THEOBALD BOEHM AND THE HISTORY OF THE ALTO FLUTE INCLUDING
THE FACSIMILE EDITION OF HIS ARRANGEMENT OF BEETHOVEN'S
LARGO FROM THE CONCERTO FOR PIANO, OP. 15, NO. 1 FOR
ALTO FLUTE AND PIANO (C. 1858), WITH THREE
RECITALS OF SELECTED WORKS BY
GRIFFES, TELEMANN, BARTÓK,
JOLIVET, GAUBERT,
AND OTHERS

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AND OTHERS

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF MUSICAL ARTS

By

Andrea Redcay, B.Mus., M.Mus.
Denton, Texas
May, 1997
Redcay, Andrea, Theobald Boehm and The History of the Alto Flute, Including

An historical perspective of Theobald Boehm (1794-1881) and his design of the modern alto flute. Chapters I and II discuss the development of design, playing technique and repertoire of the ancestors of the modern alto flute beginning with the Renaissance consorts detailed in the treatises of Agricola, Praetorius and Mersenne, through the Baroque *flûte d'amour* and its use in the music of J.S. Bach, to Boehm's alto flute design (c. 1855) and its use in early twentieth-century orchestral and chamber repertoire such as Stravinsky's *Le Sacre du Printemps* (1911), ending with specific aspects of contemporary alto flute design and manufacture since 1950, including the innovations of Dutch flutemaker Eva Kingma. Chapters III and IV concentrate on Boehm's mechanical and acoustical developments for the concert flute in C, the resulting modern alto flute in G, and his career as a virtuoso flutist, teacher, and composer. Chapter V is a critical commentary on Boehm's arrangement of Beethoven's *Largo* from the *Concerto for Piano*, Op. 15, No. 1 for alto flute and piano (c. 1858). Appendices A and B include the facsimile of the unpublished *Largo* manuscript and a list of Boehm's works for alto flute.
Tape recordings of all performances submitted as dissertation requirements are on deposit in the University of North Texas Library.
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ANDREA REDCAY, flute
accompanied by
Rose Marie Chisholm, piano

Monday, February 20, 1995 5:00 pm  Concert Hall

Poem ................................................. Charles T. Griffes
(1884-1920)

Fantasie in D Minor ................................. Georg Phillip Telemann
Dolce
Allegro
Spirituoso

Fantasie in D Major ................................. Georg Phillip Telemann
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Chants populaires tristes
(Vieilles danses)
(1881-1945)
trans. Paul Arma

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assisted by
Rita Mitra, piano • Barbara Barber, violin • Laura Bruton, viola

Monday, September 18, 1995 6:30 pm Recital Hall

Sonatina .................................................. Eldin Burton
Allegretto grazioso
Andantino sognando
Allegro giocoso; quasi fandango

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Poco adagio
Allegro
Allegro

- pause -

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ANDREA REDCAY. flute
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Rose Marie Chisholm, piano

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THEOBALD BOEHM AND THE HISTORY OF THE
ALTO FLUTE, INCLUDING THE FACSIMILE EDITION
OF HIS ARRANGEMENT OF BEETHOVEN’S LARGO
FROM THE CONCERTO FOR PIANO, OP. 15, NO. 1
FOR ALTO FLUTE AND PIANO (C. 1858)

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Presented in partial fulfillment of the
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CHAPTER I

INTRODUCTION

Virtuoso flutist, inventor, and composer, Theobald Boehm (1794-1881) is best known for his significant achievements in acoustical and mechanical design of the modern concert flute. Few realize that Boehm is also responsible for the modern design of the alto flute, now enjoying a recent rise in popularity.

