open G-sharp key with a divided sleeve and clutch.”²³²

Boehm invented his own closed G-sharp key in response to demands, but his design required greater force from *L4* because of the strong springs he used. He corrected the intonation of the A in his Schema by repositioning the A tone hole 1.2 millimeters above the original position.²³³

The fourth type of closed G-sharp key, which is still in operation today, was similar to the Dorus G-sharp key but placed on the inner side of the instrument tubing. In order to produce the G-sharp, *L4* was used again, like the pre-Boehm system. *L3* operates the A and G-sharp keys, while *L4* operates the G-sharp.²³⁴

Ring Keys

The piccolo flute in D-flat (high pitch) in Figure 3.13 by Buffet-Crampon and Cie was made in Paris in 1880 (NMM 1507). This conical African blackwood piccolo in three sections has a Boehm 1832 hybrid system, twelve German silver keys, ferrules and mounts, a screw-cap, and a metal-lined headjoint with a telescoping tuning slide. It has four rows of rods and sleeves mounted on post and axle supports.²³⁵ Because closed keys are much more consistent, modern piccolos are made with closed keys, rather than ring keys.

²³² Ibid., 5-7.

²³³ Ibid., 8.

²³⁴ Ibid., 8.

²³⁵ National Music Museum, “Piccolo,” Woodwind Instrument Collections, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).

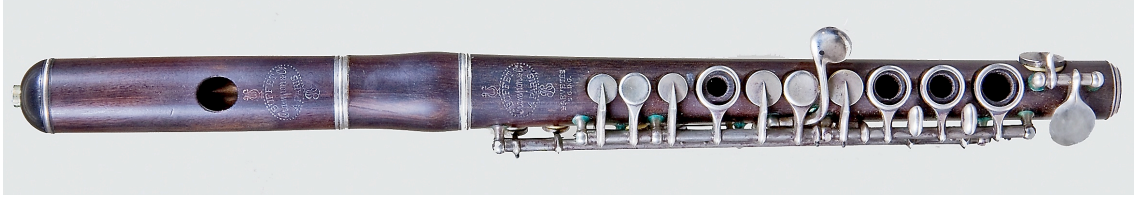


Figure 3.13. NMM 1507: Buffet-Crampon and Cie Piccolo (1880)

Tube Extensions

Some piccolos in the nineteenth century included C1 and C-sharp1; however, composers and makers found it unnecessary to include them very often.²³⁶ Gustav Mahler (1860-1911) extended the range by including the lowest and highest notes ever written for the piccolo, C1 and D-flat4.²³⁷ The Dayton C. Miller Flute Collection has two piccolos with these tube extensions. DCM 0747 piccolo in C was made by an anonymous, probably German, out of cocus with an ivory upper headjoint section and a metal tuning slide. It has eight nickel-silver keys to low C, round flaps, post and rod, two sections, nickel silver ferrules, and an end cap with a cork-setting mechanism. John C. Haynes made a piccolo in C in Boston 1897 (DCM 0182), that, according to Dayton C. Miller's ledger, was originally made for Frank Wadsworth of John Philip Sousa's Band in 1897 for solo work. This grenadilla piccolo has a Boehm system with silver keys and ribs, a C foot, open G-sharp key, two sections, and a roller for C1.²³⁸ Modern piccolos no longer come equipped with tube extensions to resemble the modern flute. Perhaps makers will consider this design for future models.

²³⁶ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 7.

²³⁷ *Ibid.*, 188.

²³⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

J. Mollenhauer and Sons Model

J. Mollenhauer and Sons was located in Fulda, Germany, and continued experiments with the Boehm piccolo. Mollenhauer experimented with changing not only the size of the bore of the body and headjoint, wall thickness, and hole sizes but also tried to retain the cylindrical bore. His results were still unsatisfactory because the tone was sharp and cutting and the high register only spoke sporadically. Eventually Mollenhauer experimented with a cylindrical headjoint and a conical bore, which proved to be more successful. An 1891 catalog features this Boehm system piccolo, but unfortunately, exact dates of these experiments are unknown because the majority of the company's archives were destroyed during World War II.²³⁹

In England it was common for flutists to play on a Boehm system flute and a conical six-keyed piccolo made by Whitaker, instead of the Boehm system piccolo. Even some artists today prefer the metal cylindrical piccolos for facility in the high register.²⁴⁰

Buffet Model (c.1838)

In 1838 Louis August Buffet received a five-year patent from the Committee of Arts and Manufacturers to apply his system to the piccolo.²⁴¹ Buffet also started to incorporate the needle springs and hollow rods in the piccolo mechanism at this time. These two mechanical additions are still currently used on flutes and piccolos.

²³⁹ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 30.

²⁴⁰ *Ibid.*, 30.

²⁴¹ Tula Giannini, *Great Flute Makers of France: The Lot and Godfroy Families, 1650-1900* (London: Tony Bingham, 1993), 109-110.

Combination Systems (Simple and Boehm)

Some makers tried to combine the simple and Boehm systems. Card made a piccolo in C in London 1845-1862 (DCM 1088) with five silver keys and ferrules with modern key cups, post and rod, and three finger rings. The left hand is a simple system with a closed G-sharp key and the Boehm system is used in the right hand utilizing the three finger ring keys. This rosewood piccolo was built in two sections with a metal-lined headjoint with a tuning slide.²⁴² Modern piccolo makers no longer experiment with combination systems.

Rudall, Carte, and Co. Model

The Powerhouse Museum Collection in Ultimo, Australia, has five piccolos featuring nineteenth century alternative systems from English maker Rudall Carte. The piccolo in D-flat in Figure 3.14 (PHM 93/117/26) was invented, developed, and patented by Richard Carte in 1866 with U.K. patent No. 3208 and was a further development of his 1851 system. It combines Boehm's design features, such as mechanized key work and a cylindrical bore with a fingering system similar to the simple system. Performers wanted the mechanical advantages of Boehm's system with the fingerings of the simple system. The Carte piccolo is made in two sections of ebonite with a metal-lined head. It has German silver keys and an ebonite lip plate.²⁴³

²⁴² Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

²⁴³ Michael Lea and Danielle Eden, "Rudall Carte Piccolos-Powerhouse Museum Flute Collection," Powerhouse Museum, <http://www.flutefocus.com/171-rudall-carte-piccolos-powerhouse-museum.html> (accessed May 4, 2010).



Figure 3.14. PHM 93/117/26: Rudall Carte Piccolo in D-flat (1867)

Card System

William Card (1788-1861) was an early advocate of the Boehm system and made instruments that combined these features and additions of his own. DCM 1088 was made by Card between 1840 and 1861. This instrument is classified as a simplified Boehm system and has a few similarities to the 1832 Boehm system, but it has a conical bore and the key work consists of five keys and three ring keys.²⁴⁴ Modern piccolo makers no longer experiment with this design.

Radcliff System

The Radcliff System piccolo was also designed by Rudall and Carte during the nineteenth century to combine features of the simple system and the Boehm system. It was based on a modification of Richard Carte's 1851 system by the English flutist John Radcliff (1814-1918).²⁴⁵ Modern piccolo makers have abandoned this design.

²⁴⁴ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 388-389.

²⁴⁵ Michael Lea and Danielle Eden, "Rudall Carte Piccolos-Powerhouse Museum Flute Collection," Powerhouse Museum, <http://www.flutefocus.com/171-rudall-carte-piccolos-powerhouse-museum.html> (accessed May 4, 2010).

Pratten System (c. 1851)

The Pratten System piccolos were made by Boosey and Company c.1851.²⁴⁶ These instruments had unique, two-level keys for *L4* and for the footjoint. This new system was an improvement of the simple eight-key piccolo with a cylindrical bore. Like many of the experimental systems described above, the Pratten System is no longer used in piccolo design.

Simplified Clinton Equisonant System (c.1855-1871)

Clinton and Company made the piccolo in C (DCM 1196) in Figure 3.15 c.1855-1871 in London. This conical-bore grenadilla piccolo has an ebonite metal-lined headjoint with a tuning slide and a barrel covered with a nickel-silver tube. The simplified Clinton equisonant system offers double tone holes for the principal rank of nickel-silver keys and ferrules. The tone holes on this instrument are referred to as double tone holes because the finger rings for *L2* and *R2* also operate the closed keys *L1* and *R1* in the principal rank.²⁴⁷ This design fell from favor and is no longer used by piccolo makers.



Figure 3.15. DCM 1196: Clinton and Co. Piccolo in C (c.1855-1871)

²⁴⁶ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 40.

²⁴⁷ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

Boehm and Carte System Combination (1867)

Rudall, Carte, and Company designed a piccolo (pitch undetermined) that combines Carte's 1851 and Boehm's 1847 systems (NMM3792). This design received a patent in 1867 and altered the right-hand mechanism. The new design allowed the performer to use simple system fingerings or Boehm's fingerings for F and F-sharp. This model retains the 1851 design for the left hand.²⁴⁸ This combination system is no longer used on modern piccolos. The remaining instruments in this chapter were used specifically for military purposes.

Fife

During the nineteenth century, most fifes were made in one cylindrical piece of boxwood, ebony, ebonite, or metal and pitched in either B-flat or A-flat for American bands.²⁴⁹ The first instrument in the Dayton C. Miller Flute Collection is Miller's father's Civil War fife made by Hopkins of Troy, New York c.1860. Dayton's father played in a fife and drum corps organized in 1864 for service in the Civil War.²⁵⁰ The fife in B-flat in Figure 3.16 was made by James Hoey in New York c.1837-1856 from one piece of conical rosewood with brass ferrules.²⁵¹



Figure 3.16. NMM 5354: James Hoey Fife in B-flat (c.1837-1856)

²⁴⁸ Stephanie Kocher, "What Was He Thinking When He Wrote That?!?" (Winner of the International Piccolo Symposium 2009 "Call for Presentations," Omaha, NE, June 13, 2009).

²⁴⁹ Andrew Fairley, *Flutes, Flautists, and Makers* (London: Pan Educational Music, 1982), 40.

²⁵⁰ Dr. Mary Jean Simpson, "Dayton Miller and The Dayton C. Miller Flute Collection," *Flutist Quarterly* 15, no. 1 (Winter 1989): 5.

²⁵¹ National Music Museum, "Piccolo," Woodwind Instrument Collections, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).

The fife became less practical to use and seemed to be left behind in the twentieth century. However, brass bands alternating with the fife and drums in playing quicksteps while on the march, were likely an influential factor in instruments of the flute family joining up with the once all-brass bands.²⁵²

By 1860, the fife was replaced by small flutes with conical bores and fitted with one to eight keys in order to produce chromatic notes.²⁵³ These small flutes could play in every scale and the conical bore produced a sweeter tone and allowed greater ease in the upper register.²⁵⁴ The piccolo was used sporadically in American Civil War era post and civilian bands.

Orchestra

When the piccolo made its orchestral debut in Beethoven's Fifth Symphony (1804-08), it functioned to extend the upper range of the woodwinds, was often given the melody while the flute played the harmony, and decorated the melodic line. From this time forward, the orchestral use of the piccolo became more frequent and increasingly innovative.²⁵⁵ Gioachino Rossini's (1792-1868) overtures to the operas *Italienne in Algiers* (1813), *Barber of Seville* (1816), *The Thievish Magpie* (1817), *Semiramide* (1823), and *William Tell* (1829) employ the piccolo as a prominent melodic soloist.²⁵⁶ In 1897, John Phillip Sousa (1854-1932) wrote his most famous march, *The Stars and Strips Forever*, which features

²⁵² Heather Hall Coleman, "The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the 19th Century" (D.M.A. diss, University of Memphis, 1999), 6.

²⁵³ H. Macauley Fitzgibbon, *The Story of the Flute*, 2nd ed. (London: Williams Reeves Bookseller Limited, 1928), 79.

²⁵⁴ Christopher Welch, *History of the Boehm Flute*, 2nd ed. (New York: G. Schirmer, 1961), 238-239.

²⁵⁵ Nancy Toff, *The Development of the Modern Flute* (New York: Taplinger Publishing Company, 1979), 68.

²⁵⁶ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 45.

the famous piccolo solo during the trio obbligato.²⁵⁷ In the early nineteenth century, piccolo parts were written in simple tonalities that rarely exceeded two flats or three sharps, which were easy to play on the one-, four-, and six-key piccolo. Once Boehm made his Boehm system piccolos, composers were able to write in any key they desired. The works of Strauss and Mahler were possibly written with the Boehm system piccolo in mind.²⁵⁸

²⁵⁷ Ibid., 73.

²⁵⁸ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 12-13.

CHAPTER IV. MODERN PICCOLO (1900-Present)

Acceptance of the Boehm system piccolo came much slower than the Boehm system flute. In the 1920s many professional performers played a Boehm system flute and a simple system or six-key piccolo.²⁵⁹ In the early twentieth century many performers preferred silver piccolos rather than wood piccolos, because it made the transition from flute to piccolo more efficient. By the late twentieth century the majority of performers switched to the wood piccolo for the warmer tone quality.

In the United States the Boehm flute manufacturing industry was well established in New York City by 1880. The leading New York flutists and their students soon located all over the country, especially in Boston, MA and Elkhart, IN. By 1886 Boston established the first Boehm flute factory becoming the capital of high quality handmade flutes and piccolos. However, a different tradition took shape in Elkhart, IN, as it became the center of mass produced low cost band instruments. To this day both instrument making centers have maintained these reputations.

The piccolo of the twentieth century has seen many new and unique developments. For instance, the rise of the silver and the German silver piccolos, the temporary experimentation with the cylindrical bore, and the additional keys modern makers have added in order to enhance the Boehm system. Some of the most significant contributions of this century include the Cooper Scale, Straubinger Pads, and the pinless mechanism.

²⁵⁹ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 9-10.

TUBE AND MATERIALS

Two-Piece Piccolo

Two-piece piccolos were standard during the twentieth century. An anonymous piccolo in C, DCM 0056 made during the turn of the twentieth century uses the simple system with six or twelve keys, if you take into account the principal rank with finger holes covering the keys. This conical piccolo in two sections has a tuning slide in the headjoint, post and rod, modern-style key cups, nickel-silver keys and ferrules, and a dark lacquered wood. Carl Bonnet made a conical piccolo in C made of cocus in New York c.1891-1918 with the Boehm system, closed G-sharp key, modern nickel-silver key work, post and rod, direct mount, and ring keys for the right hand. DCM 0680 also has a headjoint that is partially metal-lined.²⁶⁰

Four-Piece Piccolo

Some special exceptions were made to the two-piece piccolo of the twentieth century, such as the four-piece piccolo. This design has some resemblance to the four-piece piccolo made during the Classical period. DCM 0090 piccolo in C was made by the Martin Brothers in Paris 1840-1927. This cocus piccolo has five silver keys with modern-style key cups, post and rod, ivory ferrules, and an inlay at the cap.²⁶¹

²⁶⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

²⁶¹ Ibid.

Bore and Materials

During World War I and World War II, many cylindrical bore piccolos were made and are still being used today for their thin, piping sound. The third register is its best feature, but the low register is weak and the intonation can be faulty. The cylindrical bore piccolo blows easily and is favored by instrument doublers.²⁶² Cylindrical bore piccolos were made by Carl Fischer's T. Berteling and Company in New York, NY, George W. Haynes in Boston, MA, and Nils Christensen also in Boston, MA.²⁶³

However, the majority of makers during this century have determined that the conical bore piccolo is superior to the cylindrical bore piccolo due to a more full-bodied, pleasing, and "flute-like" sound it has to offer. Many makers have even stopped making cylindrical bore piccolos altogether. The tapered bore used on modern piccolos creates a more mellow tone and also allows the tone holes to be placed closer together, resulting in more comfort and ease. Bore and materials have never been settled with makers and seem to change with whatever is most popular at the time.²⁶⁴

Grenadilla

The majority of modern piccolos in use today are made of grenadilla. Instrument makers go through an extremely tedious process in order to make a fine crafted piccolo made from this type of wood. A grenadilla piccolo begins as a block of wood about ten inches long that cures for six months. It has to be

²⁶² Laurence Taylor, *Metzler and Co.'s Tutor for the Piccolo* (London: J.B. Cramer and Co. Ltd), 26.

²⁶³ Berdahl, Susan Marie Beagle, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 187.

²⁶⁴ *Ibid.*, 186.

completely dry when the instrument is made or it will crack. A lathe turns the block into a cylinder. After curing for six more months, the bore is drilled out. Six months after that, the tone holes are drilled, keys and pads are made, and the embouchure is sculpted. Many of these tasks are done with machinery, but none are automated.

In 1913 when Carl Fischer took over the Berteling line, piccolos were grenadilla bore instruments with sterling silver keys, German silver keys, or ring keys. No information is available on the earlier Berteling piccolos, and little is known about the piccolos made in the early twentieth century by W.F. Meinell, William Meinel, and Penzel-Mueller, except that they were grenadilla with silver or German silver keys, but the bore shape was unknown. William S. Haynes Company piccolos were conical wooden instruments, and the Betthoney-Wurlitzer grenadilla piccolos were conical with silver keys.²⁶⁵

Many performers prefer wood instruments for orchestral and solo work instead of metal ones for the softer tone color, so grenadilla is a great investment.²⁶⁶ Like all other woods, grenadilla has a very fine grain and can open up when the tone holes are being cut, leaving small pits. The pad will not seal properly if the grain opens at the lip of the tone hole where the pad contacts the body or the pad seat. Proper tools and care will ensure smooth tone holes that will last the life of the instrument.²⁶⁷

²⁶⁵ Berdahl, Susan Marie Beagle, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 185.

²⁶⁶ Nancy Toff, *The Flute Book: A Complete Guide for Students and Performers*, 2nd ed. (Oxford: Oxford University Press, 1996), 66.

²⁶⁷ James Keefe, "Piccolo Making at Brannen Brothers," *The Piccolo Society, Inc.* 7, no. 2 (May 1985): 1.

Cocus

At the turn of the twentieth century, an anonymous maker designed a piccolo after the design of William G. Schulze in New Haven, CT (DCM 0050). This instrument has a simplified Boehm system with six nickel-silver keys with modern-style key cups, ferrules, and four rings. The piccolo is made of a conical piece of cocus in two sections and has an open G-sharp key, as well as post and rod. It was used by Louis P. Fritze in Sousa's band. Another anonymous maker designed a piccolo in D-flat around the same time with six nickel-silver keys with modern-style key cups, ferrules, direct mount, and post and rod. DCM 1631 is a cocus piccolo in two sections with an ivory and cocus metal-lined headjoint with a tuning slide.²⁶⁸

Ebonite

George Howarth made a piccolo in C in London 1894-1933 (DCM 1363). The key work on this instrument is essentially a Boehm system with an open G-sharp key and standard trill keys for the right hand with Briccialdi variation. The mechanism for the right hand is a variation of the old system, which is similar to the Carte 1867 patent models. It includes a first finger F-sharp key or F-natural, plus the third finger F-natural old system, or the F-sharp Boehm system key. The conical piccolo in two sections has silver keys and ferrules and a socket liner.²⁶⁹

Rosewood

Rosewood was also used in the twentieth century as a piccolo material. DCM 1544 piccolo in C was made by G. H. Hüller in Schöneck 1883-1950 with

²⁶⁸ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

²⁶⁹ Ibid.

six keys, ferrules, round flaps, post and rod, direct mount, and a metal-lined ebonite upper headjoint with a nickel-silver cap cover and tuning slide. This piccolo in two sections also has a cork-setting mechanism.²⁷⁰

Silver

During World War II, silver was a scarce material and was often purchased from private sources to make military flutes and piccolos.²⁷¹ It has many advantages, such as stability, ease of machining, and attaching key work by soldering is much easier than working with wood.²⁷² Silver piccolos are made with both conical and cylindrical bores.²⁷³ As mentioned earlier, many players prefer the cylindrical bore piccolo because of the similarity it has with the silver flute.²⁷⁴

In 1912 the silver flute superseded the wood flute, but the wood piccolo retained its favor. Eventually the silver piccolo came to be accepted too. In 1930 the William S. Haynes Company reported that 95 percent of piccolos sold were sterling silver and that the wood piccolo started to decline in 1923. Despite the drop in sales of wood piccolos, it never entirely lost favor. The William S. Haynes Company and Verne Q. Powell Flutes, Inc. in Boston, MA, made the mistake of discontinuing wood piccolos for a short time after World War II, but manufacturing of the wood piccolo resumed to fulfill demand.²⁷⁵

²⁷⁰ Ibid.

²⁷¹ Robert Austin, "The Boston Flutemakers," *Flute Talk* 16, no. 1 (September 1996): 22.

²⁷² Jeremy Montagu, *The Flute* (Princes Risborough, England: Shire Publications Ltd., 1990), 44.

²⁷³ Laurence Taylor, "Approach to the Piccolo: Part II," *Instrumentalist* (January 1956): 26.

²⁷⁴ Anthony C. Baines, *Woodwind Instruments and Their History* (New York: Dover Publications, Inc., 1991), 57.

²⁷⁵ Berdahl, Susan Marie Beagle, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 187.

William S. Haynes Company released their first silver piccolo with a cylindrical bore in 1916. Ten years later, a conical-bore silver piccolo was also offered by the company. By 1950 the cylindrical bore silver piccolo was discontinued by prominent Boston makers and only the conical bore wood and silver piccolo remained.²⁷⁶ George Bundy, an employee of the Selmer Company²⁷⁷, was given the rights to distribute Selmer products in the United States and decided to settle in Elkhart, IN, the band instrument capital. He made the following remarks about piccolo bores:

As to whether the conical or cylindrical bore piccolo is best is still an unsettled question today among the best players. While the conical bore has a tone that is fuller in the low register, the high tones do not speak nearly as easily as with the cylindrical bore silver piccolo more suited to his needs, owing to the natural difficulty that he would have in obtaining the high notes. The change from the wood piccolo to the silver piccolo has by no means been as general as with the flute. There are still many fine piccolo-players using wood piccolos. Nevertheless, the cylindrical bore silver piccolo seems the instrument of the future, and in due time should be generally used. The metal piccolo plays easier than the wood, and is more responsive, as is the case with the metal flute.²⁷⁸

Despite Bundy's prediction, the cylindrical bore silver piccolo was still discontinued and not played by most professionals. In the 1950s some of the

²⁷⁶ Ibid., 188.

²⁷⁷ Selmer Musical Instruments, a division of Conn-Selmer, Inc. traces its roots to Henri Selmer who opened a shop at Place Dancourt in Paris in the early 1900s to meet the demand for his handmade reeds and mouthpieces. Eventually he also started manufacturing clarinets. Around the same time Alexandre Selmer opened a small retail store in New York City. In 1918 Alexandre returned to Paris to assist Henri in their family business, leaving an employee, George Bundy, the rights to distribute Selmer products in the United States. After finding a place in the professional clarinet market, Bundy set his sights on the flute and hired George W. Haynes, the first in a family of famous flute makers, to design the Selmer flute and piccolo.

²⁷⁸ Ibid., 188-189.

Elkhart firms redesigned Selmer's model for school band use by improving intonation and response and the security of ribbed construction.²⁷⁹

Verne Q. Powell Flutes, Inc., ledgers reveal that it underwent a similar cycle in regard to piccolo bores, even though their cylindrical silver piccolo came out almost twenty years later than that of the William S. Haynes Company. The first piccolos produced by Powell were conical wood piccolos, followed by conical silver piccolos. In 1938 the first cylindrical silver piccolo was made by Powell. In 1946 the company, like most others, eliminated the cylindrical bore but continued to manufacture conical bore silver and wood piccolos.²⁸⁰

German Silver

German silver (G.S.) is a type of white bronze, like *Neusilber* or *maillechort*. Sometimes it is called nickel silver, although it is a zinc, nickel, and copper alloy, which was used extensively for Boehm flutes and piccolos. It is much stronger and harder than brass and cheaper than silver. This material can easily be forged or cast into shapes of new mountings for cheaper instruments. Several instruments already mentioned use this material.²⁸¹

Combinations of Materials

Along with several combinations of silver and plating, the piccolo has also been made with various combinations of wood and metal. A wood body and metal headjoint, wood headjoint and metal body, and metal headjoint with a wood, plastic, or ivory embouchure plate are all possible combinations one could find

²⁷⁹ Berdahl, Susan Marie Beagle, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 189.

²⁸⁰ *Ibid.*, 189.

²⁸¹ Jeremy Montagu, *The Flute* (Princes Risborough, England: Shire Publications Ltd., 1990), 45.

during the twentieth century. Ebonite and other plastic materials have also been added as possibilities and have proven successful, especially in student model instruments.²⁸² Performer preferences will vary greatly, but many doublers prefer the wood piccolo with a sterling silver headjoint. Many feel that the silver headjoint allows for easier blowing and that increased volume of tone.²⁸³ The silver headjoint with a lip plate also eliminates the difficulty of switching from silver flute to wood piccolo.²⁸⁴

Gold (1919)

Shortly after gold was used as a material for making flutes, it was applied to the piccolo. The first gold piccolo was produced by William S. Haynes Company in 1919, and the Haynes-Schwelm Company offered a gold lip plate for a silver piccolo in the 1920s. Although both cylindrical and conical bore gold piccolos in C and D-flat were in the price lists during the 1930s, few gold piccolos were actually made.²⁸⁵

Plastic

Some makers are now producing piccolos with plastic bodies because the sound is stable and unaffected by temperature or humidity.²⁸⁶ The visual appearance of the plastic is similar to grenadilla, and the instrument has a sound

²⁸² Edwin V. Putnik, *The Art of Flute Playing* (Evanston, IL: Summy-Birchard Company, 1970), 82.

²⁸³ Laurence Taylor, "Approach to the Piccolo: Part II," *Instrumentalist* (January 1956): 26.

²⁸⁴ Nancy Toff, *Development of the Modern Flute* (New York: Taplinger Publishing Company, 1979), 65.

²⁸⁵ Susan Marie Beagle Berdahl, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 186.

²⁸⁶ Jeremy Montagu, *The Flute* (Princes Risborough, England: Shire Publications Ltd., 1990), 44.

that is more round and less shrill than the silver piccolo. This instrument is an excellent choice for students, especially when used for marching band.²⁸⁷

Imitation Ivory

Imitation ivory was also a material of choice in the early twentieth century. Maino and Orsi made a piccolo in C of imitation ivory (DCM 0279) in Milan; however, this material is no better suited than ivory when it comes to cracking. In his ledger on November 28, 1922 Miller notes, “This headjoint cracked six weeks after receipt!” The head cap and lower body ferrule are engraved with a leaf motif, and the headjoint is metal-lined with a tuning slide. The piccolo in two sections has six silver-plated brass end caps, keys, and ferrules with modern style key cups, post and rod, and direct mount.²⁸⁸

HEADJOINT

Ivory

In the early twentieth century ivory was used for piccolo headjoints. DCM 1392 piccolo in C was made by George Cloos in New York 1862-c.1950. Along with the ivory upper head sections with a tuning slide, this grenadilla piccolo has six silver keys, end cap, ferrules, and post and rod. Another twentieth-century piccolo in D-flat made by an anonymous maker (DCM 1631) also has an ivory and cocus metal-lined headjoint with a tuning slide. It has six nickel-silver keys

²⁸⁷ Nancy Toff, *Development of the Modern Flute* (New York: Taplinger Publishing Company, 1979), 65.

²⁸⁸ Dayton C. Miller Flute Collection, “Piccolo,” Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

and ferrules with modern-style key cups, direct mount, post and rod, and is conical in two sections.²⁸⁹

Grenadilla

Grenadilla (*dalbergia melaxylon*) is the most common material used for headjoints in the twentieth century, and the German firm, Theodore Nagel, is the world's largest supplier of grenadilla. The grenadilla tree grows very slowly on the East Coast of Africa and it takes around 150 years for a tree to grow to the average cutting size. DCM 0447 piccolo in C by Emil Rittershausen was made in Berlin at the turn of the twentieth century. This conical piccolo in two sections uses a Boehm system, nickel-silver keys and ferrules, closed G-sharp key, post and rod on ribs, and a metal-lined socket or sleeve. Felix Bour made a piccolo in C in Chicago 1905-1910 (DCM 1583). This piccolo also uses the Boehm system, silver keys and ferrules, and an open G-sharp key. This grenadilla piccolo in two sections has a partial metal-lined headjoint.²⁹⁰

Cocus

Another material used for headjoints in the twentieth century was cocus. DCM 0055 piccolo in C was made by Louis Lot in Paris during the twentieth century. This piccolo was made with two cocus headjoints for high and low pitch. The conical piccolo was made in two sections with a Boehm system, closed G-sharp key, silver-plated keys and ferrules, four ring keys, and post and rod with modern-style cups on ribs.²⁹¹

²⁸⁹ Ibid.

²⁹⁰ Ibid.

²⁹¹ Ibid.

Ebonite

Ebonite was rarely used for headjoints during the twentieth century.

However, DCM 0495 piccolo in C by C.G. Conn was made in 1905 with a Boehm system, open G-sharp key, and gold-plated key work. This piccolo in two sections has an ebonite headjoint and a silver body.²⁹²

Metal (1919)

Many performers in the early twentieth century chose to use cylindrical metal headjoints to match their flutes. This made the transition from flute to piccolo much easier for the performer. Haynes wrote in his 1940 catalogue,

Many players find the cylindrical bore silver piccolo gives better results than any other piccolo because it is more nearly like the flute in tone-quality and because the high tones may be produced with comparative ease.²⁹³

Nils Christensen made a metal headjoint for a metal cylindrical bore piccolo with an enlarged bore toward the joint end, which was patent protected with U.S. Patent No. 1,376,004. Christensen claimed this patent facilitated the high notes. He also made a “new model” wood piccolo with a longer body, thicker tube, and conical bore right around the same time, claiming this model produced a tone like the old six-key piccolo.²⁹⁴ The piccolo in C (DCM 1280) was made by William Sherman Haynes in Boston in 1935. This conical piccolo in

²⁹² Ibid.

²⁹³ Anthony Baines, *Woodwind Instruments and Their History* (New York: Dover Publications, Inc., 1991), 57.

²⁹⁴ Berdahl, Susan Marie Beagle, “The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers” (Ph.D. diss., University of Minnesota, 1985), 185.

two sections has a Boehm system, a closed G-sharp key, and was made specifically for the Dayton C. Miller Flute Collection.²⁹⁵

Silver (1926)

In 1926 Verne Q. Powell started his own company and sold a number of wood piccolos with silver headjoints. By 1932 the Haynes-Schwelm Company offered the same combination in their catalogue. This practice ended the controversy over the best material: wood or silver. In 1915 C. G. Conn, Ltd., made an ebonite headjoint for a metal body, but this was relatively short lived.²⁹⁶

Lip Plate

Many flutists preferred piccolos with lip plates to make the transition from each instrument as effortless as possible. DCM 0126 piccolo in C and D-flat was made by Nicholas Alberti in Chicago c.1914. This silver piccolo in two sections has a Boehm system with the Alberti patented tone hole system to permit half-step pitch changes.²⁹⁷

Transposable Piccolo

Alberti's piccolo mentioned above is a transposable piccolo. In 1914 Alberti secured a British patent for a transposable piccolo, from C to D-flat, which had oblong keys. The thin metal tube measures slightly longer than the body and contains a series of tone holes, which are permanently attached to the headjoint.

When fitted inside the body of the piccolo and pushed in completely, the

²⁹⁵ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

²⁹⁶ Berdahl, Susan Marie Beagle, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 186.

²⁹⁷ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

instrument plays in the key of C. When pulled out, the instrument plays in D-flat.²⁹⁸

Rubber Barrel

Makers like Hawkes also experimented with rubber barrels. DCM 0465 piccolo in E-flat was made in London c.1905. This grenadilla piccolo has six nickel-silver keys and ferrules with modern-style key cups, a metal-lined headjoint with a tuning slide, post and rod, and two sections.²⁹⁹

BODY AND MECHANISM

D-flat Piccolo

The piccolo played a major role in the evolution of the modern wind band.³⁰⁰ In the United States into the 1930s the C piccolo was made by manufacturers for orchestral use, and the D-flat piccolo was made for band use.³⁰¹ In the late 1920s, George Bundy of Selmer Company wrote that although he thought more D-flat piccolos were being sold, the attention was being given by the manufacturers to the C piccolo:

Some professionals will deem it strange that more D-flat piccolos are sold than C piccolos. Of course this is rather unusual, inasmuch as the professional man will generally transpose D-flat parts and use his C instrument anyway. It is also undeniable that C piccolos have been perfected far more than the D-flat instrument. This may be attributed to several causes,--one of them being that possibly the

²⁹⁸ Therese M. Wacker, "The History of the Piccolo, from Fifes to Intricate Keys," *Instrumentalist* 56, no. 4 (November 2001): 40.

²⁹⁹ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

³⁰⁰ Nancy Nourse, "The Piccolo: An Overview of its History and Instruction" (master's thesis, State University of New York at Potsdam, 1981), 69.

³⁰¹ Susan Marie Beagle Berdahl, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 191.

buyer of the D-flat piccolo is not as particular as one who ordinarily buys the C instrument.³⁰²

A-flat Piccolo

There are several pieces in the symphonic and operatic repertoire, such as the Mahler symphonies and Britten's *Billy Budd* (1951), which include parts written down to C1. In these special cases an A-flat piccolo would allow the extension of the lower range.³⁰³ These instruments along with other "miniature" flutes were used mainly in the military band and were considered flutes because they had footjoints.³⁰⁴ In 1918 the Haynes Company produced twenty-two A-flat piccolos for the Army Field Band in Washington, D.C. Out of these twenty-two instruments, only a few are in existence today. One is in the possession of Jan Gippo, piccoloist of the St. Louis Symphony, and another is owned by Lillian Burkart, owner of Burkart Flutes and Piccolos in Boston, MA.³⁰⁵

From about 1917 to 1927, the William S. Haynes Company manufactured an A-flat piccolo for military bands to play parts originally for fifes and bugles.³⁰⁶ Since the pitch is the same as the fife, this piccolo may be considered to be a Boehm system fife.³⁰⁷ The instrument had a conical bore and was made in both wood and silver in two joints, with B-flat being the lowest tone possible.

³⁰² Ibid., 192.

³⁰³ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 31.

³⁰⁴ Ibid., 31.

³⁰⁵ Ibid., 31.

³⁰⁶ Susan Marie Beagle Berdahl, "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers" (Ph.D. diss., University of Minnesota, 1985), 192.

³⁰⁷ Ibid., 192-193.

Two-Piece Piccolo (1948)

As a soloist in England's Royal Air Force Band in 1948, Murray decided to develop another modification for the Boehm piccolo and flute. He first applied this modification to the flute with the help of a flutist and mathematician, Elmer Cole, and flutist, Albert Cooper.³⁰⁸ By 1972 the Armstrong Company produced six piccolos made in two pieces with Murray's design.³⁰⁹

Key Work

According to James Keefe, "The mechanical aspect of the key work starts with a well planned design which, when properly constructed, will result in an instrument that is both reliable and comfortable to play." The keys must fit the player's hands and be designed in a way that the keys work well together. The size limitation of the piccolo can be a problem, because the maker has to avoid "end play," or motion between the posts and "side play," or looseness on the steel axle while allowing the mechanism to move freely. The adjustments between the keys must be secure so the pads will seal perfectly, and accurate adjustments of spring tension are critical for a responsive, even feel to the keys. In order to resist water damage on keys below the water line, such as the trill, thumb, and the G-sharp key, makers started using cork pads.³¹⁰

³⁰⁸ Therese M. Wacker, "The History of the Piccolo," in *The Complete Piccolo* by Jan Gippo (King of Prussia, PA: Theodore Presser Company, 1996), 30.

³⁰⁹ *Ibid.*, 30.

³¹⁰ James Keefe, "Piccolo Making at Brannen Brothers," *The Piccolo Society, Inc.* 7, no. 2 (May 1985): 6.

Cooper Scale

After working for Rudall Carte and Company for twenty years, Albert Cooper³¹¹ decided to establish himself as a flutemaker.³¹² About 150 years after Boehm's 1847 model, Albert Cooper made improvements to the scale that makers continue to use today in response to rising pitch.³¹³ To design the Cooper Scale and improve intonation problems, Cooper used his mathematical and mechanical knowledge and based all calculations on string lengths and vibrations.³¹⁴ Since he is not a flutist himself, he had to consult many noted players for guidance.³¹⁵

According to Graef,

While employed at Rudall Carte, Cooper noticed that tone hole sizes and positions varied amongst different flute brands, and he recorded these measurements, carefully combining them to reach a hoped for compromise. He made approximately ten flutes based on these calculations, but the result was not successful. Cooper started over, but this time based his scale on mathematical calculations. Over several years of slight alterations, his scale was finally perfected in 1973.³¹⁶

Although not immediately accepted, Powell Flutes, Inc., adopted the Cooper Scale in 1975 and Brannen Brothers Flutemakers Inc., followed in 1978.³¹⁷

³¹¹ Albert Cooper (b. 1924) is a British flutemaker who began his career as an apprentice at Rudall Carte. His primary contribution to flute making is the Albert Cooper Scale, where the positions and size or opening of the flute and piccolo's tone holes have been accurately determined. This scale has been universally adopted and is promoted by all major flutemakers, especially by Brannen Brothers. This new scale replaces the old Boehm System scale.

³¹² Albert Cooper, *The Flute* (London: Albert Cooper, 1980), 1.

³¹³ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2004): 18.

³¹⁴ *Ibid.*, 19.

³¹⁵ *Ibid.*, 18.

³¹⁶ *Ibid.*, 19.

³¹⁷ *Ibid.*, 20.

Bickford Brannen Design (1977)

In 1977 Bickford Brannen³¹⁸ designed a piccolo with a new look based on the measurements of Powell's old piccolos. In this new design, substantial mechanical and acoustical improvements were made. Brannen lengthened the thumb key bearing and the G key to allow the cork to contact the body rather than the G-sharp post and made the ribs more rigid by increasing their size and by adding several rib screws in critical locations. This piccolo had thin walls and the headjoint was made with a raised lip plate. It had a brighter sound and was popular with orchestral players in Europe and Japan. In the United States it gained popularity from doublers because of the lip plate.³¹⁹

Brannen Brothers Piccolo (1978)

By 1978 the Brannen brothers stopped producing piccolos for Powell and began making piccolos under their own name. They made thick- and thin-wall piccolos, new key lever patterns, pad cup and finger button dies, and post form tools.³²⁰

Straubinger Pads

It is very important that the pads totally cover the tone hole interface with the lightest touch for the most expressive playing. Poor intonation, uneven tonal

³¹⁸ Bickford Brannen began his flute-making career as an apprentice of the original Powell shop in Boston, MA in 1962, then in the Heritage Department of W.T. Armstrong in Elkhart, IN. In 1970 he returned to Powell as General Manager and in 1974 while still working for Powell, Brannen and his brother Robert co-founded Brannen Brothers Flutemakers, Inc., to produce conical Boehm flutes and piccolos. By 1978 they began making the well-known Brannen-Cooper flute. He has successfully collaborated with Albert Cooper, Johan Brögger, David Straubinger, Eva Kingma, Robert Dick, and many others leading to several successful products.

³¹⁹ James Keefe, "Piccolo Making at Brannen Brothers," *The Piccolo Society, Inc.* 7, no. 2 (May 1985): 1.

³²⁰ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

response, reduced dynamic range, and loss of tonal flexibility will occur with slight leaks caused by instability of the pad. In time, conventional felt piccolo pads will no longer cover the toneholes as they should due to dimensional instability.³²¹ Straubinger pads are designed specifically for handmade instruments. The pad cup is designed to keep the pad in place so the pad will come down on the tone hole in the exact same place each time. The pad cup also connects the cups to their appropriate companion key or keys. The stabilizer is placed inside of the pad cup to give the pad a firm and flat base to rest on. Shims and washers are placed on top of the stabilizer to make it possible for one portion of the pad to protrude more than another if necessary. Next, a pad support cushion, two skins, a washer, and a screw are added to the key cup to complete the pad.

In the late 1980s, David Straubinger began his search for a more stable piccolo pad. His ideas for the piccolo pad are an extension of the Straubinger Flute Pad.³²² He writes:

The Straubinger Piccolo Pad is designed specifically for the piccolo and its acoustical needs. The purpose of my search was to develop a pad that was stable dimensionally, had a somewhat soft feel, required little attention, and would seal with the lightest touch. In my judgment a properly adjusted pad is one that when touched to the tone hole, and before any compression of the cushion, the pad face will be touching around the entire rim of the tone hole. The search was for a pad that could be adjusted precisely and one that would hold those adjustments.³²³

³²¹ Philip Hammig, "Piccolo Models," Philip Hammig Piccolos, <http://www.hammig.com/> (accessed April 12, 2010).

³²² Ibid.

³²³ Ibid.

Open and Closed G-sharp Keys

The controversy between the open and closed G-sharp keys continued into the twentieth century. The open G-sharp key is popular in the former Soviet Union, Israel, Germany, Australia, and is popular with some American flutists, such as Clement Barone, Hubert Laws, Victor Just, and Fernando Morrone.³²⁴ English flutists Geoffrey Gilbert, William Bennett, Alexander Murray, Gareth Morris, and Simon Hunt also use the open G-sharp key.³²⁵ However, most performers seem to prefer the closed G-sharp key. DCM 0055 in Figure 4.1 is a piccolo in C by Louis Lot from the twentieth century. This conical cocus piccolo in two pieces uses the Boehm system, closed G-sharp key, silver-plated keys and ferrules, four ring keys, post and rod with modern-style key cups on ribs, and has two headjoints for high and low pitch.³²⁶



Figure 4.1. DCM 0055: Louis Lot, Piccolo in C, Twentieth Century

Note Facilitators

Although there are four note facilitators available to help with flute intonation, split-E, split-F-sharp, high C facilitator, and the footjoint lever, only

³²⁴ Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 8-9.

³²⁵ *Ibid.*, 9.

³²⁶ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

one of these note facilitators has been added to the modern piccolo: the split-E mechanism.³²⁷ On the flute and piccolo, E3 has a tendency to be too sharp in pitch and the sound tends to be weak and unclear since the closed G-sharp key was reinstated. This mechanism, an idea first created by Boehm but never instated by him, makes E3 speak easily and allows the A and G-sharp keys to work independently.³²⁸ E3 did not cause these problems for the flutes with open G-sharp keys, so Boehm never needed to explore this option.³²⁹ With the assistance of Paul Taffanel, Djalma Julliot added the split-E mechanism to the closed G-sharp flutes in 1895. As explained by Carolyn Nussbaum in her 1994 thesis *The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847*:

When playing a closed G-sharp flute, the venting of the G-sharp hole is operated solely by the A hole; therefore, when playing E3, the G-sharp hole must be kept open. The ideal situation is to have the G-sharp hole closed and the A hole open. The necessity is to duplicate the action of the open G-sharp on a closed G-sharp flute. The split-E mechanism is connected with *R2*, which covers the G-sharp hole so that the A and G-sharp keys move separately. This allows the G-sharp plate to be closed by *R2* and *L3*, thus maintaining the Boehm fingering.³³⁰

G-sharp Mechanism

The high G-sharp mechanism eliminates the necessity to employ an alternate fingering when playing the high G-sharp. This innovative mechanism adjusts the venting height of both thumb keys and when the G-sharp lever is

³²⁷ Carolyn Nussbaum, “The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847” (master’s thesis, University of North Texas, 1994), 13.

³²⁸ *Ibid.*, 13.

³²⁹ *Ibid.*, 13.

³³⁰ *Ibid.*, 13.

pressed, increasing the clarity and stability of high G-sharp. The G-sharp mechanism is included on Hammig piccolo models 650/3, 650/4, and 651/4.³³¹

Plateau Keys

On the modern piccolo, only one type of key structure is available, known as plateau keys, or the closed, American style. Like the plateau keys used on some modern flutes, the piccolo plateau keys have a solid surface.³³² Unlike the flute, the piccolo currently does not have the option for the perforated key system. This open, French style has five keys with open centers for *L2*, *L3*, *R1*, *R2*, and *R3*. If this system were introduced to the piccolo, adjustments would have to be made to the piccolo for extra venting of the perforated keys. This venting would allow flat notes to be brought up to the appropriate pitch and would create many opportunities for avant-garde composers to write extended techniques for the piccolo, including quarter-tones, multiphonics, and glissandos.³³³ Although plateau keys are more convenient for a person with smaller hands, the perforated keys help enforce proper hand position and, therefore, better technique.³³⁴

Open-Hole Quartertone Piccolo

In 1992 at the National Flute Association Convention, University of California at San Diego faculty member John Fonville approached flutemakers with an idea for an open-hole quartertone piccolo. Fonville felt there was potential in experimenting with an open-hole piccolo with two additional quartertone keys. According to Fonville perfect quartertones could be produced if

³³¹ Philip Hammig, "Piccolo Models," Philip Hammig Piccolos, <http://www.hammig.com/> (accessed April 12, 2010).

³³² Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 17.

³³³ *Ibid.*, 18.