Boehm was the product of the early Romantic generation that valued highly the range of timbres available to the newly improved instruments of the 1830s. As a performer, Boehm always strove to produce a “singing” tone on his flute. His critics credited him with the ability to produce nuances in tone and a style superior in expression. Throughout his career, he continued to expand and improve his designs. The alto flute, created late in his career, illustrates this fact. Upon completion of the 1847 concert flute design, Boehm set about to apply the same design to a flute of lower pitch. He states his purpose in his treatise of 1871 as follows:

The long felt need for deeper, stronger, and at the same time more sonorous flute tones has not been satisfactorily provided for either by the former “Flûte d’amour” or by the extension to the foot of a C flute, since the tones thus obtained are weak and uncertain, and their combination difficult and entirely unpracticable.
There must be created an entirely new instrument in the family of flutes of deeper pitch, similar to the basset horn and the English horn.¹

The modern alto flute finds its origins in the consorts² of the sixteenth century. Current knowledge of the consorts comes from the wealth of iconography and major theoretical treatises of the period such as those of Virdung, Agricola, Praetorius, and Marsenne. The terminology and delineation of pitch and range in the consorts, however, are somewhat misleading, since the Renaissance alto flute became the Baroque concert flute in D; and the Renaissance bass flute in G became the flûte d'amour of the Baroque and immediate predecessor to the nineteenth-century alto flute.

The alto flute has experienced varying stages of use and nomenclature. For example, all of the following terms in Figure 1 are found in scores and literature from the Renaissance to the present and refer to the modern alto flute and its ancestors.

Figure 1. Nomenclature for ancestors of the modern alto flute.

<table>
<thead>
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<th>Term</th>
<th>Origin</th>
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<tr>
<td>altus/bassus</td>
<td>Latin</td>
</tr>
<tr>
<td>bass flute</td>
<td>English</td>
</tr>
<tr>
<td>contralto flute</td>
<td>English</td>
</tr>
<tr>
<td>flute in G</td>
<td>English</td>
</tr>
<tr>
<td>tenor/intermediate flute</td>
<td>English</td>
</tr>
<tr>
<td>flûte d'amour</td>
<td>French</td>
</tr>
<tr>
<td>flûte pastourelle</td>
<td>French</td>
</tr>
</tbody>
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² In the 16th and 17th centuries, an instrumental ensemble consisting of two to eight players of either the same family of instrument or of mixed families.
A common voice in Renaissance and Baroque chamber music, the alto flute lost popularity in the Classical era, as the popularity of concert D flute (ancestor to the modern C flute) increased. The solo repertoire for alto flute did not expand significantly beyond the late Baroque until Theobald Boehm created a modern alto flute ca. 1855 which featured a facile mechanism and a projecting tone. As a result, the alto flute was utilized as a color instrument in the expanded late-Romantic and early twentieth-century orchestra. Since 1950, innovators such as Dutch flutemaker Eva Kingma have continued advancements for the alto flute reaching a pinnacle of ergonomic and acoustical design thus promoting its use in the constantly expanding contemporary solo and chamber repertoire.

Boehm was not only a successful designer of flutes, but he also was responsible for several other important patents in a diverse range of fields including piano manufacture and iron smelting. In his long career he gained respect not only as a performer and inventor, but also as a fine teacher and composer. Of his complete compositional oeuvre, twenty-three arrangements for alto flute in various chamber settings mark a significant addition to the alto flute repertoire as the only surviving solo pieces for alto flute from the nineteenth century. These pieces have not yet been published and are available in manuscript from the Library of Congress’s Dayton C. Miller Collection.
Boehm’s *Largo* from the *Concerto for Piano*, Op. 15, No. 1 has been chosen as the critical edition accompanying this paper because it represents Boehm’s love for lyrical music and the resulting expression through the alto flute. This elegant *Largo* presents the little known Romantic repertoire for alto flute and promotes the alto flute as a solo instrument.
CHAPTER II

THE HISTORY OF THE MODERN ALTO FLUTE

1450-1750

Prior to the innovations of Jacques Hotteterre (1674-1763), little written information is available about the Medieval and Renaissance transverse flute family. The wealth of iconographical evidence testifies to the flute's widespread use, and provided in the treatises of the time are helpful explanations of flute size, playing technique, and repertoire.

The most detailed Renaissance and early Baroque sources available are those of Sebastian Virdung (Musica Getuscht, 1511); Martin Agricola (Musica Instrumentalis Deutsch, 1528, 1532, 1542, 1545); Michael Praetorius (Syntagma Musicum, 1615-19); Marin Mersenne (Harmonie Universelle, 1636-37); Philibert Jambe de Fer (Epitome Musical, 1556); and Pierre Trichet (Traité des Instruments de Musique, ca. 1640). Each of these sources refers to the flute in use during the fifteenth and sixteenth centuries as a flute of cylindrical bore with six finger holes and no keys.¹

Of these treatises, two give drawings of the transverse flute consort which includes the ancestor to the modern alto flute, the bassus usually pitched in G.