³³⁴ *Ibid.*, 19.

holes were cut directly through the cork pad. His invention would allow the addition of twentieth century extended techniques to the piccolo repertoire, such as microtonal effects and glissandi.³³⁵

Because Boehm perfected and expanded upon existing key mechanisms that allowed players to open and close multiple keys by transferring motion to distant keys through axles and rods, modern flutes can now operate twenty-two keys with just nine fingers. Modern flutemakers have continued to develop these ideas by adding more keys and mechanisms, such as the Kingma system flute produced by Brannen Brothers, which can play a complete quartertone scale and a full range of extended techniques, as well as the standard Boehm fingerings. Flute construction continues to reflect the demands of composers as it did in the past.³³⁶

Although Fonville's open-hole piccolo has an interesting design and would provide twentieth century composers and performers with unique repertoire possibilities, flutemakers have not applied this design to their piccolos to date.

Tube Extensions

Through the years makers have experimented with other fingering systems, even though the Boehm system piccolo is most in use today. Chicago maker Nicholas Alberti made a transposable piccolo from C to D-flat with a British patent in 1914. Alberti's piccolo appears to be the same as the Boehm system externally, but it has oblong keys and a thin metal tube permanently attached to the headjoint. Slightly longer than the body of the piccolo, this metal tube contains all the holes of the normal Boehm piccolo and an extra hole. The manipulation of the tube and headjoint changes the placement of air by changing the oblong shape of the keyholes. When the headjoint and tube are pushed in the

³³⁵ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 30.

³³⁶ Sandra Graef, "Boehm and Cooper Invented Enduring Flute Improvements," *Flute Talk* 23, no. 10 (July/August 2000): 19.

piccolo is pitched in D-flat, and when they are pulled out the piccolo is pitched in C.³³⁷

Low C Foot

Haynes made another piccolo with a low C foot between 1917 and 1938. This silver piccolo was pictured in the Haynes Company catalogues from 1917 to 1919, although the ledger does not show record of this piccolo. William S. Haynes, Jr. verified the existence of this instrument in 1938.³³⁸

Old System

In some cases old system piccolos were still made in the twentieth century. An anonymous piccolo in C was made at the turn of the twentieth century with a simple system (DCM 0056). It has six nickel-silver keys and ferrules (twelve keys with the principal rank fingerholes covered with keys), post and rod with modern-style key cups, two sections, and a tuning slide in the headjoint. This conical piccolo is made of a dark wood that has been lacquered.³³⁹ The piccolo in C in Figure 4.2 DCM 0116 was made by Emil Rittershausen c.1908-1921. This grenadilla, cylindrical piccolo uses the old system and has a nickel-silver cap, twelve nickel keys with modern-style key cups (six covering the principal rank fingerholes), and ferrules. It also has post and rod, mounted ribs, two sections, and a tuning slide in the head.³⁴⁰

³³⁷ Therese M. Wacker, "The Piccolo in the Chamber Music of the Twentieth Century: An Annotated Bibliography of Selected Works" (D.M.A. diss, The Ohio State University, 2000), 30.

³³⁸ *Ibid.*, 190.

³³⁹ Dayton C. Miller Flute Collection, "Piccolo," Library of Congress, <http://memory.loc.gov/ammem/dcmhtml/dmhome.html> (accessed May 1, 2010).

³⁴⁰ *Ibid.*



Figure 4.2. DCM 0116: Emil Rittershausen, Piccolo in C, c.1908-1921

Combination System (Old and Boehm)

The old system and Boehm system were still combined on occasion during the twentieth century. DCM 0312 piccolo in C was made by Alfredo Casoli in Milan c.1906-1926. This piccolo uses the old system of fingering, but imitates the Boehm system. Most of the key work is mounted on ribs in two extended parallel rod systems looking not unlike a Boehm or other modern system piccolo mechanism. This rosewood piccolo is in two sections and has silver keys and ferrules.³⁴¹

C-sharp Trill Key

The C-sharp trill key is an optional key that was first added to the piccolo in 1863 by Louis Lot. In 1909 it received a patent by Mme. Cornélie Villedieu Laubé in France.³⁴² The C-sharp trill key is located between the small D/D-sharp trill keys and the thumb keys and is controlled with a side lever by *RI*. The additional trill key simplifies several trill combinations and provides an additional trill for G³/A³ by combining it with the C/D trill lever.³⁴³ Although this key is not usually found on modern piccolos, one American maker, James Keefe, has

³⁴¹ Ibid.

³⁴² Carolyn Nussbaum, "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847" (master's thesis, University of North Texas, 1994), 11.

³⁴³ Ibid., 11-12.

revived this key for the piccolo. Keefe and his C-sharp trill key are discussed in further detail in Chapter 5.

Rubber Inserts (c.1985)

Because makers worry about the wood cracking while drilling holes in piccolos, many have started gluing rubber inserts into the body where the tone holes are subsequently cut. A one-piece wood body is superior, but using rubber inserts can result in good pad seats too. However, rubber inserts could fall out when the wood expands in the humid summer months and contracts in the dry winter months. With a completely wood piccolo, there is never a danger of tone holes leaking or rubber inserts falling out because the instrument swells and shrinks as one unit.³⁴⁴

³⁴⁴ James Keefe, "Piccolo Making at Brannen Brothers," *The Piccolo Society, Inc.* 7, no. 2 (May 1985): 6.

CHAPTER V. CONCLUSION

Piccolos Today

Today the United States has surpassed Europe and houses the leading flute and piccolo makers in the world. Many of these makers also specialize in the design and continued development of the piccolo.

Burkart Piccolos

In order to craft Burkart piccolos, Boston maker Lillian Burkart³⁴⁵ selects the world's finest African grenadilla. After the wood is selected it is aged, cured, turned, and drilled. Once the wood is properly treated it has acoustical warmth, stability, and proper hardness and density. Key work, ribs, and posts are made of solid sterling silver or 14-karat gold. The precision and craftsmanship ensure stability, longevity, and low maintenance.³⁴⁶ The ergonomic mechanism consists of a slightly offset G, subtle modifications to the right hand and the D-sharp lever position, and new engineering of the thumb keys. These modifications aid comfort and technical facility for players with all hand sizes.³⁴⁷

All Burkart piccolos come with a split-E mechanism that can be disengaged for the G3 to A3 trill. The high G-sharp facilitator is activated when the player fingers a G-sharp3 and eliminates the need for two right-hand fingers

³⁴⁵ Burkart-Phelan, Inc. was founded in 1982 in Boston, MA by Lillian Burkart and James Phelan while they were both employees of the Verne Q. Powell Company. The company was originally founded to provide outside subcontract services to Powell for the manufacture of piccolos.

³⁴⁶ Burkart-Phelan, Inc., "Burkart Piccolos," Burkart Flutes & Piccolos, <http://www.burkart.com/picbroch.htm?sid=0001SVPOda8OKjISS00E6t7> (accessed April 12, 2010).

³⁴⁷ Ibid.

while producing high G-sharp. However, it does not inhibit the production of C4.³⁴⁸

In 2007, Lillian Burkart developed a piccolo scale that improved intonation without compromising the full, flute-like sound of her piccolos by modifying tone holes and the bore. D1 is no longer flat, D2 is no longer sharp, G2 is no longer sharp, and the intonation of B2, C-sharp2, and D3 were improved. The lower register is more resonant, and F-sharp3 and B3 speak more easily. The updated scale was showcased at the 2007 National Flute Association Convention and received many compliments.³⁴⁹ Straubinger pads are standard on Burkart piccolos. However, cork pads are still used for trill keys and the G-sharp key.

Burkart piccolos come in several model choices. The Custom Model is a handmade model with traditional Y-shaped arms attaching the key cups of all keys. The Deluxe Model is another handmade model made with French-style pointed arms attaching the key cups to all closed hole keys.³⁵⁰ Burkart offers several different headjoint styles, and Lillian Burkart oversees all headjoint cuts. The Modified Wave headjoint has a lower back wall where the chin rests and a slightly higher front wall or blowing edge. This style offers a rich, clean, projecting tone with easy dynamic control, focused low register, and excellent articulation. The Burkart Model headjoint has slightly overcut sides and a rectangular shape for an open, “flute-like” sound and extreme dynamic and color fluctuation. The Clarion Model headjoint has a relatively small embouchure hole,

³⁴⁸ Ibid.

³⁴⁹ Ibid.

³⁵⁰ Ibid.

rounded edges, and is reminiscent of early French and German piccolos.³⁵¹ The gold piccolo headjoint is available in one custom style, has a dark and mellow sound, and articulates like the flute.³⁵²

To celebrate the twenty-fifth anniversary of the Burkart Flute and Piccolo Company, Lillian Burkart built the limited edition Lillian Burkart Piccolo the XXV. The piccolos and headjoints are made from fifty year-old grenadilla from Burkart's personal collection. The Lillian Burkart Piccolo-the XXV featured in Figure 5.1 is a deluxe model with an engraved headjoint, the new 2007 scale, and a G-sharp facilitator.



Figure 5.1. Lillian Burkart Limited Edition XXV Piccolo in C

Burkart and Phelan Piccolos

Lillian Burkart and James Phelan also use grenadilla for their Burkart and Phelan piccolos. These instruments are also professionally made piccolos with the Burkart scale, acoustically engineered tone holes, a conical bore, sterling silver keys, gold springs, and quality “SOUND” pads, which are custom made for Burkart and Phelan piccolos. The split-E mechanism can be added at an additional charge for enhancement of the response of E3. The Standard headjoint

³⁵¹ Ibid.

³⁵² Ibid.

is commonly sold with the Burkart and Phelan piccolos, but the wave style and precious metal headjoints can be substituted at an additional charge.³⁵³

Hammig Piccolos

Handmade piccolos of superior design have been made in the Philipp Hammig³⁵⁴ workshop for over 200 years. Hammig piccolos are offered in the standard pitch of A=442, but other tunings are available by special order. The Hammig Scale reveals balance in intonation and an easy response in all registers of the piccolo. Straubinger pads and the split-E mechanism are standard on all Hammig piccolos. The Hammig Cut headjoint is resistant for color and a powerful sound with depth and projection in all registers. The Modified Wave headjoint offers a focused, rich sound, and a wide dynamic range. The Modified Wave Thin headjoint has thinner walls than the Modified Wave headjoint with a raised embouchure plate. This allows for stability, clarity, and flexibility.³⁵⁵

Hammig piccolos are currently available in three models. The 650/2 and 650/3 Models have a mechanism constructed of nickel-silver heavily coated with pure silver. The mechanism of the 650/4 is made of solid sterling silver. All models come standard with the split-E mechanism and French style pointed arms attaching the trill, G-sharp and D-sharp keys. Additionally, all models with the exception of the 650/2 Model, feature a G-sharp3 mechanism to enhance the

³⁵³ Ibid.

³⁵⁴ The Hammig family legacy of woodwind instruments began c.1780. The tradition began with Christian Gottlob Hammig (1759-1836) in Markneukirchen, Germany where he made flutes, piccolos, clarinets, and oboes. In the early 1900s the family business was left in the hands of Phillip Hammig. Today Miyazawa Flutes does all of the marketing for Phillip Hammig piccolos in the United States.

³⁵⁵ Philip Hammig, "Piccolo Models," Philip Hammig Piccolos, <http://www.hammig.com/> (accessed April 12, 2010).

production of this note.³⁵⁶ Model 650/2 has a mechanism constructed of nickel-silver that is heavily coated with pure silver, Straubinger pads, and is handmade with grenadilla. Headjoint options include Hammig Cut, Modified Wave, and Modified Wave Thin.³⁵⁷

The mechanism of Model 650/3 is also constructed of nickel-silver and heavily coated with pure silver. This model is handmade with grenadilla, uses Straubinger pads, has the same headjoint options, and features the G-sharp and split-E mechanisms.³⁵⁸ Model 650/4 has the same headjoint options, Straubinger pads, is handmade of grenadilla, and features a solid sterling silver mechanism with the G-sharp and split-E mechanisms. As Figure 5.2 shows, this piccolo can also be made from cocus wood.³⁵⁹



Figure 5.2. Philipp Hammig Piccolo in C

Keefe Piccolos

Keefe Piccolos³⁶⁰ are made in both grenadilla and Caribbean cocus wood (Brya ebenus), which is carefully selected for the best acoustical and mechanical

³⁵⁶ Philip Hammig, "Piccolo Models," Philip Hammig Piccolos, <http://www.hammig.com/> (accessed April 12, 2010).

³⁵⁷ Ibid.

³⁵⁸ Ibid.

³⁵⁹ Ibid.

³⁶⁰ Like many of the finest flute and piccolo makers in the United States, the Keefe Piccolo Company is located in Boston, MA. James Keefe began his piccolomaking career at Brannen Brothers in 1978. Keefe has made several innovations in headjoint and mechanical design,

foundation. Both woods are fine grain and resistant to moisture to avoid cracking. Grenadilla produces a rich, dark sound while cocus is considered more resonant and slightly brighter in tone.³⁶¹

Keefe piccolos are built with a bridged mechanism to reduce friction and maintenance. This is a pinless mechanism for main-line keys that uses bridge rods to transfer motion between the keys. Keefe piccolos also come equipped with a C-sharp trill mechanism (U.S. Patent 7,394,007B2), as Figure 5.3 demonstrates, for trill simplicity of all standard trills found on the flute, including the G3/A3 trill.³⁶² The C-sharp trill is one of the most useful options on the flute, producing at least six trills that are otherwise awkward and out of tune. On the conical piccolo, the high G/A trill is nearly impossible because the normal flute trill fingerings do not produce a true A and the only fingering that does produce a true A is too awkward for most players. Keefe's C-sharp trill has become very popular as it produces all of the flute trills and several more. According to James Keefe,

Until now, when asked to trill high G to A, piccolo players have had the option of choosing from a number of problematic fingerings, or simply trilling from G to G-sharp. To produce the G/A trill, we have added a key that allows the player to trill the G-Sharp key in combination with the C-sharp trill key (this G-sharp trill key is operated by *RI*). Trilling the G-sharp/C-sharp trill mechanism in combination with the upper trill key produces a true G/A trill.³⁶³

including the C-sharp trill key. He has dedicated his career to meeting the needs of piccolo players today.

³⁶¹ Keefe Piccolo Company, "Keefe Piccolos," Keefe Piccolo Company, <http://www.keefepiccolo.com/> (accessed April 12, 2010).

³⁶² Ibid.

³⁶³ Ibid.



Figure 5.3. James Keefe Piccolo in C

For players who wish to improve the response of the high E, the split-E mechanism and the split-E insert in the tone hole under the lower G key are both available. Well over half of the performers who purchase Keefe piccolos request the split-E mechanism option, which restores the correct venting on the closed G-sharp piccolo to venting that Boehm originally designed for the flute with the open G-sharp key. In order to improve response of the high G-sharp without the addition of the second and third fingers of the right hand, the high G-sharp facilitator, also known as the half-closing thumb key can be added. On the keys below the water line, such as the trill keys, thumb key, and G-sharp key, cork pads are always used, but the main-line keys are padded with felt. Cork padding on the main-line keys is also available as an option.³⁶⁴

Keefe piccolos also come with a Brossa F-sharp key, which allows one to close the F-sharp key independently of the other right hand keys. It consists of a small touch piece that is located to the right of the D key and is operated by *R3*. Its principal use is to avoid cross fingerings in the right hand. For example, when slurring E to F-sharp to G, instead of lifting *R1* and *R2* while closing *R3*, one could play the E with *R1* and *R2* plus *R3* on the Brossa F-sharp. To slur from E to

³⁶⁴ Ibid.

F-sharp, *R1* and *R2* would then be raised while keeping the Brossa F-sharp depressed. *R3* would then be raised to slur from F-sharp to G. Some players also find the Brossa F-sharp useful for improving the response of the high F-sharp.

Choosing the right headjoint is really important because the headjoint is the heart of the instrument. Keefe encourages his customers to try multiple headjoints before purchasing their piccolo, and he gives customers one year to exchange their headjoint if they so choose. Keefe headjoints are also available in a variety styles including the traditional, which provides a rich, dark, and focused sound; the modern with a sharper blowing edge providing a quicker response and a dark sound; the classic with the larger embouchure hole that produces more resistance and the darkest sound; and finally the custom, which allows the makers to work with the players to make headjoints to other specifications when the designs Keefe normally offers do not meet their needs.³⁶⁵

Powell Piccolos

While the orchestral repertoire makes many demands on the piccolo, the players depend on instruments to confidently produce a strong, colorful sound that is in tune on the high note of Dmitri Shostakovich's (1906-1975) Symphony No. 8 (1943) while projecting in the low passages of Maurice Ravel's (1875-1937) Mother Goose Suite (1908-1911). Powell piccolos produce a dark, lyrical tone that makes the instrument sound like an extension of the flute.³⁶⁶

Powell's handmade piccolos are available in two choices of wood and two choices of precious metal work. Powell uses grenadilla or kingwood from Brazil

³⁶⁵ Ibid.

³⁶⁶ Powell Flutes, Inc., "Piccolos," Powell Piccolos, http://www.powellflutes.com/ftree/ftree_t2/ftree_3/ftree_t3_pic.html (accessed April 12, 2010).

for the body and sterling silver or 9-karat rosegold for the mechanism, which comes with the split-E mechanism. The headjoints are traditional with a profiled embouchure where the lip plate is carved from the wood and a wave embouchure can also be ordered.³⁶⁷

The new signature piccolo features aged grendilla for the body and headjoint, the Powell scale, sterling silver mechanism and rings, conical bore, tone hole undercutting by hand to enhance ease of playing and resonance, Pisoni Star Pads, and is pitched at A=442. The split-E mechanism is available at an additional cost and there is a choice between the classical- and wave-style headjoint.³⁶⁸

Further Research

As piccolo makers strive for new technical advances, the composer increases demand on the piccolo and the performer. While new models for the piccolo were introduced, old models continued to be used and written about in treatises, catalogues, and tutors for many years. As long as instruments were being purchased, makers would include these models in their catalogues and continue to produce all systems of piccolos and flutes to meet and satisfy the demands of all of their customers.³⁶⁹ While comparing the development of the piccolo with the development of the flute, it can be noted that the physical introduction of a particular model piccolo lagged significantly behind the

³⁶⁷ Ibid.

³⁶⁸ Ibid.

³⁶⁹ Zartouri Dombourian-Eby, "The Piccolo in the 19th Century" (D.M. diss, Northwestern University, 1987), 393.

introduction of the same model flute. Since it took composers, treatises, and method books years to accept and utilize each new instrument, the gap between the development of the flute and piccolo continued to grow.³⁷⁰

As the piccolo continues to flourish as a solo instrument and a significant component of the orchestral repertoire, this document should lead to further research in regard to the piccolo. There are several topics relating to the piccolo yet to be explored, such as a social history of the piccolo, a survey of solo literature, chamber literature or opera literature, the use of the small transverse flute in iconography, and continued study of instrument makers. The piccolo is a beautiful instrument, and hopefully this document will encourage research and study in these other areas.

³⁷⁰ Ibid., 398.

BIBLIOGRAPHY

Journal Articles

Journal Articles Pertaining to the Piccolo

- Baasch, Robert. "The D-flat and C Piccolos." *Woodwind World* (April 1959): 9-10.
- Beard, Christine Erlander. "Piccolo Discography, Part I." *Flute Talk* (April 2006).
- _____. "Piccolo Discography, Part II." *Flute Talk* (May/June 2006).
- Brown, Carol. "Piccolo Solos." *Instrumentalist* (1976): 50-3.
- Burkart, Lillian and James Phelan. "New Powell Piccolos As Fine As Ever." *The Piccolo Society, Inc.* 7, no. 1 (December 1984): 1-4.
- Coltman, John W. "Some Observations on the Piccolo." *Flutist Quarterly* 26, no. 1 (Winter 1991): 17-18.
- Dombourian-Eby, Zartouri. "A History of the Piccolo." [A brief summary of her doctoral dissertation.] *Flutist Quarterly* 26, no. 1 (Winter 1991): 13-16.
- Ellis, Cynthia. "Sticks, Swabs, and Piccolo Bores." *Flute Talk* 25, no. 6 (February 2006): 20-21.
- Forbes, Elizabeth. "Piccolo," ed. Stanley Sadie, *New Grove Dictionary of Musical Instruments* 3 (1985): 111.
- Gilman, Irving E. "The Piccolo: Knowing Its Problems and Choosing a Good Instrument." *Woodwind Anthology* (December 1959): 65-66.
- Gippo, Jan. "Let's Talk Picc: The Piccolo, Then and Now." *Flute Talk* 18 (December 1998): 31-32.
- Higbee, Dale. "Michel Corrette on the Piccolo and Speculations Regarding Vivaldi's 'Flautino'." *Galpin Society Journal* 17 (1964): 115-6.
- Hyman, Dick. "Piping Up for the Piccolo." *Ovation* 6 (November 1985): 8.
- Keefe, James. "Piccolo Making at Brannen Brothers." *The Piccolo Society, Inc.* 7, no. 2 (May 1985): 1-6.

- Kujala, Walfrid. "Stress and Strain Forever? Not with a D-flat Piccolo." *Woodwind Anthology* (June 1972): 172-173.
- "Maryland Senator Boosts Piccolos." *Music Trades* (July 1976): 36.
- Matthews, Haydn M. "Dangers and Difficulties of the Piccolo." *The Flutist* (May 1922): 689-90.
- Nourse, Nancy. "The Piccolo: Examining The Footnotes." *Flutist Quarterly* 11, no. 2 (Spring 1990): 47-49.
- Rathburn, Helen. "PICCOLODEON plays NYC." *The Piccolo Society, Inc.* 7, no. 1 (December 1984): 1.
- Smith, Jan. "A Dozen Reasons for Piccolo Playing." *Flute Talk* 11, no. 1 (September 1991): 31-32.
- Stoddard, H.E. "Flute and Piccolo in our Orchestra." *International Musician* (June 1950): 20-21.
- Stolper, Mary. "Practice Tips for the Piccolo." *The Flutist's Handbook: A Pedagogy Anthology* Santa Clarita, CA: The National Flute Association, Inc., 1998.
- Taylor, Laurence. "Approach to the Piccolo: Part I." *Instrumentalist* (December 1955): 24-25.
- _____. "Approach to the Piccolo: Part II." *Instrumentalist* (January 1956): 25-26.
- _____. "Approach to the Piccolo: Part III." *Instrumentalist* (February 1956): 26-27.
- _____. "Flute and Piccolo Solos with Band." Part I. *Instrumentalist* (May 1965): 69-70.
- _____. "Flute and Piccolo Solos with Band." Part II. *Instrumentalist* (June 1965): 78-80.
- _____. "The Piccolo: A Problem of Pitch." *Woodwind Anthology* (January-February 1952): 9.
- _____. "The Piccolo and I." *Music Journal* (November 1954): 15 and 43.
- _____. "Practical Information About the Piccolo." *Woodwind Anthology* (October 1951): 8-9.