![Diagram of the Renaissance flute consort shown in treatises.](image)

**Figure 2.** The Renaissance flute consort shown in treatises.²
a. Consort of flutes from Agricola’s *Musica Instrumentalis Deutsch*, 1528
b. Consort of three flutes and fife from Praetorius’ *Syntagma Musicum*, 1615-19

The more common pitch for the Renaissance bass flute was G, however three copies of keyless cylindrical flutes in the Verona Collection, show that bass flutes were often pitched lower. These three replicas have give us valuable insight into bass flute dimensions.³ They measure:

1. Length from cork = 32.4”, Bore = 0.9”, Pitch = F-sharp
2. Length from cork = 34.5”, Bore = 1.02”, Pitch = F-natural
3. Length from cork = 38.4”, Bore = 1.02”, Pitch = E-flat

---

The extreme length of the E-flat flute created difficulties for the performer. An example of this is shown in Figure 3 where the player second from the left is reaching with a straight right arm, forcing the head to tilt far to the left.

Figure 3. Posture for playing the Renaissance bass flute.⁴

⁴Ibid, plate I.
The Renaissance sources also provide basic playing tutorials with each author focusing on one pertinent detail. For example, Trichet refers to properly holding and blowing the awkward bass flute when he writes:

If faut pour les entonner les tenir de travers joignant la bouche, et mettre la levre inférieure sur le bord de l'emboucheure en poussant le vent fort doucement, comme on fait au fifre, sauf la bass qui s'entonne quelquefois par derrier et se tient prez de la poitrine. (my italics)\(^5\)

Few of the surviving manuscripts from the fifteenth and sixteenth centuries specify instrumentation, so it is difficult to discern the specific use of the transverse flute family. However, Robert Weaver's article "Sixteenth Century Instrumentation,"\(^6\) cites two famous intermedii\(^7\) that specify transverse flutes: Corteccia's intermedi for the Cosimo de Medici wedding of 1539 and Bardi's intermedi to L'Amico Fido of 1585. The "Ritornello for three flutes" in Peri's Euridice (1600) which is commonly cited as an early example of "orchestration," according to Jocselyn Godwin, is a mistaken attribution. Godwin writes:

The passage in question, on pp. 11-12 of the original score, has three instrumental parts all in soprano clefs, with ranges F\(\sharp\)1 to E\(_2\), E\(_1\) to E\(_3\), and D\(_1\) to D\(_3\). They are thus suitable for tenor flutes. But the rubric says nothing about

---

\(^5\)Trichet, Trichet: extracts edited by F. Lesure in Annales Musicologiques III (1955), 72. Translation: It is necessary in producing a good sound [on the flute] to hold the lips firmly placing the lower lip on the edge of the embouchure hole while blowing lightly, like on the fife, except for the bass flute that sounds best when blown obliquely across the embouchure while holding the body [of the flute] close to the chest pointing the end of the flute behind.


\(^7\)In the Renaissance, a work between the acts of a play. Elaborate plays were staged for important state events such as for the weddings of the Medici family of Florence. These interludes between acts of the play were either purely instrumental or staged presentations with accompaniment.
“traverse”; it reads only: “Tirsi viene in scena sonando la presente Zinfonia con un Triflauto . . .” It is wrong to state, therefore, that flutes are specified. Peri does not tell us what to use to represent Tirsi’s “Triflauto,” or triple flute; recorders have just as much claim as transverse flutes.8

In the 60 years after Mersenne’s early Baroque treatise of 1636-37, several writers mention the bass transverse flute in various contexts, but it is not until the end of the seventeenth century that our knowledge of the transverse flute family through scores and documentation is augmented. A few early Baroque examples of composers scoring more specifically for different types of flutes include a rare example of the bass flute used soloistically in Schein’s Geistliche Konzerte (1626). The parts are of low range and the flute seems to provide balance to the violin part written at the same pitch. The “flute” in such English consort music as Morley’s Consort Lessons (1599) and Leighton’s Tears and Lamentations (1614) is sometimes thought to be a bass flute or bass recorder.9

In Mersenne’s treatise Harmonie Universelle (1637), he specifies only two sizes of flutes. Both are referred to as flûtes d’allemand, one pitched in D, the other in G. This indicates that the full consort of the sixteenth century was now disbanding and that certain members of the consort were developing distinctive characteristics for specific scoring.

Approximately seventy years after Mersenne’s treatise Jacques Hotteterre (1674-1763) published the first known flute tutor. Titled Principes de la Flûte Traversière, ou

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8 Godwin, 76.
9 Ibid.
"Flûte d’Allemagne" (1707), it is specifically written for the conical bore, one-key flute in D. By mid-seventeenth century, *flûte traversière* became synonymous with the increasingly popular concert flute in D, the basis for the concert flute of the Classical era. The popularity of the flute in D was due to its manageable size and easy tone production.

While the concert flute in D with its brighter tone quality was preferred for symphonic use, the lower-pitched members of the flute family such as the *flûte d’amour*, *quint* and *quart* bass flutes (pitched in F and G respectively), and the octave bass flute in D were favored for chamber music due to their darker, more sonorous tone quality. Figure 4 lists specific measurements for comparison among the various flutes of the Baroque.

Figure 4. Varying sizes of the Baroque flute.\textsuperscript{10}

<table>
<thead>
<tr>
<th>Maker and Instrument</th>
<th>Embouchure distance (mm)</th>
<th>Approximate pitch at a’ (Hz)</th>
<th>Diameter of conical bore (mm)</th>
</tr>
</thead>
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<td>Schuchart: concert flute (at a typical <em>corps de rechange</em> setting)</td>
<td>540</td>
<td>430</td>
<td>19-13.5</td>
</tr>
<tr>
<td>Fridrich: <em>flûte d’amour</em></td>
<td>683</td>
<td>350</td>
<td>19.5-13.6</td>
</tr>
<tr>
<td>Scherer: low <em>flûte d’amour</em> or <em>flûte pastourelle</em></td>
<td>715</td>
<td>330</td>
<td>19-13.5</td>
</tr>
<tr>
<td>Anciuti: bass flute in G\textsuperscript{11}</td>
<td>970</td>
<td>280</td>
<td>19.5-14</td>
</tr>
</tbody>
</table>


\textsuperscript{11} There was also a less frequently used octave bass flute pitched an octave below the concert flute in D.
When defining the differences in Baroque flutes, it is imperative to remember the wide variety in pitch levels across eighteenth-century Europe. Evidence from the period indicates that the pitch varied from $A = 350$ to $A = 500$. The continental standards were as follows: the medium ‘German’ pitch, which itself could vary by two-thirds of a tone; the ‘French chamber pitch’, a minor third below the medium; and the higher ‘choir pitch’ favored by the Italians (especially the Venetians) which is a minor third above the medium. It is assumed that due to the method for notation, which had all flutes written in D regardless of size, the performer moved freely from one flute to another. Thus, the Baroque flutist was expected to be well trained in transposition.

Quantz mentions in his *Versuch* (1752) that the low pitch was a distinctive feature of the influential early French flute. One of the very few surviving specimens of this type was made by the flutemaker Naust (c. 1700). The portrait in Figure 5 is a Naust flute. It is a mid-range flute of the *flûte d'amour* family pitched at $A = 360$. The three musicians in the Tournières painting of Figure 5 are thought to be Mssrs. de la Barre, Hotteterre, and Marais grouped around a score. The seated figure holds an ivory one-key flute, which is extremely long, thus low-pitched, and with offset third and sixth holes (necessary to execute technical passages on the very long body).