- Trott, Laurence. *Some Helpful Thoughts*. (unpublished article.) 1981.
- _____. "On the Cover..." *Woodwind World-Brass and Percussion* 19 (May-June 1980): 2.
- _____. "Why Not the Piccolo?" *Woodwind World-Brass and Percussion* 19 (May-June 1980): 17-19.
- Wacker, Therese M. "The History of the Piccolo, from Fifes to Intricate Keys." *Flute Talk* (May/June 2001): 8-15.
- _____. "The History of the Piccolo, from Fifes to Intricate Keys." *Instrumentalist* 56, no. 4 (November 2001): 36-78.
- Watterson, Thomas. "Piccolo-nial bicentennial." *The Christian Science Monitor* (May 17, 1976): 2.

Journal Articles Pertaining to the Flute

- Addington, Christopher. "In Search of the Baroque Flute: The Flute Family 1680-1750." *Early Music* 12, no. 1 (February 1984): 34-47.
- Anderson, Claudia. "The Flute in Early America." *Flute Talk* 25, no. 2 (October 2005): 22-25.
- Austin, Robert. "The Boston Flutemakers." *Flute Talk* 16, no. 1 (September 1996): 21-23.
- Baines, Anthony C. "Two Cassel Inventories." *Galpin Society Journal* 4 (1951): 30-8.
- Baines, Anthony C. and Harold C. Hind. "Military Band." *New Grove Dictionary of Music and Musicians* 12 (1980): 310-6.
- Baines, Anthony C., and Klaus P. Wachsmann. "Classification of Musical Instruments." *Galpin Society Journal* 14 (1961): 3-29.
- Bigio, Robert, and Michael Wright. "On Reaming Flutes." *Galpin Society Journal* 58 (2005): 51-57.
- Braun, Joachim. "Musical Instruments in Byzantine Illuminated Manuscripts." *Early Music* 8, no. 3 (July 1980): 312-29.
- Brown, Howard Mayer. "Flute." *New Grove Dictionary of Music and Musicians* 6 (1980): 664-81.

- Burnau, John. "The Life of Theobald Boehm." *Woodwind Anthology* (May 1967): 134-138.
- Byrne, Maurice. "Schuchart and the Extended Foot-Joint." *Galpin Society Journal* 18 (March 1965): 7-13.
- Carse, Adam. "The 'Adam Carse' Collection of Wind Instruments." *Galpin Society Journal* 2 (1949): 3-9.
- Caskey, L. D. "Archaeological Notes: Recent Acquisitions of the Museum of Fine Arts, Boston." *Archaeological Institute of America Bulletin* 41 (1937): 525-27.
- Cavally, Robert. "The Ideal Flute Tone." *Woodwind Anthology*. Evanston, IL: *The Instrumentalist*, 1972, 4-5.
- Cole, Robert. "Another Facet of Flute Playing." *Instrumentalist* (May 1972): 44-46.
- Coltman, John W. "Acoustics of the Flute." *Instrumentalist* (January 1972): 39.
- _____. "Observations on the High E." *Flutist Quarterly* 10 (Winter 1984): 7.
- _____. "A New C# for the Boehm Flute." *Instrumentalist* 31 (May 1977): 62-65.
- Cooper, Albert. "Split E or Split F Sharp?" *Pan, The Journal of the British Flute Society* 10 (1992): 8-9.
- Dehne-Niemann, Eberhard. "The Quantz Flute." *Traverso* 9, no. 4 (October 1997): 1-4.
- Eisen, Cliff and Stanley Sadie. "Wolfgang Amadeus Mozart," ed. Stanley Sadie, *New Grove Dictionary of Music and Musicians* 12 (1980): 680-752.
- Elson, Louis C. "The Orchestra Up-to Date." *The Flutist* (1921): 330.
- Galpin, Francis. "The Whistles and Reed Instruments of the American Indians of the North-West Coast." *Proceedings of the Musical Association* 29 (1903): 115-38.
- Giannini, Tula. "An Old Key for a New Flute: The Boehm Flute with Closed G#: Historical Perspectives." *Flutist Quarterly* 10 (Fall 1984): 15-20.
- Gippo, Jan. "Beethoven's Mistake." *Flute Talk* 13, no. 1 (September 1993): 31-32.

- Godwin, Joscelyn. "The Renaissance Flute." *Consort* 28 (1972): 70-81.
- Graef, Sandra. "Boehm and Cooper Invented Enduring Flute Improvements." *Flute Talk* 23, no. 10 (July/August 2004): 18-20.
- Halfpenny, Eric. "A Renaissance Bass Flute." *Galpin Society Journal* 23 (1970): 116.
- _____. "An Eighteenth-Century Trade List of Musical Instruments." *Galpin Society Journal* 17 (February 1964): 99-102.
- _____. "A French Commentary on Quantz." *Music and Letters* 37 (1956), 61-66.
- _____. "Two Rare Transverse Flutes." *Galpin Society Journal* 13 (1960): 38-43.
- Hellyer, Roger. "Harmoniemusik." *New Grove Dictionary of Music and Musicians* 8 (1980): 167-8.
- Hunter, Mary. "The Alla Turca Style in the late Eighteenth Century: Race and Gender in the Symphony and the Seraglio." *The Exotic in Western Music*, edited by Jonathan Bellman, 43-73. Boston: Northeastern University Press, 1998.
- Jicha, Victoria. "The Largest Flute Collection." *Flute Talk* 21, no. 10 (July/August 2002): 26-28.
- Karp, Cary. "Woodwind Instrument Bore Measurement." *Galpin Society Journal* 31 (1978): 9-31.
- Kirnbauer, Martin and Peter Thalheimer. "Jacob Denner (1681-1753): New Aspects of his Biography and his Importance for the History of the Flute in Germany." *Early Music*, forthcoming.
- Kozma, Tibor. "The Piccolo in Fledermaus." *Opera News*. New York: The Metropolitan Opera Guild (December 17, 1951): 28-9.
- Kramer, Lawrence. "The Harem Threshold: Turkish Music and Greek Love in Beethoven's Ode to Joy." *19th-Century Music* 22, no. 1 (Summer 1998): 78-90.
- Kujala, Walfrid. "Embellishment, Italian Style: Ornamenting the Large Movement of Vivaldi's C Major Piccolo Concerto." *Woodwind Anthology* (December 1976): 272-273.
- _____. "Evolutions in Flute Design." *Flute Talk* 21, no. 3 (November 2001): 6-7.

- _____. "The Murray Flute." *Woodwind Anthology* (November 1972): 178-181.
- Lambert, Johann Heinrich. "Observations sur les Flûtes." *Nouveaux Mémoires de L'Academie Royale*. Berlin: C.F. Voss, 1777.
- Landell, Jonathan. "Machines and Craftsmanship In Creating Handmade Flutes." *Flute Talk* 22, no. 3 (November 2002): 26.
- Lawrence, Eleanor. "Re-evaluating the G# Key: An Introduction." *Flutist Quarterly* 10 (Fall 1984): 6-9.
- _____. "Theobald Boehm on the Open G# Key." *Flutist Quarterly* 10 (Fall 1984): 7-9.
- _____. "Practically Speaking." *Flutist Quarterly* 10 (Fall 1984): 10-12.
- Lawrence, Eleanor, and Peter Schultz. "Facts and Figures on Open G# Flutes." *Flutist Quarterly* 10 (Fall 1984): 23.
- Lesure, François. "La Facture Instrumentale à Paris au Seizieme Siecle." *Galpin Society Journal* 7 (1954): 11-52.
- Lomas, Michael J. "Secular Civilian Amateur Wind Bands in Southern England in the Late Eighteenth and Early Nineteenth Centuries." *Galpin Society Journal* 45 (March 1992): 78-98.
- Marianiello, Linda. "Baroque and Historical Flutes: Peter Thalheimer at the Minneapolis Convention." *Flutist Quarterly* 16, no. 1 (Winter 1991): 45-47.
- Marvin, Bob. "Recorders and English Flutes in European Collections." *Galpin Society Journal* 25 (July 1972): 30-57.
- Meyland, Raymond and P. Hardouin. "Flûte." *Science de la Musique*. Edited by Marc Honegger. Paris, Bordas, 1976, 382-3.
- Millard, Robert E. "Making the Flute Indispensable." *The Flutist* (January 1923): 878-80.
- Minzloff, Oliver R. "Open G#? Gee Whiz!" *Flutist Quarterly* 10 (Fall 1984): 21-22.
- Mirimonde, A.P. de. "Les sujets musicaux chez Antoine Watteau." *Gazette des Beaux-Arts* 58, no. 6, 249-87.

- Montagu, Jeremy. "The Sound of Music." *The Consort* 36 (1980): 355-60.
- Montagu, Jeremy, and John Burton. "A Proposed New Classification System for Musical Instruments." *Ethnomusicology* 15, no. 1 (January 1971): 49-70.
- Moore, T.W. "Recent Developments in Flute Design." *Musical Opinion* (July 1953): 599.
- Powell, Ardal. "The Eichertopf Flute: the Earliest Surviving Four-joint Traverso?" *Tibia*, forthcoming.
- _____. "Science, Technology and the Art of Flutemaking in the Eighteenth Century." *Flutist Quarterly* 19, no. 3 (Spring 1994): 33-42.
- Powell, Ardal with David Lasocki. "Bach and the Flute: the Players, the Instruments, the Music." *Early Music*, forthcoming (August 1994).
- Puglisi, Filadelfio. "A Three-Piece Flute in Assisi." *Galpin Society Journal* 37 (March 1984): 6-9.
- "Questions and Answers." *The Flutist* (March 1921): 357.
- Selfridge-Field, Eleanor. "Vivaldi's esoteric instruments." *Early Music* 6, no. 3 (July 1978): 332-8.
- Sheldon, Robert E. "A Quantz Flute at the Library of Congress." Edited by Linda Marianiello. *Flutist Quarterly* 19, no. 3 (Spring 1994): 28.
- _____. "The Musical Instrument Collections at the Library of Congress." *Flutist Quarterly* 16, no. 3 (Summer 1991): 19-23.
- Shorey, David. "The French-Model Flute and its Origins." *Flutist Quarterly* 12, no. 3 (Summer 1987): 9-25.
- Shorey, David and Nina. *Tenth Anniversary Catalog*. 10, no. 2 (Spring 1989).
- Simpson, Dr. Mary Jean. "Dayton Miller and The Dayton C. Miller Flute Collection." *Flutist Quarterly* 15, no. 1 (Winter 1989): 5-11.
- Smith, Catherine P. "Changing Use of the Flute and its Changing Construction 1774-1795." *American Recorder* 20, no. 1 (May 1979): 4-8.
- Taylor, Laurence. "Flute Facts." *Instrumentalist* (October 1951): 45.
- _____. "Utilizing the Large Flute Sections." *Instrumentalist* (December 1964): 84-7.

- Thomas, Bernard. "The Renaissance Flute." *Early Music* 3, no. 1 (1975): 6-8.
- Toff, Nancy. "Recent Developments in Flute Design." *Instrumentalist* 33 (June 1979): 34-37.
- Underwood, Jervis. "N.F.A. Selects Outstanding Flute Music." *Instrumentalist* (November 1978): 42-46.
- Veenstra, Adolf. "The Classification of the Flute." *Galpin Society Journal* 17 (1964): 54-61.
- Weaver, Robert L. "Sixteenth-Century Instrumentation." *Musical Quarterly* 47, no. 3 (1961): 373.
- Webb, Robert K. "An Annotated Flute Choir Bibliography." *Instrumentalist* (June 1975): 63-6.
- Wimberly, David. "Alexander Murray: Vision Quest." *Flutist Quarterly* 11 (Winter 1985): 48-51.
- Woodward, Bonnie Blaszczyk. "The Dayton C. Miller Flute Collection." *Woodwind Anthology* (April 1975): 244-247.
- Woodwind Anthology*. Vol. I. Evanston, IL: The Instrumentalist Company, 1983.
- Woodwind Anthology*. Edited by Rudo S. Globus. New York: Woodwind Magazine, 1952.
- Wright, Lawrence. "Renaissance Recorder Music." *Recorder and Music Magazine* 1, no. 9 (1965): 265.
- _____. "The Recorder Consort in the Renaissance." *Recorder and Music Magazine* 1, no. 6 (1964): 179-80.
- Yonce, Tammy Evans. "The Flute in the Baroque Period." *Flute Talk* 24, no. 9 (May/June 2005): 22-23.

Books

- Abrashev, Bozhidar and Vladimir Gadjev. *The Illustrated Encyclopedia of Musical Instruments*. Bulgaria: Kibea Publishing Company, 2000.
- Adams, Peter H. *Antique Woodwind Instruments: An Identification and Price Guide*. Atglen, PA: Schiffer Publishing, Ltd., 2005.

- Adkins, Lieut-Col. H. E. *Treatise on the Military Band*. London: Boosey and Co. Ltd., 1945.
- Agricola, Martin. *Musica Instrumentalis Deudsch*. Translated and edited by William E. Hettrick. Cambridge: Cambridge University Press, 1994.
- Amadeus: His Music and the Instruments of Eighteenth-Century Vienna*. Rapid City, South Dakota, The Shrine to Music Museum, The University of South Dakota Vermillion, 1990.
- Ananoff, Alexandre. *François Boucher*. Lausanne-Paris: La Bibliothèque des Arts, 1976.
- Andersen, Arthur Olaf. *Practical Orchestration*. Boston, C. C. Birchard and Company, 1929.
- Anfilov, Gleb. *Physics and Music*. Transcribed by Boris Kuznetsov. Moscow: MIR Publishers, 1966.
- Arbeau, Thoinot, and Jehan Tabourot. *Orchesography*. 1589. Reprint. Transcribed by Mary Stewart Evans. New York: Dover, 1967.
- Backus, John. *The Acoustical Foundations of Music*. 2nd ed. New York: W.W. Norton and Company, 1977.
- Baines, Anthony C. *Catalogue of Musical Instruments*. Vol. II, Non-keyboard Instruments at Victoria and Albert Museum. London: Her Majesty's Stationery Office, 1968.
- _____. *European and American Musical Instruments*. London: B.T. Batsford, Ltd., 1966.
- _____. *Musical Instruments Through the Ages*. New York: Walker and Company, 1961.
- _____. *The Oxford Companion to Musical Instruments*. Oxford: Oxford University Press, 1992.
- _____. *Woodwind Instruments and Their History*. New York: Dover Publications, Inc., 1991.
- Barone, Clement. *Learning the Piccolo*. New York: Musicprint Corporation, 1975.

- Barthorpe, Michael. *Crimean Uniforms: British Infantry*. London: Historical Research Unit, 1974.
- Bartolozzi, Bruno. *New Sounds for Woodwind*. Edited and translated by Reginald Smith Brindle. London: Oxford University Press, 1982.
- The Bate Collection of Historical Wind Instruments: Catalogue of Instruments*. Oxford: The Bate Collection, Faculty of Music, University of Oxford, 1976.
- Bate, Philip. *The Flute: A Study of Its History*. New York: W.W. Norton and Company, 1969.
- Bekker, Paul. *The Orchestra*. New York: W.W. Norton and Company, 1936.
- Benade, Arthur H. *Fundamentals of Musical Acoustics*. New York: Dover Publications, Inc., 1976.
- Berger, Kenneth. *The Band in the United States: A Preliminary Review of Band Research and Research Needs*. Evansville, IN: Band Associates, 1961.
- Bergeron, L.E. *Manuel du Tourneur*. Paris: Hamelin-Bergeron, 1816.
- Berlioz, Hector. *An Abridged Treatise on Modern Instrumentation and Orchestration*. New York: Carl Fischer, 1888.
- _____. *Traité d'instrumentation et d'orchestration*. Paris: Henri Lemoine, 1844. Reprint. 2nd ed., Farnborough: Gregg Press, 1970.
- _____. *A Treatise on Modern Instrumentation and Orchestration*. London: Novello, 1844.
- _____. *Treatise on Instrumentation*. Enlarged and Revised by Richard Strauss. Translated by Theodore Front. New York: Edwin F. Kalmus, Inc., 1948.
- Bessaraboff, Nicholas. *Ancient European Musical Instruments: An Organological Study of the Musical Instruments in the Leslie Lindsey Mason Collection at the Museum of Fine Arts, Boston*. Preface by Edwin J. Hipkiss. Foreword by Canon Francis W. Galpin. 2nd ed. New York: October House, Inc., 1964.
- Bierley, Paul E. *John Philip Sousa: American Phenomenon*. New York: Appleton-Century-Crofts, 1973.
- Bigio, Robert. *Readings in the History of the Flute*. London: Cambridge University Press, 2006.

- The Billboard Encyclopedia of Classical Music*. Edited by Stanley Sadie. Forward by Vladimir Ashkenazy. New York: Billboard Books, 2004.
- The Bird Fancier's Delight*. 1717. Reprint. Edited by Stanley Godman. London: Schott and Co. Ltd., 1954.
- Birsak, Kurt. *Die Holzblas Instrumente im Salzburger Museum Carolino Augusteum*. Salzburg: Carolino Augusteum Museum, 1973.
- Blakeman, Edward. *Taffanel: Genius of the Flute*. Oxford: Oxford University Press, 2005.
- Boehm, Theobald. *Die Revolution der Flöte*. Tutzing: Verlegt Bei Hans Schneider, 1981.
- _____. *The Flute and Flute Playing in Acoustical, Technical, and Artistic Aspects*. Translated by Dayton C. Miller. New York: Dover Publications, Inc., 1964.
- _____. *On the Construction on Flutes*. Edited by Frans Vester. Munich: Frits Knuf Buren, 1982.
- Bonanni, Filippo. *Antique Musical Instruments and Their Players*. New York: Dover Publications, Inc., 1964.
- _____. *The Showcase of Musical Instruments*. New York: Dover Publications, Inc., 1964.
- Borders, James M. *European and American Wind and Percussion Instruments: Catalogue of the Stearns Collection of Musical Instruments, University of Michigan*. Ann Arbor, MI: The University of Michigan Press, 1988.
- Borel, François. *Collections d'instruments de musique: Les senza*. Neuchâtel: Musée d'Ethnographie, 1986.
- Buchner, Dr. Alexander. *Musical Instruments Through the Ages*. Translated by Iris Urwin. 3rd ed. London, Spring Books, 1964.
- Bouterse, Jan. *Dutch Woodwind Instruments and Their Makers, 1660-1760*. Utrecht: Koninklijke Vereniging voor Nederlandse Muziekgeschiedenis, 2005.
- Bragard, Roger and Ferdinand J. de Hen. *Musical Instruments in Art and History*. Transcribed by Bill Hopkins. New York: The Viking Press, 1967.

- Broholm, Hans Christian, William P. Larsen, and Godtfred Skjerne. *The Lures of the Bronze Age: An Archaeological, Technical, and Musicological Investigation*. Copenhagen: Gyldendalske Boghandel, 1949.
- Brown, Howard Mayer. *Instrumental Music Printed Before 1600*. Cambridge, MA: Harvard University Press, 1965.
- Brown, Rachel. *The Early Flute: A Practical Guide*. Cambridge: Cambridge University Press, 2002.
- Bryant, Carolyn. *And the Band Played On*. Washington, D.C.: Smithsonian Institution Press, 1975.
- Buchner, Alexander. *Musical Instruments: An Illustrated History*. Translated by Borek Vancura. New York: Crown Publishers, Inc., 1973.
- _____. *Musical Instruments Through the Ages: An Illustrated History*. Translated by Iris Unwin. London: Batchworth Press Limited, 1961.
- Burks, Aldine K. *Follow the Pipers: A Guide to Contemporary Flute Artists and Teachers*. Westfield, NY, 1969.
- Burney, Charles. *A General History of Music*. Vol. I. New York: Dover Publications, Inc., 1957.
- _____. *A General History of Music*. Vol. II. New York: Dover Publications, Inc., 1957.
- The Cambridge Companion to the Orchestra*. Edited by Colin Lawson. Cambridge: Cambridge University Press, 2003.
- Campbell, Murray, and Clive Greated. *The Musicians's Guide to Acoustics*. New York: Schirmer Books, 1987.
- Campbell, Murray, Clive Greated, and Arnold Myers. *Musical Instruments: History, Technology, and Performance of Instruments of Western Music*. Oxford: Oxford University Press, 2004.
- Camus, Raoul F. *Military Music of the American Revolution*. Chapel Hill, NC: The University of North Carolina Press, 1976.
- Carnyx et la Lyra, Le* [exhibition catalogue]. Besançon: Musée des Beaux-Arts et Archeologie; Orléans: Musée Historique et Archeologique de l'Orleanais; Évreux: Musée de l'Ancien Eveche, 1993.

- Carroll, Paul. *Baroque Woodwind Instruments*. Brookfield, VT: Ashgate Publishing Limited, 1999.
- Carse, Adam. *The Adam Carse Collection of Old Musical Wind Instruments*. London: London County Council, 1951.
- _____. *Album of Photographs of Music Wind Instruments*. Vol. I. London: Horniman Museum, (unpublished).
- _____. *Musical Wind Instruments*. New York: Dover Publications, Inc., 2002.
- _____. *The Orchestra in the XVIIIth Century*. Cambridge, MA: W. Heffer and Sons, Ltd., 1940.
- _____. *Practical Hints on Orchestration*. London: Augener Ltd., 1916.
- Cary, Arthur Deering Lucius. *Regimental Records of the Royal Welch Fusiliers*. Vol. I, 1914-1918. London: Forster Groom and Co. LTD, 1921.
- _____. *Regimental Records of the Royal Welch Fusiliers*. Vol. III, 1914-1918. London: Forster Groom and Co. LTD, 1928.
- _____. *Regimental Records of the Royal Welch Fusiliers*. Vol. IV, 1914-1918. London: Forster Groom and Co. LTD, 1929.
- Cary, Arthur Deering Lucius and Stoupe McCance. *Regimental Records of the Royal Welch Fusiliers*. Vol. II, 1816-1914. London: Royal United Service Institute, 1923.
- Catalogue of the Adam Carse Collection of Old Musical Wind Instruments*. London: London County Council, 1951.
- Catalogue of Canadian Chamber Music and Supplement*. Toronto: Canadian Music Centre, 1967 and 1976.
- Catalogue of the Crosby Brown Collection of Musical Instruments of all Nations*. New York: The Metropolitan Museum of Art, 1904.
- Chang, Sa-hun. *Korean Musical Instruments* [in Korean with English summary]. 2nd ed. Seoul: Seoul National University, 1976.
- Chapman, F. B. *Flute Technique*. 3rd ed. London: Oxford University Press, 1958.
- A Checklist of Western European Fifes, Piccolos, and Transverse Flutes*. New York, Metropolitan Museum of Art, 1977.

- Cooper, Albert. *The Flute*. London: Albert Cooper, 1980.
- _____. "My Work on Flutes." *Flute*, edited by James Galway, 49-57. New York: Schirmer Books, 1988.
- Corder, F. *The Orchestra and How to Write for It*. London: J. Curwen and Sons, 1896.
- Corrette, Michel. *Méthode Pour apprendre aisément à jouer de la Flûte Traversière*. Paris: Boivin, 1735.
- _____. *Flute-Playing in the Eighteenth Century*. Transcribed by Carol Reglin Farrar. Brooklyn, NY: Institute of Medieval Music, Ltd., 1970.
- Couperin, François. *Flötenmusik*. Edited by Hans Peter Schmitz. Basel: Bärenreiter, 1976.
- Crane, Frederick. *Extant Medieval Musical Instruments: A Provisional Catalogue by Type*. Iowa City: University of Iowa Press, 1972.
- Daubeny, Ulric. *Orchestral Wind Instruments: Ancient and Modern Being an Account of the Origin and Evolution of Wind Instruments From the Earliest to the Most Recent Times*. London: New Temple Press, 1919.
- Dauvois, Michel, and Xavier Boutillon. "Grottes et Lithophones." In *Acoustique et instruments anciens: Colloque organize par la Société Française d'Acoustique et la cite de la musique, 17 et 18 novembre 1998*, 215-23. Paris: N.p., 1999.
- Day, Charles Russell. *A Descriptive Catalogue of the Musical Instruments recently exhibited at the Royal Military Exhibition, London, 1890*. London: Eyre and Spottiswoode, 1891.
- Debost, Michel. *The Simple Flute From A to Z*. Oxford: Oxford University Press, 2002.
- Dick, Robert. *The Other Flute: A Performance Manuel of Contemporary Techniques*. New York: Oxford University Press, 1975.
- Diderot, D. and d'Alembert Jean L. *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers, par une societé de gens de letter*. Paris, 1751-1777.
- Dobrinski, Ingeborg. *Das Solostück für Querflöte In der ersten Hälfte des 20. Jahrhunderts*. Germany: Gustav Bosse Verlag Regensburg, 1981.

- Donington, Robert. *The Instruments of Music*. 3rd ed. London: Methuen, 1970.
- _____. *Music and Its Instruments*. London: Methuen and Co., Ltd., 1982.
- Dorgeuille, Claude. *The French Flute School 1860-1950*. Translated and edited by Edward Blakeman. Discography by Christopher Steward. London: Tony Bingham, 1986.
- Downey, Fairfax. *Fife, Drum and Bugle*. Ft. Collins, CO: Fairfax Downey, 1971.
- Elson, Arthur. *Orchestral Instruments and Their Use*. Boston: L. C. Page and Company, 1902.
- Engel, Carl. *Musical Instruments*. London: Publisher, 1908.
- _____. *Musical Instruments in the South Kensington Museum*. 2nd ed. London: Publisher, 1874.
- Ewen, David. *Mainstreams of Music: Orchestral Music*. Vol. II. New York: Franklin Watts Inc., 1973.
- Eyck, Jacob van. *Der Fluyten Lust-hof*. Vols. I and II. 1646. Reprint. Amsterdam, Muziekuitgeverij Ixijzet, 1957.
- Fairley, Andrew. *Flutes, Flautists, and Makers*. London: Pan Educational Music, 1982.
- Farmer, Henry George. *Studies in Oriental Musical Instruments*. Boston: Longwood Press, 1939.
- Farrar, Carol Reglin. *Michel Corrette and Flute-Playing in the Eighteenth Century*. New York: Institute of Medieval Music, Ltd., 1970.
- Fitzgibbon, H. Macaulay. *The Story of the Flute*. London: Williams Reeves Bookseller Limited.
- _____. *The Story of the Flute*. 2nd ed., rev. Edited by Ferderick J. Crowest. London: Williams Reeves Bookseller Limited; New York: Charles Scribner's Sons, 1928.
- Fletcher, Neville H. and Thomas D. Rossing. *The Physics of Musical Instruments*. 2nd Edition. New York: Springer-Verlag New York, Inc., 1998.
- The Flutist's Handbook: A Pedagogy Anthology*. Santa Clarita, CA: The National Flute Association, Inc., 1998.

- Flutist's Magazine: and Musical Miscellany*. Edited by W.N. James. London: Boosey and Co., 1827.
- Fonville, John. "The Open-Hole Piccolo." *Flute Talk* 15, no. 6 (February 1996): 32.
- Forsyth, Cecil. *Orchestration*. New York: Dover Publications, Inc., 1982.
- Fox, Lilla. *Instruments of Processional Music*. London: Lutterworth Press, 1967.
- Francoeur, Louis-Joseph. *Diapason Générale de Tous les Instruments à Vent*. Paris, 1772.
- Fuller, David. *Mechanical Musical Instruments as a Source for the Study of Notes Inégales*. Cleveland Heights, Ohio: Divisions, 1974.
- Galpin, Francis. *An Autobiography*. New York: St. Martin's Press, 1979.
- _____. *Old English Instruments of Music: Their History and Their Character*. 2nd ed. London: Methuen and Co. Ltd., 1911.
- _____. *A Textbook of European Musical Instruments: Their Origin, History, and Character*. Westport, CT: Greenwood Press, Publishers, 1976.
- Galway, James. *Flute*. New York: Schirmer Books, 1982.
- Gammond, Peter. *Musical Instruments in Color*. New York: Macmillan Publishing Co., Inc., 1975.
- Gardner, Maurice. *The Orchestrator's Handbook*. New York: Staff Music Publishing Company, 1948.
- Garsault, de. *Notionnaire ou Mémoire Raisonné de ce qu'il y a d'utile et d'intéressant dans les Connoissances acquises depuis la Création du Monde jusqu'à présent*. Paris: Chez Guillaume Desprez, 1761.
- Geiringer, Karl. *Instruments in the History of Western Music*. New York: Oxford University Press, 1978.
- _____. *Musical Instruments*. Transcribed by Bernard Miall. New York: Oxford University Press, 1943.
- _____. *Musical Instruments: Their History in Western Culture from the Stone Age to the Present*. Translated by Bernard Miall. New York: Oxford University Press, 1945.

- Gevaert, François Auguste. *Nouveau Traité de L'Instrumentation*. 1828. Reprint. Lemoine, 1885.
- Giannini, Tula. *Great Flute Makers of France: The Lot and Godfroy Families, 1650-1900*. London: Tony Bingham, 1993.
- Gilchrist, Martyn. *Whistles*. Princes Risborough, England: Shire, 2000.
- Gilliam, Laura E. and William Lichtenwanger. *Dayton C. Miller Flute Collection: A Checklist of the Instruments*. Washington: Library of Congress, 1961.
- Gimpel, Jean. *The Medieval Machine: The Industrial Revolution of the Middle Ages*. 2nd ed. Aldershot, England: Wildwood House, 1988.
- Gippo, Jan. *The Complete Piccolo: A comprehensive guide to fingerings, repertoire, and history*. Forward by Laurie Sokoloff. King of Prussia, PA: Theodore Presser Company, 1996.
- Girard, Adrien. *Histoire et richesses de la flute*. Paris: Libraire Gründ, 1953.
- Goepp, Philip H. *Symphonies and Their Meaning*. London: J.B. Lippincott Company, 1913.
- Goldman, Richard Franko. *The Concert Band*. New York: Rinehart and Company, Inc., 1946.
- _____. *The Wind Band: It's Literature and Technique*. Boston: Allyn and Bacon, Inc., 1961.
- Gorgerat, Gerald. *Encyclopedia de la musique pour instruments à vent*. 2nd ed. Lausanne, Rencontre, 1955.
- Grupp, Maurice. *In the Name of Wind Instrument Playing: the First Guide to Natural and Correct Wind Instrument Playing*. New York: M. Baron Co., 1939.
- Harrison, Frank and Joan Rimmer. *European Musical Instruments*. New York: W.W. Norton and Company, Inc., 1964.
- Harrison, Frank Ll., and Joan Rimmer. *The Showcase of Musical Instruments*. New York: Dover, 1964.
- Heacox, Arthur E. *Project Lessons in Orchestration*. Philadelphia, Oliver Ditson Company, 1928.

- Head, Matthew W. *Orientalism, Masquerade and Mozart's Turkish Music*. London: Royal Music Association, 2000.
- Heller, George N. *Ensemble Music for Wind and Percussion Instruments: A Catalogue*. Washington, D. C., M.E.N.C., 1970.
- Henderson, W.J. *The Orchestra and Orchestral Music*. New York: Scribner's Sons, 1889.
- Heyde, Herbert. *Flöten*. Leipzig: Veb Deutscher Verlag für Musik, 1978.
- _____. "Makers' Mark on Wind Instruments." William Waterhouse, *The New Langwill Index*, London: Tony Bingham, 1993b.
- Hind, Harold C. *The Orchestra and its Instruments*. London: Hawkes and Son, 1936.
- Hipkins, Alfred T. *Musical Instruments, Historic, Rare and Unique*. Edinburgh, 1888.
- Hoffman, Richard. *Practical Instrumentation*. London: Augener and Co., 1893.
- Hotteterre, Jacques-Martin. *Principles of the Flute, Recorder, and Oboe*. Translated by Paul Marshall Douglas. New York: Dover Publications, Inc., 1968.
- Howard, Keith. *Korean Musical Instruments: A Practical Guide*. Seoul, Korea: Se-Kwang Music Publishing Company, 1988.
- Howell, Thomas. *The Avant-Garde Flute: A Handbook for Composers and Flutists*. Berkeley, CA: University of California Press, 1974.
- Hunt, Edgar. *The Recorder and its Music*. 2nd ed. London: Eulenburg, 1976.
- Hunt, Simon. *Learning to Play the Flute*. Vol. I. London: Pan Educational Music, 1979.
- The Illustrated Encyclopedia of Musical Instruments*. Edited by Robert Dearling. New York: Schirmer Books, 1996.
- Jackson, Gerald. *First Flute*. Edited by David Simmons. London: J.M. Dent and Sons, Ltd., 1968.
- Jacob, Gordon. *Orchestral Technique: A Manuel for Students*. 3rd ed. London: Oxford University Press, 1982.

- James, W.N. *A Word or Two on the Flute*. Edinburgh: Charles Smith and Co., 1826.
- Johnstone, Arthur Edward. *Instruments of the Modern Symphony Orchestra and Band*. New York: Carl Fischer, Inc., 1917.
- Journal of the Society for Army Historical Research*. London: Robert Stockwell Ltd., 1969.
- Juzhong Zhang. *The Institute of Cultural Relics and Archaeology of Henan Province*. Zhengzhou, China.
- Kartomi, Margaret J. *On Concepts and Classification of Musical Instruments*. Chicago: University of Chicago Press, 1990.
- Kastner, Georges. *Manuel Général de Musique Militaire à l'usage des Armées Françaises*. Paris: Firmin Didot Frères, 1848.
- Kennan, Kent and Donald Grantham. *The Technique of Orchestration*. 6th ed. Upper Saddle River, NJ: Prentice Hall, 2002.
- Kincaid, William. *The Advanced Flutist: A Guide To Multiple Tonguing, Vibrato and Sensitive Fingering*. Bryn Mawr, PA: Elkan-Vogel, Inc., 1975.
- _____. *The Art and Practice of Modern Flute Technique*. New York: MCA Inc., 1967.
- Kling, Henri. *Modern Orchestration and Instrumentation*. New York: Carl Fischer, 1905.
- Koechlin, Charles. *Les Instruments à Vent*. Paris: Presses Universitaires de France, 1948.
- Koizumi, Hiroshi. *Technique for Contemporary Flute Music for Players and Composers*. Japan: Schott Japan Company Ltd., 1996.
- Koury, David J. *Orchestral Performance Practices in Nineteenth-Century – Size, Proportions, and Seating*. Ann Arbor, MI: UMI Research Press, 1986.
- Krell, John. *Kincaidiana*. 2nd ed. Santa Clarita, CA: The National Flute Association, Inc., 1997.
- _____. *The Piccolo: An Artist's Approach*. Elkhart, IN: W.T. Armstrong Co., 1976.

- Laborde, Jean Benjamin de. *Essai sur la Musique ancienne et moderne*. Vol. 1-4. Paris, 1780.
- Langey, Otto. *Practical Tutor for the Piccolo in the Simple and Boehm Systems*. London: Hawkes and Son, 1906.
- Langwill, Lyndesay G. *An Index of Musical Wind Instrument Makers*. 2nd ed. Great Britain: Lorimer and Chalmers Ltd., 1962.
- Latham, Alison, ed. *The Oxford Companion to Music*. Oxford: Oxford University Press, 2002.
- Lavoix, Henri. *Histoire de L'Instrumentation depuis le 16 siècle jusqu'à Nos Jours*. Paris: Firmin-Didot, 1878.
- Lorenzo, Leonardo De. *My Complete Story of the Flute*. Revised and Expanded Edition. Lubbock, TX: Texas Tech University Press, 1992.
- Macquarre, Andre. *Daily Exercises for the Flute*. New York: G. Schirmer, 1899.
- Majer, Joseph Friedrich Bernhard Caspar. *Museum Musicum Theoretico Practicum*. Schwäbisch Hall: Georg Michael Majer, 1732. Facsimile: [Michaelstein]: Kultur-und Forschungsstätte Michaelstein, 1991.
- Marcuse, Sibyl. *Musical Instruments: A Comprehensive Dictionary*. New York: Doubleday and Company, Inc., 1964.
- _____. *A Survey of Musical Instruments*. New York: Harper and Row Publishers, 1975.
- Mattson, Donald E. and Louis D. Walz. *Old Fort Snelling Instruction Book for the Fife with Music of Early America*. St. Paul, Minnesota Historical Society, 1974.
- McCutchan, Ann. *Marcel Moyse: Voice of the Flute*. Portland, OR: Amadeus Press, 1994.
- McNeil, Ian, ed. *An Encyclopaedia of the History of Technology*. London and New York: Routledge, 1990.
- Meierott, Lenz. *Die geschichtliche Entwicklung der kleinen Flötentypen und ihre Verwendung in der Musik des 17 und 18 Jahrhunderts*. Tutzing, Verlegt Bei Hans Schneider, 1974.
- Melnik, Henry. *Universal's Fundamental Method for the Flute and Piccolo: A Graded Elementary Course*. New York: Universal, 1943.

- Mersenne, Marin. *Harmonie Universelle: The Books on Instruments*. Transcribed by Roger E. Chapman. The Hague, Martinus Nijhoff, 1957.
- Meylan, Raymond. *La Flûte: les grandes lignes de son développement de la préhistoire à nos jours*. Lausanne, Payot, 1974.
- _____. *The Flute*. Translated by Alfred Clayton. London: B.T. Batsford, Ltd., 1988.
- Miller, Dayton Clarence. *Catalogue of Books and Literary Material Relating to the Flute and Other Musical Instruments*. Cleveland: Privately Printed, 1935.
- Montagu, Jeremy. *The Flute*. Princes Risborough, England: Shire Publications Ltd., 1990.
- _____. *Musical Instruments of the Bible*. London: Scarecrow Press, 2002.
- _____. *Origins and Development of Musical Instruments*. Lanham, Maryland: Scarecrow Press, Inc., 2007.
- _____. *The World of Baroque and Classical Musical Instruments*. New York: The Overlook Press, 1979.
- _____. *The World of Medieval and Renaissance Musical Instruments*. New York: The Overlook Press, 1976.
- _____. *The World of Romantic and Modern Musical Instruments*. New York: The Overlook Press, 1981.
- Morley, Thomas. *First Book of Consort Lessons*. Edited by Sydney Beck. London: Peters, 1959.
- Munrow, David. *Instruments of the Middle Ages and Renaissance*. London: Oxford University Press, 1976.
- Music in Canada*. Edited by Ernest MacMillan. Toronto: University of Toronto Press, 1955.
- Music in Colonial Massachusetts 1630-1820*. Vol. I. Boston: The University Press of Virginia, 1980.
- Music in Colonial Massachusetts 1630-1820*. Vol. II. Boston: The University Press of Virginia, 1980.

- Musical Instruments in the Royal Ontario Museum*. Toronto: Thorn Press, 1971.
- Musical Instruments of the World*. Edited by the Diagram Group. New York: Paddington Press Ltd., 1976.
- Musique pour Flûte*. 2nd ed. Paris: Alphonse Leduc.
- National Flute Association. *N.F.A. Music Library Catalog*. 1st ed. January 1975.
- National Flute Association. *Newsletter*. Hempstead, NY.
- Nederveen, C.J. *Acoustical Aspects of Woodwind Instruments*. Revised edition. DeKalb, IL: Northern Illinois University Press, 1998.
- Nettel, Reginald. *The Orchestra in England: A Social History*. London: Jonathan Cape, 1946.
- Nettl, Paul. *Forgotten Musicians*. New York: Philosophical Library, 1951.
- Neuhaus, Margaret N. *The Baroque Flute Fingering Book*. 2nd ed. Edited by Ardal Powell. New York: Folkers and Powell, 2002.
- The New Grove Dictionary of Music and Musicians*. Edited by Stanley Sadie. London: Macmillan, 1984.
- The New Grove Dictionary of Music and Musicians*. Edited by Stanley Sadie. 2nd ed. London: Macmillan, 2001.
- The New Harvard Dictionary of Music*. Edited by Don Michael Randel. Cambridge, MA: The Belknap Press of Harvard University Press, 1999.
- Traversière. *Science de la Musique*. Edited by Marc Honegger. Paris: Bordas, 1976.
- Newsom, Jon. *Our Musical Past: A History of the Instruments and the Musical Selections*. Washington, D.C.: Library of Congress, 1976.
- Old Fort Henry Archives. Photograph of Band of the 14th Battalion, Kingston, Ontario, April 1872.
- Paetkau, David H. *The Growth of Instruments and Instrumental Music*. New York: Vantage Press, 1962.
- Palmer, Harold G. *Teaching Techniques of the Woodwinds*. New York: Belwin Inc., 1952.

- Patents For Inventions Abridgments of Specifications Relating To Music and Musical Instruments A.D. 1694-1866.* 2nd ed. London: George E. Eyre and William Spottiswoode, 1871.
- Pellerite, James A. *A Handbook of Literature for the Flute.* 3rd ed. Bloomington, IN: Zalo Publications, 1978.
- _____. *A Modern Guide to Fingerings for the Flute.* Bloomington, IN: Zalo Publications, 1972.
- Petrie, Captain Martin. *Equipment of Infantry.* London: Her Majesty's Stationery Office, 1865.
- Phelan, James and Mitchell D. Brody. *The Complete Guide to the Flute: from Acoustics and Construction to Repair and Maintenance.* Edited by Sheila Wendy Wosk. Boston: Conservatory Publications, 1980.
- The Piccolo Society. *Newsletter.* Edited by Charlotte A. Kolczynski. Amherst, NY.
- Picken, Laurence E. R. *Folk Musical Instruments of Turkey.* London: Oxford University Press, 1975.
- Poole, Fred H. *Flute tutor for B-flat Flute, F Flute, E-flat Flute and Piccolo.* London: Henry Potter and Co. (Drums) Ltd.
- Poor, Mary Louise. *Guide to Flute Teaching.* New York: Envolve Music Company, 1978.
- Potter, Samuel. *The Art of Playing the Fife with the Camp, Garrison and Street Duty.* London: Henry Potter, c. 1830.
- Powell, Ardal. *The Flute.* New Haven, CT: Yale University Press, 2002.
- Praetorius, Michael. *Syntagma Musicum.* (1615-19). Transcribed by H. Blumenfeld, 2nd ed. New York: Bärenreiter, 1962.
- _____. *Syntagma Musicum I—De Organographia.* Braunschweig: Elias Holwein, 1619. Facsimile, Kassel: Bärenreiter, 1958. Translated and edited by David Z. Crookes. Oxford: Clarendon Press, 1986.
- _____. *Syntagma Musicum II—De Organographia.* Braunschweig: Elias Holwein, 1619. Facsimile, Kassel: Bärenreiter, 1958. Translated and edited by David Z. Crookes. Oxford: Clarendon Press, 1986.

- _____. *Syntagma Musicum III*. Translated and edited by Jeffery Kite-Powell. Oxford: Oxford University Press, 2004.
- Prout, Ebenzer. *The Orchestra*. London: Augener, 1897.
- _____. *The Orchestra: Vol. I, Technique of the Instruments*. London: Augener and Co., 1899.
- Pulver, Jeffrey. *A Dictionary of Old English Music and Musical Instruments*. New York: E. P. Dutton, 1923.
- Putnik, Edwin V. *The Art of Flute Playing*. Evanston, IL: Summy-Birchard Company, 1970.
- Quantz, Johann Joachim. *On Playing the Flute*. Translated by Edward R. Reilly. Boston: Northeastern University Press, 2001.
- Rainey, Thomas E. Jr. *The Flute Manual: A Comprehensive Text and Resource Book for Both the Teacher and the Student*. New York: University Press of America, Inc., 1985.
- Rault, Lucie. *Musical Instruments*. New York: Harry N. Abrams, Inc., 2000.
- Raynor, Henry. *The Orchestra: A History*. London: Robert Hale, 1978.
- Read, Gardner. *Thesaurus of Orchestral Devices*. New York: Pitman Publishing Corporation, 1953.
- Reese, Gustav. *Music in the Middle Ages*. New York: Norton, 1940.
- Remnant, Mary. *Musical Instruments: An Illustrated History from Antiquity to the Present*. London: B.T. Batsford, Ltd., 1989.
- The Ridley Collection of Musical Wind Instruments in Luton Museum*. [Now housed at The Royal College of Music.] The Corporation of Luton Museum and Art Gallery, 1957.
- Riemenschneider, Albert. *Some Aspects of the Use of Flutes in the Sacred and Choral and Vocal Works of Johann Sebastian Bach*. Washington, Music Division, The Dayton C. Miller Fund, The Library of Congress, 1950.
- _____. *The Use of the Flutes in the Works of J.S. Bach*. Washington, Music Division, The Dayton C. Miller Fund, The Library of Congress, 1950.