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12 Addington, 35.
Figure 5. A group of French musicians and a Baroque ivory one-key flute by Naust. Painting by Robert Tournières (1667-1752) (London National Gallery)\textsuperscript{13}

\textsuperscript{13} Bate, plate 3.
From the experience of playing on his French low-pitched replica flute, contemporary historian Christopher Addington describes the sound:

It has a far richer, more eloquent sound than any other flute I have heard; and it is perfectly suited to the music composed by the great flautists of the day, de la Barre, Hotteterre and Philidor. Not only is it tuned to a very low pitch, but it is designed to play particularly strongly in its lower range. Thus it sounds at its best playing the notes at the bottom of the staff, which were much favoured by those composers. It also has the plaintive quality considered typical of French flute music.\(^\text{14}\)

The early French flute ca. 1707-1722 was the subject of redesigning which changed its tone quality and expanded the range. Where the early French flute was constructed in three parts, the new design introduced first by Stanesby and P.J. Bressan around 1720 was constructed in four pieces. Some of the experiments in producing the new design included an extension of the foot to include C\(_1\), improved boring, and varied cork position and wall thickness. The new instrument had a more refined sound, a range of three octaves, and sounded much stronger in the notes above the staff. The new finger position allowed for more nimble handling as well.

The lower pitched four-piece French flute was referred to as the *flûte d’amour* or *flauto d’amore*. It is 100-150 mm longer than the concert flute and plays about a major or minor 3\(^{\text{rd}}\) below A = 440.\(^\text{15}\) The *flûte d’amour* differs in sound from the early French flute

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\(^{14}\) Addington, 39.

\(^{15}\) Addington, 40.
in that its middle and upper registers produce a more haunting veiled tone due to the more narrow bore.

The decade from 1720 to 1730 was a time of transition and innovation in the development of wind instruments throughout Europe. The Italians who traditionally favored the higher pitched qualities of the concert flute began to incorporate it into the lively orchestral music of the period. In general, the French maintained their dominance in flute performance, but declined in repertoire production. In Germany, however, the flute enjoyed a resurgence of interest primarily as a result of the work of J.S. Bach.

German composers favored the traditional standards of the lower-pitched flûte d'amour over the concert flute in D. Quantz describes the ideal flute tone quality in his Versuch as “thick, round, and masculine.” He continues saying, “In general, the most pleasing tone quality on the flute is that which more nearly resembles a contralto than a soprano, or which imitates the chest tones of the human voice.” The Germans held to the principal that the flûte d'amour was essentially a chamber instrument, one which could play serious, expressive music such as in the trio sonata.

Bach’s chamber music for the flute, composed between 1720-1730, is by most accounts considered to be written for the flûte d'amour, with the possible exceptions of the E-minor sonata (BWV 1034) and the G-major sonata (BWV 1038.) Bach was no doubt influenced by the leading authority on the French flute, Jacques Hotteterre, and Hotteterre’s textbook L'Art de Préluder (1712), which gives very detailed instruction on

the transposition of flute scores. However, three of Bach’s sonatas and the trio from The Musical Offering in their surviving forms suggest that Bach did not realize the difficulty in performing in the keys of E major, E-flat major, G minor and C minor. An experienced flutist of the time would have known that these keys were meant for transposition. Christopher Addington suggests that the several of Bach’s chamber works for the flute were intended for the flûte d’amour. Figure 6 illustrates Addington’s theory.

Figure 6. Bach’s chamber music for the flute: a reconstruction of the original tonalities.17

<table>
<thead>
<tr>
<th>BWV No.</th>
<th>Flute Part (Addington’s theory) for flûte d’amour</th>
<th>Keyboard Part (Bach’s manuscript)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1013</td>
<td>A Minor</td>
<td>Unaccompanied</td>
</tr>
<tr>
<td>1033</td>
<td>C Major</td>
<td>Originally unaccompanied</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(continuo later added by C.P.E. Bach)</td>
</tr>
<tr>
<td>1032</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>1030</td>
<td>B Minor</td>
<td>G Minor</td>
</tr>
<tr>
<td>1020</td>
<td>B Minor</td>
<td>G Minor</td>
</tr>
<tr>
<td>1031</td>
<td>G</td>
<td>E-flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(alternatively E)</td>
</tr>
<tr>
<td>1035</td>
<td>G</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(alternatively E-flat)</td>
</tr>
<tr>
<td>1079</td>
<td>E Minor</td>
<td>C Minor</td>
</tr>
<tr>
<td></td>
<td>(Musical Offering)</td>
<td></td>
</tr>
<tr>
<td>1034</td>
<td>E Minor</td>
<td>E Minor</td>
</tr>
<tr>
<td>1038</td>
<td>G</td>
<td>C,D, E-flat, or E</td>
</tr>
</tbody>
</table>