- Rimsky-Korsakov, Nikolay. *Principles of Orchestration: With Musical Examples Drawn From His Own Works*. Translated by Edward Agate. New York: Dover Publications, Inc., 1964.
- Robinson, Trevor. *The Amateur Wind Instrument Maker*. Revised Edition. Massachusetts: The University of Massachusetts Press, 1980.
- Rockstro, Richard Shepherd. *A Treatise on the Construction, the History and the Practice of the Flute, Including a Sketch of the Elements of Acoustics*. London: Rudall Carte and Co., 1928.
- _____. *A Treatise on the Flute*. London: Musica Rara, 1928.
- Rousseau, J.J. *Lettres originales*. Paris: Charles Pougens, 1798.
- Sachs, Curt. *The History of Musical Instruments*. New York: W.W. Norton and Company, Inc., 1940.
- Sarro, A. *Zum Selbstunterricht, Schule für die Piccolo-Flöte*. Leipzig: Hansa-Ausgabe, (no date).
- Scheck, Gustav. *Die Boehm Flöte*. Mainz: B. Schott's Sohne, 1966.
- _____. *Die Flöte und ihre Musik*. Mainz: B. Schott's Sohne, 1975.
- Schillinger, Joseph. *The Schillinger System of Musical Composition: Book XII, Theory of Orchestration*. New York: Carl Fischer, Inc., 1941.
- Scholes, Percy A., ed. *The Oxford Companion to Music*. 10 editions. London: Oxford University Press, 1938-1970.
- Schwartz, H.W. *The Story of Musical Instruments*. New York: Garden City Publishing Co., Inc., 1938.
- Sconzo, F. *Il Flauto e i Flautisti*. Milan, Ulrico Hoepli, 1930.
- Sheldon, Robert E. and Carol Lynn Ward Bamford. *Guides to Special Collections in the Music Division at the Library of Congress. Dayton C. Miller Flute Collection*. Washington: Library of Congress, 2004.
- Singer, Charles, E.J. Homlyard, A.R. Hall and Trevor I. Williams, eds. *A History of Technology*. 8 Vols. Oxford: Oxford University Press, 1957.
- Sloane, Irving. *Making Musical Instruments*. New York: E.P. Dutton, 1978.
- Solum, John. *The Early Flute*. Oxford: Oxford University Press, 1995.

- Spitzer, John, and Neal Zaslaw. *The Birth of the Orchestra: History of an Institution, 1650-1815*. New York: Oxford University Press, 2004.
- Stevens, Roger S. *Artistic Flute Technique and Study*. Hollywood, CA: Highland Music Company, 1967.
- Sydenham, P.H. *Measuring Instruments: Tools of Knowledge and Control*. Stevenage and New York: Peregrinus, 1979.
- Takahashi, Toshio. *Takahashi Flute School*. Vols. 1-5. Princeton, New Jersey: Summy-Birchard Music, 1971.
- Taylor, Laurence. *Metzler and Co.'s Tutor for the Piccolo*. London: J.B. Cramer and Co. Ltd.
- Terry, Charles Sanford. *Bach's Orchestra*. Reprint. London: Oxford University Press, 1958.
- Thibault, G., Jean Jenkins, and Josiane Bran-Ricci. *Eighteenth Century Musical Instruments: France and Britain*. London: Victoria and Albert Museum, 1973.
- Tiede, Clayton H. *The Practical Band Instrument Repair Manual*. Dubuque, IA: Wm. C. Brown Company Publishers, 1962.
- Timm, Everett L. *The Woodwinds*. Boston: Allyn and Bacon, Inc., 1964.
- Toff, Nancy. *The Development of the Modern Flute*. New York: Taplinger Publishing Company, 1979.
- _____. *The Flute Book: A Complete Guide for Students and Performers*. 2nd ed. Oxford: Oxford University Press, 1996.
- _____. *Monarch of the Flute: The Life of Georges Barrère*. Oxford: Oxford University Press, 2005.
- Towarnicki, Eugeniusz. *Studium Techniki Na Malym Flecie*. Vol. I. PWM Edition, 1985.
- _____. *Studium Techniki Na Malym Flecie*. Vol. II. PWM Edition, 1985.
- Tromlitz, Johann George. *The Keyed Flute*. Translated and edited with an introduction by Ardal Powell. Oxford: Clarendon Press, 1996.

- _____. *The Virtuoso Flute-Player*. Translated and Edited by Ardal Powell. Cambridge: Cambridge University Press, 1991.
- Vertkov, K., G. Blagodatov, and E. Yazovitskaya. *Atlas of Musical Instruments of the Peoples Inhabiting the USSR* [in Russian with English summaries (2nd ed. only)]. 2nd ed. Moscow: State Publishers, 1975.
- Vester, Frans. *Flute Repertoire Catalogue*. London: Musica Rara, 1967.
- Virdung, Sebastian. *Musica Getutscht: A Treatise On Musical Instruments (1511)*. Translated and edited by Beth Bullard. New York: Cambridge University Press, 1993.
- Voorhees, J.L. *The Classification of Flute Fingering Systems of the Nineteenth and Twentieth Centuries*. Netherlands: Frits Knuf, 1980.
- Voxman, Himie and Lyle Merriman. *Woodwind Ensemble Music Guide*. Evanston, IL: Instrumentalist Co., 1973.
- Wacker, Therese M. "The History of the Piccolo." *The Complete Piccolo* by Jan Gippo. King of Prussia, PA: Theodore Presser Company, 1996.
- Wade-Matthews, Max. *The History of Musical Instruments and Music-Making: A Complete History of Musical Forms and the Orchestra*. London: Southwater, 2001.
- _____. *The World Encyclopedia of Musical Instruments*. London: Anness Publishing Limited, 2000.
- Wagner, Ernest F. *Table of Fingerings for the Boehm Flute with Closed G Sharp Key: Table of Fingerings for the Boehm Flute with Open G Sharp Key*. New York: Carl Fischer, 1968.
- Wainwright, Jonathan, and Peter Holman, eds. *From Renaissance to Baroque: Changes in Instruments and Instrumental Music in the Seventeenth Century*. Aldershot, England: Ashgate, 2005.
- Walker, Ernest. *A History of Music in England*. 3rd ed. Oxford: Clarendon Press, 1952.
- Warner, Thomas E. *An Annotated Bibliography of Woodwind Instruction Books 1600-1830*. Detroit: Information Coordinators, 1967.
- Weisburg, Arthur. *The Art of Wind Playing*. New York: Macmillan Publishing Co., Inc., 1975.

- Weisshaar, Otto H. *Preventive Maintenance of Musical Instruments*. New York: Belwin, Inc., 1966.
- Welch, Christopher. *History of the Boehm Flute*. London: Rudall, Carte and Co., 1883.
- _____. *History of the Boehm Flute*. 2nd ed. New York: G. Schirmer, 1961.
- _____. *Six Lectures on the Recorder and Other Flutes in Relation to Literature*. London: Oxford University Press, 1911.
- Westphal, Frederick W. *Guide to Teaching Woodwinds*. 5th ed. Dubuque, IA: Wm. C. Brown Co., 1962.
- Wetzger, Paul. *Die Flöte, Ihre Entstehung und Entwicklung bis zur Jetztzeit*. Heilbronn, C.F. Schmidt, 1905.
- Whitwell, David. *A New History of Wind Music*. Evanston, IL: Instrumentalist Company, 1980.
- Widor, Charles-Marie. *The Technique of the Modern Orchestra: A Manuel of Practical Instrumentation*. Transcribed by Edward Suddard. London: Joseph Williams, 1906.
- Wilkins, Frederick. *The Flutist's Guide*. 3rd ed. Artley, Inc., 1963.
- Wilkins, Wayne. *The Index of Flute Music including The Index of Baroque Trio Sonatas*. Magnolia, AR: The Music Register, 1974.
- William Waterhouse. *The New Langwill Index*. London: Tony Bingham, 1993.
- Wind Instruments of European Art Music*. Horniman Museum and Library, London, Inner London Education Authority, 1974.
- Winternitz, Emanuel. *Musical Instruments of the Western World*. New York: McGraw-Hill Book Company, 1967.
- Woodwind Book 1957-8*. Edited by Brian Manton-Myatt. London: Boosey and Hawkes, 1957.
- Wright, Rowland. *Dictionnaire des Instruments de Musique*. Clapham Park, London: The Queensgate Press, 1941.
- Wye, Trevor and Patricia Morris. *A Piccolo Practice Book*. London and Sevenoaks: Novello, 1988.

Young, Phillip T. *Twenty-five Hundred Historical Woodwinds*. New York: Pendragon Press, 1982.

Theses and Dissertations

Beard, Christine Erlander. "The Evolution of the Piccolo as a Solo Instrument from Vivaldi to Present." D.M.A. Lecture-Recital, The University of Texas at Austin, 2002.

Berdahl, Susan Marie Beagle. "The First Hundred Years of the Boehm Flute In the United States, 1845-1945: A Biographical Dictionary of American Boehm Flutemakers." Ph.D. diss., University of Minnesota, 1985.

Coleman, Heather Hall. "The Adoption and Role of the D-flat Piccolo and Other High Band Flutes in the 19th Century." D.M.A. diss, University of Memphis, 1999.

Dombourian-Eby, Zartouri. "The Piccolo in the 19th Century." D.M. diss, Northwestern University, 1987.

Hollaway, William Wood. "Martin Agricola's *Musica Instrumentalis Deusch*: A Translation." Ph.D. diss, North Texas State University, 1972.

Kaplan, David Leon. "Stylistic Trends in the Small Woodwind Ensemble From 1750-1825." Ph.D. diss, Indiana University, 1977.

Lampl, Hans. "A Translation of *Syntagma Musicum III* By Michael Praetorius." D.M.A. diss, University of Southern California, 1957.

Mathic, Gordon William. "A Theoretical Basis for College Trumpet Study." D.M. diss, University of Illinois at Urbana-Champaign, Urbana, IL, 1969.

Myers, Herbert W. "The Practical Acoustics of Early Woodwinds." D.M.A. diss, Stanford University, 1980.

Nourse, Nancy. "The Piccolo: An Overview of its History and Instruction." Master's Thesis, State University of New York at Potsdam, 1981.

Nussbaum, Carolyn. "The Flute: The Mechanical Improvements on the Body of the Orchestral Instrument Since 1847." Master's Thesis, University of North Texas, 1994.

Orr, Emily G. "Teaching the Piccolo: A Survey of Selected College Flute Teachers." D.M.A. diss, University of North Carolina at Greensboro, 2005.

Roseman, Joseph Jacob. "William Hebert: Fundamentals of Playing and Teaching Piccolo." D.M. diss, The Florida State University, 1996.

Wacker, Therese M. "The piccolo in the Chamber Music of the Twentieth Century: An annotated Bibliography of Selected Works." D.M.A. diss, The Ohio State University, 2000.

Weigel, Jane Marie. "An Annotated Performer's Guide With Revised Full Scores of the Piccolo Solos and Duets in the John Philip Sousa Library at the University of Illinois." D.M.A. diss, University of Illinois at Urbana-Champaign, 1999.

White, Darwin Gayle. "Woodwind Scoring Practices in the Symphonies of Beethoven, Schubert, Mendelssohn, and Berlioz from 1800 to 1840." Ph.D. diss, George Peabody College for Teachers, 1971.

Media and Online Resources

Badura-Skoda, Eva. "Turca, alla." *Grove Music Online. Oxford Music Online*, 2001.
http://www.oxfordmusiconline.com.ezproxy.lib.ou.edu/subscriber/article/grove/music/28593?q=turca%2C+alla&search=quick&pos=1&_start=1#firsthit (accessed April 16, 2010).

Baines, Anthony and Stanley Sadie. "janissary music." *The Oxford Companion to Music. Oxford Music Online*, 2001.
http://www.oxfordmusiconline.com.ezproxy.lib.ou.edu/subscriber/article/opr/t114/e3528?q=janissary+music++&search=quick&pos=2&_start=1#firsthit (accessed April 16, 2010).

Burkart-Phelan, Inc. "Burkart Piccolos." Burkart Flutes & Piccolos,
<http://www.burkart.com/picbroch.htm?sid=0001SVPOda8OKjISS00E6t7>
(accessed April 12, 2010).

Dayton C. Miller Flute Collection. "Piccolo." Library of Congress,
<http://memory.loc.gov/ammem/dcmhtml/dmhorne.html> (accessed May 1, 2010).

J.J. Quantz. "Cork-setting mechanism." <http://flutesbaroques.com> (accessed June 16, 2010).

Keefe Piccolo Company. "Keefe Piccolos." Keefe Piccolo Company,
<http://www.keefepiccolo.com/> (accessed April 12, 2010).

- Lea, Michael and Danielle Eden. "Rudall Carte Piccolos-Powerhouse Museum Flute Collection." Powerhouse Museum. <http://www.flutefocus.com/171-rudall-carte-piccolos-power-house-museum.html> (accessed May 4, 2010).
- Montagu, Jeremy, Howard Mayer Brown/Jaap Frank, and Ardall Powell. *Flute*. Oxford Music Online, accessed February 2010; available from http://www.oxfordmusiconline.com.ezproxy.usd.edu.subscriber/article/grove/music/40569?q=flute&article_section=all&search=article&pos=2&_start=1#firsthit (accessed April 16, 2010).
- Montagu, Jeremy, Armin Suppan, Wolfgang Suppan, D.J.S. Murray, and Raoul F. Camus. "Military Music." *JSTOR. Cambridge University Press*, <http://www.jstor.org.ezproxy.lib.ou.edu/action/doAdvancedSearch?q0=montagu%2C+armin%2C+suppan%2C+murray%2C+and+camus&f0=all&c0=AND&q1=military+music&f1=all&c1=AND&q2=&f2=all&c2=AND&q3=&f3=all&wc=on&Search=Search&sd=&ed=&la=&jo=> (accessed April 16, 2010).
- National Music Museum. "Piccolo." Woodwind Instrument Collections, <http://orgs.usd.edu/nmm/collect.html> (accessed May 1, 2010).
- Perl, Benjamin. "Mozart in Turkey." *Cambridge Opera Journal* 12, no. 3 (November 2000): 219-235. *JSTOR. Cambridge University Press*, <http://www.jstor.org.ezproxy.lib.ou.edu/action/doAdvancedSearch?q0=perl%2C+benjamin&f0=all&c0=AND&q1=mozart+in+turkey&f1=all&c1=AND&q2=&f2=all&c2=AND&q3=&f3=all&wc=on&Search=Search&sd=&ed=&la=&jo=> (accessed April 16, 2010).
- Philip Hammig. "Piccolo Models." Philip Hammig Piccolos, <http://www.hammig.com/> (accessed April 12, 2010).
- Pirker, Michael. "Janissary music." *Grove Music Online. Oxford Music Online*, 2001. http://www.oxfordmusiconline.com.ezproxy.lib.ou.edu/subscriber/article/grove/music/14133?q=Janissary+music++&search=quick&pos=1&_start=1#firsthit (accessed April 16, 2010).
- Pirker, Michael. "Pictorial Documents of the Music Bands of the Janissaries (Mehter) and the Austrian Military Music." *Research Center for Musical Iconography* (Fall 1990): 2-12.
- Powell, Ardall. *Louis Lot. Flute History*, accessed May 2009; available from http://www.flutehistory.com/Instrument/Makers/Louis_Lot/index.php3: Internet.

Powell Flutes, Inc. "Piccolos." Powell Piccolos,
http://www.powellflutes.com/free/ftree_t2/ftree_3/ftree_t3_pic.html
(accessed April 12, 2010).

Newspaper Articles

Cheek, Lawrence. "Piccolomaker Harvests 'Green' From Tree." Tempo, *The Cincinnati Enquirer*, May 18, 1984.

Presentations

Kocher, Stephanie. "What Was He Thinking When He Wrote That?!?" Winner of the International Piccolo Symposium 2009 "Call for Presentations," Omaha, NE, June 13, 2009.

APPENDIX A
HISTORICAL INSTRUMENTS

Historical Instruments Key

Piccolo Makers

A:	Anonymous	He:	Herrouard Pere et Fils
Ad:	R. Oswald Adler	Hec:	Wilhelm Heckel
Al:	Nicholas Alberti	Her:	Herouard freres
As:	Astor, G & Co.	Hg:	George W. Haynes
Asc:	Lesti Ascone	Ho:	Troy Hopkins
B:	Theobald Boehm	Hol:	D. Hollings
Ba:	E. Baack	How:	George Howarth
Bar:	Barnett Samuel & Son	Hw:	Hawkes & Sons
Bc:	Buffet, Crampon & Co.	I:	Ivan O. Hawk
Be:	Charles Bertin	J:	Djalma Julliot
Ber:	C. Berteling	K:	G & A Klemm
Bi:	A. Binyon	Ke:	R. Keilwerth
Bo:	C. Bonnet	Kl:	Klein
Boo:	Boosey & Sons	L:	Lyon & Healy
Bou:	Felix Bour	La:	C. Lange
Br:	C. Bruno & Son	Laf:	Lafleur
Bu:	A. Buffet	Le:	Lefèvre
Buh:	Bühner & Keller	Lew:	Lewish & Scott Mfg. Co., Inc.
Bur:	Burghley	LH:	Lyon & Healy
C:	Crosby	Li:	W. Liebel
Ca:	W. Card	LL:	Louis Lot
Camp:	Camp	Lu:	U. Luvoni
Ch:	A. Charly	M:	William Meinl
Cha:	S.A. Chappel	Ma:	Martin
Ci:	H. Meunier & Cie	Mah:	C. Mahillon
Cl:	Clementi & Co.	Mai:	P. Maino
Cli:	Clinton & Co.	Me:	H.F. Meyer
Clo:	George Cloos	Mea:	J. & H. Meachim
Co:	Collard & Co.	Met:	C. Metzler
Col:	M.H. Colonieu & Co.	Mi:	J.A. Mils
Con:	C.G. Conn	MI:	Mlingu
D:	Dobner & Consort	Mo:	Monzani [& Hill?]
Da:	T. Dawkins	O:	Osmanek
E:	Evette & Schaeffer	P:	Henry August Pollman
Eu:	Euler	Pa:	G.C. Payne
F:	Firth, Son & Co.	Par:	Parker
Fe:	Felchlin	Pe:	Penzel and Mueller
Fi:	Firth, Hall & Pond	Pi:	E. Piana
G:	Clair Godfroy ainé	Pia:	P. Piana
Ga:	Gautie, P & fils, Toulouse	Pie:	Pierrat
Gau:	Gautrot aine	Po:	H. Pohlman
Go:	Goulding & D'Almaine	Pot:	Potter & Co.
H:	J.R. Holcomb & Co.	Pr:	T. Prowse
		Pra:	Pratten
		R:	Renab
Ha:	William Hall & Son	Ra:	Agostino Rampone
Hac:	Hack	Re:	Ruckert
Has:	Hastrick	Ri:	Emil Rittershausen
Haw:	Hawkes	Ro:	C.H. Roth
Hay:	J.C. Haynes & Co.	Ru:	Rudall, Carte & Co.
Hays:	A. Hays	Rud:	Rudall, Rose, Carte & Co.
		S:	Moses Slater

Sc: Schulze
 Sch: Carl Gottlob Schuster
 SM: Moses Slater and Godfrey Martin Co.
 SR: Sears Roebuck
 St: Jacob Streulli
 Ste: Stengel
 T: Eugene Thibouville
 Ta: Tabard
 Tb: Buthod Thibouville
 Th: Jerome Thibouville
 TL: J. Thibouville-Lamy
 U: Unknown
 W: B. Wiltshire
 Wa: Paul Walch
 Wai: F. Wainwright
 Wal: J. Wallis & Sons
 Wh: Whitaker & Co.
 Wo: Robert Wolf & Co.
 Ws: Wm. S. Haynes Co.
 Wy: Wylde
 Z: J. Ziegler

Country

A: Austria
 C: Czech
 E: England
 F: France
 G: Germany
 I: Italy
 J: Japan
 R: Russia
 S: Switzerland
 U: Unknown
 USA: United States of America

Material Used

B: Brass
 BE: Bettonite
 BF: Brass Ferrules
 BH: Black Horn Rings
 BK: Brass Keys
 BL: Blackwood
 BO: Boxwood
 BT: Brass Tube
 C: Cocus
 CM: Cast Metal
 CO: Cocoa
 CY: Curly Yellow Wood
 E: Ebony
 EB: Ebonite
 EE: Ebonite Embouchure
 DG: Dark Grenadilla
 G: Grenadilla
 Gl: Glass

Go: Gold
 I: Ivory
 IE: Imitation Ebony
 IR: Ivory Rings
 LM: Lead Mouthpiece
 M: Maple
 Ma: Mahogany
 MB: Metal Body
 ME: Metal
 MSB: Maple Stained Black
 NP: Nickel Plated
 NS: Nickel Silver
 P: Pearwood
 Pe: Pewter
 Pl: Plastic
 PM: Pewter Mouthpiece
 R: Rosewood
 RM: Rock Maple
 S: Silver
 SF: Silver Fittings
 Sfe: Silver Ferrules
 SP: Silver Plated
 SS: Sterling Silver
 ST: Silver Tips
 Ste: Black-Plated Steel
 T: Tin
 U: Unknown
 W: Wood Stained Brown
 WB: Wood with Black Varnish
 WM: White Metal
 WR: Wood Stained Red
 YW: Yellow Wood

Bore

Cyl: Cylindrical
 Co: Conical
 U: Unknown

Model

#: 1867 System
 A: Artist Model
 B: Boehm System
 Br: Briccialdi System
 BW: Boston Wonder
 C: Crosby Model
 Cl: Clinton's Equisonant System
 Co: Columbia Model
 M: Military Model
 Me: Meyer System
 NB: Non-Boehm System
 P: Professional Model
 Pa: Pratten System
 S: Simple System
 US: U.S. Army Fife

Historical Instruments

Date	Maker	Country	Material	Key	Pitch	Bore	Keys	Model	Collection
Fifes	Fifes	Fifes	Fifes	Fifes	Fifes	Fifes	Fifes	Fifes	Fifes
c. 1900	R	USA	U	U	U	U	0	U	U
c. 1900	R	USA	M	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	IE	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	R	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	C	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	C	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	E	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	C	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	E	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	C	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	E	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	NP	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	NP/EE	B/C	U	U	0	U	George Bauer
c. 1900	R	USA	C	U	U	U	0	C	George Bauer
c. 1900	R	USA	E	B/C	U	U	0	C	George Bauer
c. 1900	R	USA	G	B/C	U	U	0	A	George Bauer
c. 1900	R	USA	G	B-flat	U	U	0	M	George Bauer
c. 1900	R	USA	G	B-flat	U	U	0	M	George Bauer
c. 1900	U	U	U	B-flat/C	U	U	0	U	George Bauer
c. 1900	U	U	U	B-flat/C	U	U	0	U	George Bauer
c. 1900	U	U	U	B-flat/C	U	U	0	U	George Bauer
c. 1900	U	U	U	B-flat/C	U	U	0	U	George Bauer
U	G	F	M	B	U	U	0	U	Clair Godfroy aîné
U	G	F	M	C	U	U	0	U	Clair Godfroy aîné
U	G	F	IE	B	U	U	0	U	Clair Godfroy aîné
U	G	F	IE	C	U	U	0	U	Clair Godfroy aîné
U	G	F	R	B	U	U	0	U	Clair Godfroy aîné
U	G	F	R	C	U	U	0	U	Clair Godfroy aîné
U	G	F	C	B	U	U	0	U	Clair Godfroy aîné
U	G	F	C	C	U	U	0	U	Clair Godfroy aîné
U	G	F	C	B	U	U	0	U	Clair Godfroy aîné
U	G	F	C	C	U	U	0	U	Clair Godfroy aîné

Historical Instruments

U	G	F	C	B	U	U	0	U	Clair Godfroy aîné
U	G	F	C	C	U	U	0	U	Clair Godfroy aîné
U	G	F	E	B	U	U	0	U	Clair Godfroy aîné
U	G	F	E	C	U	U	0	U	Clair Godfroy aîné
U	G	F	E	B	U	U	0	U	Clair Godfroy aîné
U	G	F	E	C	U	U	0	U	Clair Godfroy aîné
U	G	F	C	B	U	U	0	U	Clair Godfroy aîné
U	G	F	C	C	U	U	0	U	Clair Godfroy aîné
U	G	F	E	B	U	U	0	U	Clair Godfroy aîné
U	G	F	E	C	U	U	0	U	Clair Godfroy aîné
U	G	F	NP	B	U	U	0	U	Clair Godfroy aîné
U	G	F	NP	C	U	U	0	U	Clair Godfroy aîné
U	G	F	C	B	U	U	0	C	Clair Godfroy aîné
U	G	F	C	C	U	U	0	C	Clair Godfroy aîné
U	G	F	E	B	U	U	0	C	Clair Godfroy aîné
U	G	F	E	C	U	U	0	C	Clair Godfroy aîné
U	G	F	DG	B	U	U	0	U	Clair Godfroy aîné
U	G	F	DG	C	U	U	0	U	Clair Godfroy aîné
1901	H	USA	MSB	U	U	U	0	U	U
1901	H	USA	C	U	U	U	0	U	U
1901	H	USA	E	U	U	U	0	U	U
1901	H	USA	E	U	U	U	0	U	U
1901	H	USA	B	U	U	U	0	U	U
1901	H	USA	NP	U	U	U	0	U	U
U	L	USA	M	B-flat	U	U	0	U	U
U	L	USA	M	C	U	U	0	U	U
U	L	USA	IE	B-flat	U	U	0	U	U
U	L	USA	IE	C	U	U	0	U	U
U	L	USA	R	B-flat	U	U	0	U	U
U	L	USA	R	C	U	U	0	U	U
U	L	USA	C	B-flat	U	U	0	U	U
U	L	USA	C	C	U	U	0	U	U
U	L	USA	C	B-flat	U	U	0	U	U
U	L	USA	C/NP	C	U	U	0	U	U
U	L	USA	E/NP	C	U	U	0	U	U

Historical Instruments

U	L	USA	E/NP	C	U	U	0	U	U
U	L	USA	B/NP	B-flat	U	U	0	U	U
U	L	USA	B/NP	C	U	U	0	U	U
U	L	USA	U	B-flat	U	U	0	U	U
U	L	USA	U	C	U	U	0	U	U
U	L	USA	NP	B-flat	U	U	0	U	U
U	L	USA	NP	C	U	U	0	U	U
U	L	USA	NP	B-flat	U	U	0	P	U
U	L	USA	NP	C	U	U	0	P	U
U	C	USA	C	B-flat	U	U	0	US	U
U	C	USA	C	C	U	U	0	US	U
U	C	USA	E	B-flat	U	U	0	US	U
U	C	USA	E	C	U	U	0	US	U
U	M	USA	CM/NP	C	U	U	0	U	U
U	M	USA	CM/NP	C	U	U	0	U	U
U	M	USA	CM/NP	C	U	U	0	U	U
U	M	USA	T	U	U	U	0	U	U
U	M	USA	T	U	U	U	0	U	U
U	M	USA	T	U	U	U	0	U	U
U	M	USA	R	C/B	U	U	0	U	U
U	M	USA	R	C/B	U	U	0	U	U
U	M	USA	C	C/B	U	U	0	U	U
U	M	USA	C	C/B	U	U	0	U	U
U	M	USA	E	C/B	U	U	0	U	U
U	M	USA	E	C/B	U	U	0	C	U
U	M	USA	C	C/B	U	U	0	C	U
U	M	USA	G	B-flat	U	U	0	U	U
U	M	USA	G	B-flat	U	U	0	U	U
U	M	USA	G	B-flat	U	U	0	U	U
U	M	USA	G	U	U	U	0	U	U
U	M	USA	G	U	U	U	0	U	U
U	P	USA	IE	C	U	U	0	U	U
U	P	USA	IE	B	U	U	0	U	U
U	P	USA	R	C	U	U	0	U	U
U	P	USA	R	B	U	U	0	U	U

Historical Instruments

U	P	USA	C	C	U	U	0	U	U
U	P	USA	C	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	C	C	U	U	0	U	U
U	P	USA	C	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	U	?	U	U	0	U	U
U	P	USA	U	B	U	U	0	U	U
U	P	USA	NP	C	U	U	0	U	U
U	P	USA	NP	B	U	U	0	U	U
U	P	USA	NP	C	U	U	0	U	U
U	P	USA	NP	B	U	U	0	U	U
U	P	USA	MB/NP	C	U	U	0	U	U
U	P	USA	MB/NP	B	U	U	0	U	U
U	P	USA	E	C	U	U	0	U	U
U	P	USA	E	B	U	U	0	U	U
U	P	USA	U	U	U	U	0	U	U
U	P	USA	U	U	U	U	0	U	U
U	P	USA	U	U	U	U	0	U	U
U	S	USA	R	B-flat	U	U	0	U	U
U	S	USA	R	C	U	U	0	U	U
U	S	USA	C	B-flat	U	U	0	U	U
U	S	USA	C	C	U	U	0	U	U
U	S	USA	E	B-flat	U	U	0	U	U
U	S	USA	E	C	U	U	0	U	U
U	S	USA	C	B-flat	U	U	0	C	U
U	S	USA	C	C	U	U	0	C	U

Historical Instruments

U	S	USA	E	B-flat	U	U	0	C	U
U	S	USA	E	C	U	U	0	C	U
U	S	USA	E	B-flat	U	U	0	U	U
U	S	USA	E	C	U	U	0	U	U
U	S	USA	G	B-flat	U	U	0	U	U
U	S	USA	G	C	U	U	0	U	U
U	S	USA	E	B-flat	U	U	0	U	U
U	S	USA	E	C	U	U	0	U	U
U	S	USA	NP	B-flat	U	U	0	U	U
U	S	USA	NP	C	U	U	0	U	U
U	S	USA	NP	B-flat	U	U	0	U	U
U	S	USA	NP	C	U	U	0	U	U
U	T	USA	M	U	U	Cyl	0	U	U
c. 1860	Ho	USA	R/Sfe/LM	U	U	U	0	U	Dayton C. Miller
1865-67	F	USA	R/C/BF	A-flat	U	U	0	U	Dayton C. Miller
19th c.	A	USA	NP/B	A-flat	U	U	0	U	Dayton C. Miller
19th c.	A	USA	P/BF	C	U	U	0	U	Dayton C. Miller
19th c.	A	USA	Pe/PM	B-flat	U	U	0	U	Dayton C. Miller
19th c.	C	USA	W/ST	B-flat	U	U	0	U	Dayton C. Miller
U	A	G	E/ST	C	U	U	0	U	Dayton C. Miller
c. 1926	I	USA	NP/BT	U	U	U	0	U	Dayton C. Miller
c. 1926	I	USA	U	U	U	U	0	U	Dayton C. Miller
19th c.	A	S	BO/BF	U	U	U	0	U	Dayton C. Miller
1816-36	Pr	E	P/BK	B-flat	U	U	0	U	Dayton C. Miller
c. 1850	St	S	CY/BF	B-flat	U	U	0	U	Dayton C. Miller
1802-21	C	E	P/BF	C	U	U	0	U	Dayton C. Miller
19th c.	A	USA	R/SF	E-flat	U	U	0	U	Dayton C. Miller
19th c.	A	USA	S	A-flat	U	U	0	U	Dayton C. Miller
1808-35	Pa	E	YW/BF	A	U	U	0	U	Dayton C. Miller
c. 1823	Po	E	YW/BF	A	U	U	0	U	Dayton C. Miller
1848-75	Ha	USA	R/SF	C	U	U	0	U	Dayton C. Miller
19th c.	A	USA	Gi	A	U	U	0	U	Dayton C. Miller
19th c.	A	USA	WB	A-flat	U	U	0	U	Dayton C. Miller
1836-74	C	USA	WR/SF	B-flat	U	U	0	U	Dayton C. Miller
1874-88	Hol	E	YW/BF	A-flat	U	U	0	U	Dayton C. Miller

Historical Instruments

1930	Ci	F	WB/BF	D	U	U	0	U	Dayton C. Miller
19th c.	A	E	R/SF	B	U	U	0	U	Dayton C. Miller
19th c.	A	USA	M/B	C	U	U	0	U	Dayton C. Miller
1836-74	C	USA	R/SF	U	U	U	0	U	Dayton C. Miller
19th c.	A	USA	GSF	B	U	U	0	U	Dayton C. Miller
19th c.	A	USA	R/SF	B-flat	U	U	0	U	Dayton C. Miller
19th c.	A	USA	M	C	U	U	0	U	Dayton C. Miller
19th c.	He	F	BO/BF	C	U	U	0	U	Dayton C. Miller
1917	Ad	G	BL/WM	B-flat	U	Con	0	U	Bate
U	As	E	BO/BF	B-flat	U	U	0	U	Bate
U	Ga	E	WB	A-flat	U	Cyl	0	U	Bate
U	Met	E	M	U	U	Cyl	0	U	Bate
U	W	E	BO	A-flat	U	Cyl	0	U	Bate
U	A	E	BO	A-flat	U	Cyl	0	U	Bate
U	A	E	B	A-flat	U	Cyl	0	U	Bate
U	A	E	CO	E-flat	U	U	0	U	Bate
1816-20	U	E	U	B-flat	U	U	0	U	Adam Carse
19th c.	U	E	U	C?	U	U	0	U	Adam Carse
19th c.	U	E	U	B-flat	U	U	0	U	Adam Carse
19th c.	U	?	Iron	B-flat	U	U	0	U	Metropolitan Museum of Art
ca. 1800	U	C	BO	C	U	Con	0	U	Metropolitan Museum of Art
1750-1770	U	G	M	B	U	U	0	U	Metropolitan Museum of Art
19th c.	U	I	M	C	U	U	0	U	Metropolitan Museum of Art
19th/20th c.	U	U	CO	B-flat	U	U	0	U	Metropolitan Museum of Art
20th c.	U	USA	Ste	A	U	U	0	U	Stearns Collection UM
20th c.	U	USA	Ste	A	U	U	0	U	Stearns Collection UM
19th c.	Wa	G	BO	B-flat	U	U	0	U	Stearns Collection UM
U	U	U	R	B-flat	U	U	0	U	Stearns Collection UM
U	U	U	NP	B-flat	U	U	0	U	Stearns Collection UM
U	U	U	E/SF	B-flat	U	U	0	U	Stearns Collection UM
19th c.	Clo	USA	NP	B-flat	U	U	0	U	Stearns Collection UM
U	U	U	B/BF	B-flat	U	U	0	U	Stearns Collection UM
U	U	U	B/BF	C	U	U	0	U	Stearns Collection UM
U	U	U	R/SF	C	U	U	0	U	Stearns Collection UM
19th c.	U	U	RM/BF	C	U	U	0	U	Stearns Collection UM

Historical Instruments

U	U	U	R/BF	U	U	U	0	U	Stearns Collection UM
U	U	U	E/SF	U	U	U	0	U	Stearns Collection UM
19th c.	U	U	RM/BF	U	U	U	0	U	Stearns Collection UM
Flageolets	Fl.	Fl.	Fl.	Fl.	Fl.	Fl.	Fl.	Fl.	Flageolets
c. 1900	R	USA	CO	C	U	U	1	U	George Bauer
c. 1900	R	USA	CO	C	U	U	4	U	George Bauer
c. 1900	R	USA	CO	C	U	U	6	U	George Bauer
c. 1900	R	USA	G	B	U	U	1	U	George Bauer
c. 1900	R	USA	G	B	U	U	6	U	George Bauer
c. 1900	R	USA	G	C	U	U	1	U	George Bauer
c. 1900	R	USA	G	C	U	U	6	U	George Bauer
Fl/Pic	F/P	F/P	F/P	F/P	F/P	F/P	F/P	F/P	Flageolets/Piccolos
c. 1900	R	USA	BO	D	U	U	1	U	George Bauer
c. 1900	R	USA	CO	D	U	U	1	U	George Bauer
c. 1900	R	USA	CO	D	U	U	4	U	George Bauer
c. 1900	R	USA	CO	D	U	U	6	U	George Bauer
U	U	U	G	D	U	U	6	U	U
U	G	F	BO	D	U	U	1	U	Clair Godfroy aîné
U	G	F	CO	D	U	U	1	U	Clair Godfroy aîné
U	G	F	CO	D	U	U	4	U	Clair Godfroy aîné
U	G	F	CO	D	U	U	6	U	Clair Godfroy aîné
1901	H	USA	G	U	U	U	4	U	U
1901	H	USA	G	U	U	U	6	U	U
U	M	USA	G	C	U	U	1	U	U
U	M	USA	G	C	U	U	4	U	U
U	M	USA	G	C	U	U	6	U	U
19th c.	A	U	R	F	U	U	1	U	Dayton C. Miller
1898-9	LH	U	BO	D(=C)	U	U	1	U	U
1898-9	LH	U	G	D(=C)	U	U	5	U	U
1898-9	LH	U	G	D(=C)	U	U	6	U	U
c. 1905	SR	USA	BO	C	U	U	1	U	U
c. 1905	SR	USA	G	C	U	U	5	U	U
c. 1905	SR	USA	G	C	U	U	6	U	U

Historical Instruments

Piccolos	Picc	Picc	Picc	Picc	Picc	Picc	Picc	Picc	Piccolos
c. 1900	R	USA	BO	D/E-flat	U	U	1	U	George Bauer
c. 1900	R	USA	C	D/E-flat	U	U	1	U	George Bauer
c. 1900	R	USA	C	D/E-flat	U	U	1	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	4	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	4	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	Me	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	Clo	USA	C	D/E-flat	U	U	1	U	George Bauer
c. 1900	Clo	USA	G	D/E-flat	U	U	4	U	George Bauer
c. 1900	Clo	USA	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	Clo	USA	G	D/E-flat	U	U	4	U	George Bauer
c. 1900	Clo	USA	G	D/E-flat	U	U	4	U	George Bauer
c. 1900	Bu	F	G	D/E-flat	U	U	6	U	George Bauer
c. 1900	R	USA	G	D/E-flat	U	U	U	U	George Bauer
c. 1900	R	USA	U	D/E-flat	U	U	U	U	George Bauer
c. 1900	BC	F	U	D/E-flat	U	U	U	U	George Bauer
c. 1900	B	G	G	U	U	U	U	U	Theodore Berteling
c. 1900	B	G	G	U	U	U	U	U	Theodore Berteling
c. 1900	B	G	G	U	U	U	U	U	Theodore Berteling
c. 1900	B	G	G	U	U	U	U	U	Theodore Berteling
c. 1900	U	U	BE	A-flat	U	Con	U	U	Cundy-Bettony
c. 1900	U	U	U	U	U	Cyl	U	Co	Cundy-Bettony
c. 1900	U	U	SS	U	U	Con	U	U	Cundy-Bettony
c. 1900	U	U	SS	U	U	Cyl	U	U	Cundy-Bettony
c. 1900	B	G	SP	C/D-flat	U	Cyl	U	BW	Cundy-Bettony
c. 1900	B	G	SP	D-flat	U	Cyl	U	BW	Cundy-Bettony

Historical Instruments

c. 1900	Pra	E	C	D/E-flat/F	U	U	U	Pa	Boosey & Co.
c. 1900	Pra	E	U	D/E-flat/F	U	U	U	Pa	Boosey & Co.
c. 1900	Pra	E	U	D/E-flat/F	U	U	U	Pa	Boosey & Co.
c. 1900	Pra	E	U	D/E-flat/F	U	U	U	Pa	Boosey & Co.
c. 1900	U	U	U	U	U	U	U	B	Boosey & Co.
c. 1900	U	U	U	U	U	U	U	B	Boosey & Co.
c. 1900	U	U	C/E	F/D/E-flat	A=440	U	6	U	Boosey & Co.
c. 1900	U	U	C	E-flat	U	U	6	U	Boosey & Co.
c. 1900	U	U	C	D	A=440	U	6	U	Boosey & Co.
c. 1900	B	G	EB	U	A=440	Cyl	U	B	Boosey & Co.
c. 1900	B	G	NS	C	U	U	U	B/BW	Boosey & Co.
c. 1900	B	G	SP	D-flat	U	U	U	B/BW	Boosey & Co.
c. 1900	Me	G	G	C	U	U	6	Me	Buegeleisen & Jacobson
c. 1900	Me	G	G	D-flat	U	U	6	Me	Buegeleisen & Jacobson
c. 1900	Me	G	G	C	U	U	6	Me	Buegeleisen & Jacobson
c. 1900	Me	G	G	D-flat	U	U	6	Me	Buegeleisen & Jacobson
U	U	U	E/M	U	A=440	U	U	B	Conn
U	U	U	E/M	U	A=440	U	U	B	Conn
U	U	U	E/SS	U	U	U	U	B	Couesnon
U	U	U	U	C/E-flat	U	Cyl/Con	U	B	Couesnon
U	Bu	F	G	E-flat	U	U	U	B	J. Howard Foote
U	Bu	F	G	D	U	U	U	B	J. Howard Foote
U	Be	F	E	E-flat	U	U	U	B	J. Howard Foote
U	Be	F	E	D	U	U	U	B	J. Howard Foote
U	G	F	G	E-flat	U	U	U	B	J. Howard Foote
U	G	F	G	D	U	U	U	B	J. Howard Foote
U	U	U	G	E-flat	U	U	1	U	U
U	U	U	G	D	U	U	1	U	U
U	U	U	G	B-flat	U	U	1	U	U
U	U	U	G	B-flat	U	U	6	U	U
U	U	U	G	E-flat	U	U	4	U	U
U	U	U	G	D	U	U	4	U	U
U	U	U	G	E-flat	U	U	6	U	U
U	U	U	G	D	U	U	6	U	U
U	Be	F	C	E-flat	U	U	6	U	U

Historical Instruments

U	Be	F	C	D	U	U	6	U	U
U	Me	G	G	E-flat	U	U	6	U	U
U	Me	G	G	D	U	U	6	U	U
U	G	F	E/G	U	U	U	U	U	U
U	G	F	E/G	U	U	U	U	U	U
U	G	F	U	U	U	U	U	U	U
U	G	F	W	U	U	U	4	U	U
U	G	F	W	U	U	U	5	U	U
U	G	F	W	U	U	U	4	U	U
U	G	F	W	U	U	U	5	U	U
U	G	F	W	U	U	U	4	U	U
U	G	F	W	U	U	U	5	U	U
U	Clo	USA	G	E-flat	U	U	U	U	U
U	Clo	USA	G	B-flat	U	U	U	U	U
U	U	U	BO	D	U	U	1	U	U
U	U	U	BO	E-flat	U	U	1	U	U
U	U	U	C	D	U	U	1	U	U
U	U	U	C	E-flat	U	U	1	U	U
U	U	U	G	D	U	U	4	U	U
U	U	U	G	E-flat	U	U	4	U	U
U	U	U	G	D	U	U	4	U	U
U	U	U	G	E-flat	U	U	U	U	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	6	U	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	6	U	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	U	U	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	U	U	U
U	U	U	G	D	U	U	6	U	U
U	U	U	U	E-flat	U	U	U	U	U
U	U	U	G	D	U	U	6	Me	U

Historical Instruments

U	U	U	G	E-flat	U	U	6	Me	U
U	U	U	G	D	U	U	6	Me	U
U	U	U	G	E-flat	U	U	U	Me	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	6	U	U
U	Clo	USA	C	D	U	U	1	U	U
U	Clo	USA	C	E-flat	U	U	1	U	U
U	Clo	USA	G	D	U	U	5	U	U
U	Clo	USA	G	E-flat	U	U	4	U	U
U	Clo	USA	G	D	U	U	6	U	U
U	Clo	USA	G	E-flat	U	U	6	U	U
U	Clo	USA	G	D	U	U	6	U	U
U	Clo	USA	G	E-flat	U	U	6	U	U
U	Clo	USA	G	D	U	U	6	U	U
U	Clo	USA	G	E-flat	U	U	6	U	U
U	B	G	U	D	U	U	U	U	U
U	B	G	U	E-flat	U	U	U	U	U
U	Ru	E	EB	D	U	U	U	U	U
U	Ru	E	EB	E-flat	U	U	U	U	U
U	Hec	G	U	U	U	Con	6	U	U
U	Hec	G	U	U	U	Con	6	U	U
U	Hec	G	U	U	U	Con	U	U	U
U	Hec	G	U	U	U	Con	U	U	U
U	H	USA	G	D/E-flat	U	U	1	U	U
U	H	USA	G	D/E-flat	U	U	4	U	U
U	H	USA	G	D/E-flat	U	U	4	U	U
U	H	USA	G	D/E-flat	U	U	6	U	U
U	H	USA	G	D/E-flat	U	U	6	U	U
U	H	USA	G	D/E-flat	U	U	6	U	U
U	H	USA	G	D/E-flat	U	U	6	Me	U
U	K	G	P	D/E-flat	A=435	U	1	S	U
U	K	G	BO	D/E-flat	A=435	U	1	S	U
U	K	G	G	D/E-flat	A=435	U	1	S	U
U	K	G	G	D/E-flat	A=435	U	1	S	U
U	K	G	G	D/E-flat	A=435	U	4	S	U

Historical Instruments

U	K	G	G	D/E-flat	A=435	U	4	S	U
U	K	G	G	D/E-flat	A=435	U	4	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	D/E-flat	A=435	U	6	S	U
U	K	G	G	U	U	U	6	S	U
U	K	G	G	U	U	U	6	Me	U
U	K	G	G	U	U	U	6	Me	U
U	K	G	G	U	U	U	6	Me	U
U	K	G	G	U	U	U	6	Me	U
U	L	USA	C	E-flat	U	U	1	U	U
U	L	USA	G	E-flat	U	U	4	U	U
U	L	USA	G	E-flat	U	U	4	U	U
U	L	USA	G	E-flat	U	U	6	U	U
U	L	USA	G	E-flat	U	U	6	U	U
U	L	USA	G	E-flat	U	U	6	U	U
U	L	USA	G	E-flat	U	U	6	U	U
U	L	USA	G	E-flat	U	U	6	Me	U
U	Clo	USA	G	E-flat	U	U	6	U	U
U	Clo	USA	G	E-flat	U	U	6	U	U
U	Me	G	G	D	U	U	6	U	U
U	Me	G	G	E-flat	U	U	6	U	U
U	BC	E	C	E-flat	U	U	U	B	U
U	M	USA	G	U	U	U	U	B	U
U	M	USA	G	U	U	U	U	B	U
U	M	USA	G	U	U	U	U	B	U
U	M	USA	G	C/D/D-flat/E-flat	U	U	1	S	U
U	M	USA	G	C/D/D-flat/E-flat	U	U	1	S	U
U	M	USA	G	C/D/D-flat/E-flat	U	U	4	S	U
U	M	USA	G	C/D/D-flat/E-flat	U	U	6	S	U

Historical Instruments

U	M	USA	G	C/D/D-flat/E-flat	U	U	6	S	U
U	M	USA	G	U	U	U	6	S	U
U	M	USA	G	U	U	U	6	S	U
U	M	USA	G	U	U	U	6	S	U
U	M	USA	G	U	U	U	6	Me	U
U	M	USA	G	U	U	U	6	Pa	U
U	Pe	G	G	D-flat	A=440	U	6	S	U
U	Pe	G	G	D-flat/C	A=440	U	U	B	U
U	Pe	G	U	D-flat/C	A=440	U	U	B	U
U	U	U	G	D	U	U	6	U	U
U	U	U	G	E-flat	U	U	6	U	U
U	TL	F	E	D/E-flat	U	U	6	U	U
U	TL	F	E	D/E-flat	U	U	6	U	U
U	TL	F	E	D/E-flat	U	U	U	B	U
U	U	USA	G	D/E-flat	U	U	6	Me	U
U	U	USA	G	D/E-flat	U	U	6	Me	U
U	P	USA	C	B-flat	U	U	1	U	U
U	P	USA	C	B-flat	U	U	1	U	U
U	P	USA	C	B-flat	U	U	4	U	U
U	P	USA	C	B-flat	U	U	6	U	U
U	S	USA	G	B-flat	U	U	1	U	U
U	S	USA	G	B-flat	U	U	1	U	U
U	S	USA	G	B-flat	U	U	6	U	U
U	S	USA	G	B-flat	U	U	1	U	U
U	S	USA	G	D	U	U	1	U	U
U	S	USA	G	D	U	U	4	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	6	U	U
U	S	USA	G	D	U	U	8	U	U
U	S	USA	G	D	U	U	6	Me	U
U	S	USA	G	D	U	U	6	Me	U

Historical Instruments

U	S	USA	G	E-flat	U	U	1	U	U
U	S	USA	G	E-flat	U	U	U	U	U
U	S	USA	G	E-flat	U	U	4	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	U	U
U	S	USA	G	E-flat	U	U	6	Me	U
U	S	USA	G	E-flat	U	U	6	Me	U
U	Me	G	U	D	U	U	6	U	U
U	Me	G	U	E-flat	U	U	6	U	U
U	Clo	USA	C	D	U	U	6	U	U
U	Clo	USA	C	D	U	U	U	U	U
U	Clo	USA	C	E-flat	U	U	6	U	U
U	Clo	USA	C	E-flat	U	U	6	U	U
U	Clo	USA	C	B-flat	U	U	6	U	U
U	U	U	G	D	U	Cyl	6	U	U
U	U	U	G	E-flat	U	Cyl	6	U	U
U	E	F	C	D	U	U	U	B	U
U	E	F	C	E-flat	U	U	U	B	U
U	Clo	USA	G	D	U	U	U	B	U
U	Clo	USA	G	E-flat	U	U	U	B	U
U	Clo	USA	G	D	U	U	U	B	U
U	Clo	USA	G	E-flat	U	U	U	B	U
U	T	F	E/G	U	U	U	U	B	U
U	T	F	E/G	U	U	U	U	B	U
U	T	F	E/G	U	U	U	6	NB	U
U	T	F	E/G	U	U	U	5	NB	U
U	T	F	E/G	U	U	U	4	NB	U
U	T	F	E/G	U	U	U	6	NB	U
U	T	F	E/G	U	U	U	5	NB	U
U	T	F	E/G	U	U	U	4	NB	U
U	T	F	B/G	U	U	U	6	NB	U

Historical Instruments

U	T	F	B/G	U	U	U	5	NB	U
U	T	F	B/G	U	U	U	4	NB	U
U	T	F	B/G	U	U	U	1	NB	U
U	T	F	B/G	U	U	U	1	NB	U
U	T	F	B/G	U	U	U	5	NB	U
U	T	F	B/G	U	U	U	4	NB	U
U	T	F	B/G	U	U	U	1	NB	U
U	T	F	B/G	U	U	U	1	NB	U
U	T	F	ME	U	U	Cyl	5	U	U
U	T	F	ME	U	U	Cyl	6	U	U
U	T	F	ME	U	U	Cyl	8	U	U
U	T	F	ME	U	U	Cyl	10	U	U
U	B	G	G	Db	A=450	Cyl	U	B	U
c. 1880	Me	G	C/I/SF	C	U	U	6	U	Dayton C. Miller
1833-47	Fi	USA	B/IR	E-flat	U	U	1	U	Dayton C. Miller
19th c.	A	U	B/IR	D-flat	U	U	1	U	Dayton C. Miller
1890	Sc	USA	G/SF	C	U	U	5	B	Dayton C. Miller
1862-81	B	G	G/SF	C	U	U	U	B	Dayton C. Miller
c. 1900	LL	F	C/SF	C	U	U	U	B	Dayton C. Miller
19th c.	A	U	WB/SF	C	U	U	6	U	Dayton C. Miller
19th c.	Ra	I	C/SF	C	U	U	7	U	Dayton C. Miller
19th c.	A	U	W/S	D-flat	U	U	6	U	Dayton C. Miller
19th c.	A	U	S	D-flat	U	U	6	U	Dayton C. Miller
1918	Ru	E	C/SF	C	U	U	U	B	Dayton C. Miller
19th c.	A	U	C/SF	C	U	U	1	U	Dayton C. Miller
c. 1900	Me	G	G/E/SF	D-flat	U	U	6	U	Dayton C. Miller
19th c.	Ma	F	C/IR	C	U	U	5	U	Dayton C. Miller
19th c.	Ri	G	G/SF	C	U	U	6	U	Dayton C. Miller
c. 1914	Al	USA	U	C/D-flat	U	U	U	B	Dayton C. Miller
19th c.	A	U	WB	D-flat	U	U	1	U	Dayton C. Miller
19th c.	A	U	G/S	C	U	U	8	U	Dayton C. Miller
1897	Hay	USA	G/SF	C	U	U	U	U	Dayton C. Miller
19th c.	A	U	W/BK/IR	C	U	U	1	U	Dayton C. Miller
19th c.	Lu	I	E/SF	C	U	U	6	U	Dayton C. Miller
19th c.	Z	A	E/SF	D-flat	U	U	6	U	Dayton C. Miller

Historical Instruments

19th c.	Mai	I	B/BK/BH	D-flat	U	U	5	U	Dayton C. Miller
c. 1920	Mai	I	WB/SF	A-flat	U	U	6	U	Dayton C. Miller
19th c.	"S"	U	B/BK/IR	D-flat	U	U	1	U	Dayton C. Miller
c. 1922	Mai	I	I/SF	C	U	U	6	U	Dayton C. Miller
20th c.	Ra	I	S	C	U	U	7	U	Dayton C. Miller
19th c.	A	U	R/SF	C	U	U	1	U	Dayton C. Miller
c. 1906	Ra	I	C/SF	C	U	U	9	U	Dayton C. Miller
c. 1875-80	Le	F	C/SF	D-flat	U	U	6	U	Dayton C. Miller
c. 1862-81	B	G	G/SF	C	U	U	U	U	Dayton C. Miller
c. 1824	Mea	USA	B/BK/IR	A-flat	U	U	1	U	Dayton C. Miller
19th c.	A	U	C/SF	E-flat	U	U	4	U	Dayton C. Miller
19th c.	A	U	E/SF	E-flat	U	U	6	U	Dayton C. Miller
1820-47	Z	A	E/SF	F	U	U	4	U	Dayton C. Miller
c. 1878	Co	E	E/SF	D-flat	U	U	U	U	Dayton C. Miller
19th c.	Ber	USA	G/I/E/SF	D-flat	U	U	6	U	Dayton C. Miller
c. 1889	Ch	F	G/SF	D-flat	U	U	1	U	Dayton C. Miller
20th c.	Wal	E	C/E/SF	C	U	U	6	U	Dayton C. Miller
1820-47	Z	A	I/S/Go	C	U	U	6	U	Dayton C. Miller
20th c.	Ri	G	G/SF	D-flat	U	U	U	B	Dayton C. Miller
1888	Hg	USA	C/SF	C	U	U	U	B	Dayton C. Miller
c. 1905	Hw	E	G/SF	E-flat	U	U	6	U	Dayton C. Miller
19th c.	Ber	USA	G/SF	C	U	U	U	B	Dayton C. Miller
20th c.	Con	USA	S/E/Go	C	U	U	U	B	Dayton C. Miller
1838-52	Wy	E	R/S/SF	C	U	U	6	U	Dayton C. Miller
18th c.	A	G	E/S/I	C	U	U	1	U	Dayton C. Miller
c. 1926	Ws	USA	S	C	U	U	U	B	Dayton C. Miller
19th c.	A	U	W/I/BK	C	U	U	1	U	Dayton C. Miller
c. 1827-40	Ma	F	B/BK/BH	C(?)	U	U	1	U	Dayton C. Miller
19th c.	Ste	G	B/BK/BH	C	U	U	1	U	Dayton C. Miller
c. 1775-85	LL	F	B/BK/BH	C	U	U	1	U	Dayton C. Miller
19th c.	O	G	YW/SF	C	U	U	6	U	Dayton C. Miller
19th c.	Bu	F	ME/I	C	U	U	5	U	Dayton C. Miller
1883-1910	Bo	USA	C/SF	C	U	U	U	B	Dayton C. Miller
19th c.	A	U	G/I/SF	C	U	U	8	U	Dayton C. Miller
20th c.	A	J	ME	D-flat	U	U	U	U	Dayton C. Miller

Historical Instruments

c. 1818-40	Eu	G	G/I/SF	D-flat	U	U	6	U	Dayton C. Miller
19th c.	A	U	C/I/SF	D-flat	U	U	6	U	Dayton C. Miller
c. 1818-40	Eu	G	R/SF	C	U	U	6	U	Dayton C. Miller
19th c.	Li	G	E/SF	C	U	U	6	U	Dayton C. Miller
1875	La	R	G/SF	C	U	U	6	U	Dayton C. Miller
c. 1824-51	Fe	G	B/I/SK	D-flat	U	U	1	U	Dayton C. Miller
19th c.	Mah	G	R/C/SF	U	U	U	5	U	Dayton C. Miller
1871-1904	Cha	E	C/SF	D-flat	U	U	6	U	Dayton C. Miller
19th c.	Me	G	G/E/I/SF	E-flat	U	U	6	U	Dayton C. Miller
c. 1830	D	G	B/I/BK	C	U	U	1	U	Dayton C. Miller
c. 1780-1837	Buh	G	B/I/BK	E-flat	U	U	1	U	Dayton C. Miller
1902	J	F	S	C	U	U	U	B	Dayton C. Miller
1840-61	Ca	E	R/SF	C	U	U	5	B	Dayton C. Miller
c. 1845	Bur	E	Ma	C	U	U	1	U	Dayton C. Miller
c. 1880	A	U	C/SF	D-flat	U	U	6	U	Dayton C. Miller
19th c.	Pot	E	W/BK	C	U	U	1	U	Dayton C. Miller
c. 1855-71	Cli	E	G	C	U	U	U	Cl	Dayton C. Miller
1820-29	Mo	E	G	C	U	U	4	U	Dayton C. Miller
1834-62	Cl	E	BO	E-flat	U	U	1	U	Dayton C. Miller
1935	Ws	USA	S	C	U	U	U	B	Dayton C. Miller
1855-71	Rud	E	R	C	U	U	6	U	Dayton C. Miller
c. 1875	Pi	I	EB	C	U	U	U	Br	Dayton C. Miller
20th c.	How	E	EB	C	U	U	U	B	Dayton C. Miller
1939	Lew	USA	PI	U	U	U	U	U	Dayton C. Miller
19th c.	Clo	USA	G	C	U	U	6	U	Dayton C. Miller
1842-59	Hac	E	BO	U	U	U	U	U	Dayton C. Miller
1844-50	Bi	E	BO	E-flat	U	U	1	U	Dayton C. Miller
19th c.	A	U	R	C	U	U	6	U	Dayton C. Miller
19th c.	A	U	BO	C	U	U	1	U	Dayton C. Miller
19th c.	U	G	R	C	U	U	6	U	Dayton C. Miller
19th c.	A	U	G	D-flat	U	U	6	U	Dayton C. Miller

Historical Instruments

19th c.	A	U	G/SF	C	U	U	6	U	Dayton C. Miller
c. 1890	Bou	F/USA	G/SF	C	U	U	U	B	Dayton C. Miller
c. 1838	Camp	E	G/SF	C(?)	U	U	6	U	Dayton C. Miller
U	Boo	E	BO	E-flat	U	U	5	U	Bate
1867	Col	E	ME	U	U	Con	U	U	Bate
U	Gau	F	U	E-flat	U	U	5	U	Bate
U	G	F	C	U	U	U	U	B	Bate
U	Go	U	BO	U	U	U	1	U	Bate
U	Has	E	BO	U	U	U	5	U	Bate
U	Hays	U	C	U	U	U	6	U	Bate
U	Her	U	BO	U	U	U	4	U	Bate
U	Hol	U	C	U	U	U	1	U	Bate
U	Par	U	M	E-flat	U	U	1	U	Bate
U	Pot	E	C	E-flat	U	U	5	U	Bate
1867	Ru	E	ME	U	U	U	U	U	Bate
U	Tulou	F	C	U	U	U	5	U	Bate
U	Tulou	F	C	D-flat	U	U	4	U	Bate
U	Wal	E	BL	E-flat	U	U	4	U	Bate
U	Wal	E	BO	D	U	U	U	U	Bate
1823	Wh	U	I	U	U	U	1	U	Bate
U	U	E	BL	E-flat	U	U	5	U	Bate
U	A	E	BO	D	U	U	1	U	Bate
U	A	U	BL	D-flat	U	U	6	U	Bate
c. 1820-25	Parker	E	U	U	U	U	1	U	Adam Carse
19th c.	Hawes	E	U	U	U	U	4	U	Adam Carse
19th c.	Kohler	E	U	E-flat	U	U	4	U	Adam Carse
U	Da	E	U	U	U	U	6	U	Adam Carse
19th c.	U	U	I	U	U	U	6	U	Adam Carse
19th c.	Th	E/F	U	E-flat	U	U	U	B	Adam Carse
19th c.	Mi	E	U	U	U	U	4	U	Adam Carse
18th c.	U	F	I	F	U	U	1	U	Metropolitan Museum of Art

Historical Instruments

19th c.	U	F	G	D	U	U	1	U	Metropolitan Museum of Art
19th c.	U	F	BO	D-flat	U	U	1	U	Metropolitan Museum of Art
c. 1900	Me	G	G	F	U	U	6	U	Metropolitan Museum of Art
c. 1900	Re	G	G	D	U	U	6	U	Metropolitan Museum of Art
19th c.	U	E	C	B	U	U	4	U	Metropolitan Museum of Art
U	G	G	BO	U	U	U	1	U	U
18th c.	Pie	U	BO	U	U	U	1	U	U
U	Tb	U	BO	U	U	U	1	U	U
U	Wai	E	BO	U	U	U	1	U	U
U	Go	E	BO	U	U	U	1	U	U
U	Pot	E	BO	U	U	U	1	U	U
U	Pia	I	BO	U	U	U	4	U	U
U	Kl	G	E	U	U	U	7	U	U
U	Ta	F	E	U	U	U	4	U	U
U	MI	F	E	U	U	U	1	U	U
U	G	F	E	U	U	U	1	U	U
U	Asc	U	E	U	U	U	1	U	U
c. 1830	U	A	B	U	U	U	4	U	U
c. 1840	U	E	C	U	U	U	4	U	U
U	Laf	F	C	U	U	U	5	U	U
U	Ba	USA	C	U	U	U	4	U	U
U	Wo	E	C	U	U	U	4	U	U
U	U	U	BO	U	U	U	0	U	U
U	Bc	F	BL	U	U	U	U	B	U
U	Wal	E	C	U	U	U	6	U	U
U	Ke	U	S	G	U	U	0	U	U
U	Bar	E	M	U	U	U	5	U	U
U	Sch	G	BL	U	U	U	U	U	U
c. 1900	U	G	BL	U	U	U	9	U	U
U	Haw	E	BL	U	U	U	U	B	U
U	Ru	E	C	U	U	U	U	#	U

Historical Instruments

U	U	E	EB	U	U	U	U	#	U
U	Ru	E	BL	U	U	U	U	B	U
U	Ro	G	C	U	U	U	U	B	U
c. 1920	U	F	SP	U	U	Con	U	B	U
19th c.	U	E	W	D	U	U	1	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	1	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	4	U	Stearns Collection, UM
19th c.	U	E	BO	D	U	U	5	U	Stearns Collection, UM
19th c.	U	E	BO	D	U	U	5	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	6	U	Stearns Collection, UM
U	SM	U	CO	D/Eb(=C/Db)	U	U	6	U	U
U	SM	U	CO	B(=A)	U	U	1	U	U
U	SM	U	CO	B(=A)	U	U	4	U	U
U	SM	U	CO	C(=B)	U	U	1	U	U
U	SM	U	CO	C(=B)	U	U	4	U	U
U	SM	U	G	U	U	U	U	U	U
1881	LH	U	G	C	U	U	U	U	U
1881	LH	U	G	DB	U	U	U	U	U
1881	LH	U	G	C	U	U	U	U	U
1881	LH	U	G	Db	U	U	U	U	U
1881	LH	U	G	C	U	U	4	U	U
1881	LH	U	G	Db	U	U	4	U	U
1881	LH	U	G	C	U	U	6	U	U
1881	LH	U	G	Db	U	U	6	U	U
1881	LH	U	G	C	U	U	6	U	U
1881	LH	U	G	Db	U	U	6	U	U
1881	LH	U	G	C	U	Cyl	6	U	U
1881	LH	U	G	Db	U	Cyl	6	U	U
1888	Br	U	CO	Bb/C(=Ab/B)	U	U	1	U	U

Historical Instruments

U	U	E	EB	U	U	U	U	#	U
U	Ru	E	BL	U	U	U	U	B	U
U	Ro	G	C	U	U	U	U	B	U
c. 1920	U	F	SP	U	U	Con	U	B	U
19th c.	U	E	W	D	U	U	1	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	1	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	4	U	Stearns Collection, UM
19th c.	U	E	BO	D	U	U	5	U	Stearns Collection, UM
19th c.	U	E	BO	D	U	U	5	U	Stearns Collection, UM
19th c.	U	E	R	D	U	U	6	U	Stearns Collection, UM
U	SM	U	CO	D/Eb(=C/Db)	U	U	6	U	U
U	SM	U	CO	B(=A)	U	U	1	U	U
U	SM	U	CO	B(=A)	U	U	4	U	U
U	SM	U	CO	C(=B)	U	U	1	U	U
U	SM	U	CO	C(=B)	U	U	4	U	U
U	SM	U	G	U	U	U	U	U	U
1881	LH	U	G	C	U	U	U	U	U
1881	LH	U	G	DB	U	U	U	U	U
1881	LH	U	G	C	U	U	U	U	U
1881	LH	U	G	Db	U	U	U	U	U
1881	LH	U	G	C	U	U	4	U	U
1881	LH	U	G	Db	U	U	4	U	U
1881	LH	U	G	C	U	U	6	U	U
1881	LH	U	G	Db	U	U	6	U	U
1881	LH	U	G	C	U	U	6	U	U
1881	LH	U	G	Db	U	U	6	U	U
1881	LH	U	G	C	U	U	6	U	U
1881	LH	U	G	Db	U	U	6	U	U
1881	LH	U	G	C	U	Cyl	6	U	U
1881	LH	U	G	Db	U	Cyl	6	U	U
1888	Br	U	CO	Bb/C(=Ab/B)	U	U	1	U	U

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1888	Br	U	CO	D(=C)	U	U	6	U	U
1888	Br	U	CO	Eb(=Db)	U	U	6	U	U
1888	Br	U	CO	Bb(=Ab)	U	U	6	U	U
1888	Br	U	G	D(=C)	U	Cyl	6	U	U
1897	SR	USA	CO	D/Eb(=C/Db)	U	U	1	U	U
1897	SR	USA	CO	D/Eb(=C/Db)	U	U	1	U	U
1897	SR	USA	G	D/Eb(=C/Db)	U	U	4	U	U
1897	SR	USA	G	D/Eb(=C/Db)	U	U	6	U	U
1897	SR	USA	I/G	D/Eb(=C/Db)	U	U	6	U	U
1897	SR	USA	U	D/Eb(=C/Db)	U	U	U	U	U
1898-9	LH	U	CO	D/Eb(=C/Db)	U	U	1	U	U
1898-9	LH	U	CO	D/Eb(=C/Db)	U	U	4	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	4	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	4	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	6	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	6	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	6	U	U
1898-9	LH	U	U	D/Eb(=C/Db)	U	U	6	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	6	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	U	U	U
1898-9	LH	U	CO	C/Db	U	U	U	B	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	U	U	U
1898-9	LH	U	G	D/Eb(=C/Db)	U	U	6	U	U
c. 1905	SR	USA	CO	D/Eb(=C/Db)	U	U	1	U	U
c. 1905	SR	USA	G	D/Eb(=C/Db)	U	U	1	U	U
c. 1905	SR	USA	G	D/Eb(=C/Db)	U	U	4	U	U
c. 1905	SR	USA	G	D/Eb(=C/Db)	U	U	6	U	U
c. 1905	SR	USA	G	D/Eb(=C/Db)	U	U	6	Me	U
c. 1905	SR	USA	G	D/Eb(=C/Db)	U	U	6	U	U
U	Con	USA	M	Eb/D(=Db/C)	U	U	U	B	U
U	Con	USA	M	Eb/D(=Db/C)	U	U	U	B	U

Historical Instruments

Tin Whistle	TW	TW	TW	TW	TW	TW	TW	TW	Tin Whistles
c. 1900	R	USA	T	U	U	U	U	U	George Bauer
c. 1900	R	USA	B	U	U	U	U	U	George Bauer
c. 1900	R	USA	NP	U	U	U	U	U	George Bauer