Contemporary historian Philip Bate has pointed out that flute obbligatos in Bach’s church cantatas are often intended for the flûte d’amour; more specifically Charles

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Sanford Terry, eminent English scholar and biographer of Bach, believes that the *Cantata No. 192* ("Nun danket Alle Gott"), the *St. Matthew Passion* and secular cantata *Vereinigte Zwietracht* are all intended for *flûte d’amour*. Terry based his theory on the fact that even though Bach specified "Flauto traverso", the lower range of the parts exceed the capability of the concert flute.\(^{18}\)

The *Christmas Oratorio*, and a group of overtures and concertos by Telemann, Graupner, and Molter dating from ca. 1730, provide the only surviving examples of specific scoring for *flûte d’amour*. Similar thematic material in the Baroque pastoral style occurs in each, and the final movements are in fast triple meter with frequent "hunting call" figures, far better represented by the wider bored alto voice rather than the thinner more shrill soprano concert flute.\(^{19}\)

Though the higher pitched concert flute increased in popularity by the mid-eighteenth century, Rococco composers such as Telemann, C.P.E. and W.F. Bach continued to write music that was far more idiomatic for the *flûte d’amour*. For example, Telemann’s *Twelve Fantasias* (ca. 1740) for unaccompanied flute is the only collection of pieces for the flute systematically covering a range of different keys.\(^{20}\) Historian Franz Vester has suggested that the more remote keys were intended for *flûte d’amour*. It is also possible that Telemann intended the exercises to be a thorough technical challenge for the newly popular concert flute. W.F. Bach wrote a collection of six duets for two flutes.

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\(^{18}\) Charles W. Smith, *The History and Literature of the Alto Flute*. (DMA dissertation, George Peabody College for Teachers, 1974; Ann Arbor, MI: UMI 75-12,432), 27.

\(^{19}\) Addington, “The Bach Flute,” 270.

\(^{20}\) Addington, “In Search of the Baroque Flute,” 45.
Two are in E-flat major and one is in F minor, keys rare for flute during the Baroque. The choice of keys indicates a direct suggestion for the *flûte d'amour* in B-flat.

**Bass Flutes**

Examples of scoring for the bass flute in G or D are not are much fewer than those for the *flûte d'amour*. Although we have a few surviving examples of the bass instrument, the repertoire is scant. C.P.E. Bach’s F Major Trio Sonata (WQ163) specifies “Bassflöte” (modern editions call for bass recorder). Favoured in France, the low *quart* and *quint* flutes, in A and G respectively, are found in such repertoire as Hottetterre’s *Air et brunettes* where the lowest voice of the trio plays bass to two higher-pitched flutes; Couperin’s *L’apothéose de Lulli* with bass flute in G; and Philidor’s *La chasse* for bass flute in G.\(^\text{21}\)

Flute makers at the end of the Baroque created elaborate designs for a five-key bass flute pitched in G or D (octave below the concert flute). The most remarkable of designs was that of J.M. Anciuti of Milan in 1739 shown in Figure 7.

\(\text{Figure 7. Bass flute by J. M. Anciuti (Milan 1739). (Vienna, Junghistorisches Museum, Sammlung alter Musikinstrumente)}\)^\(^\text{22}\)

\(^{21}\) Ibid, 44-45.

\(^{22}\) Ibid, 44
The Anciuti bass flute's bore and embouchure are based on that of the concert flute, but the length is almost doubled. The reach is solved by two ingenious devices: a curved head piece made out of a single piece of wood and ergonically designed finger holes that are raised out of the wall and cut at acute angles to aid in finger placement. The craftsmanship is unique and yet conservative in that it preserves the old style of the Renaissance keyless flutes.  

1750-1850

Between 1750 and 1830, prior to Theobald Boehm's work, flute makers consistently experimented with new designs, particularly in bore size and through the addition of keys. Even though there was a lack of standardization for all voices in the flute family, the concert flute in D was the most popular flute in orchestral, chamber and solo settings. From this period, there are no known surviving manuscripts that specify alto- and bass-voiced flutes, but surviving examples of instruments indicate that some flutists must have maintained the tradition of transposition.

The supplement to the *Encyclopédie* of Diderot and d'Alembert (Figure 8) gives a detailed description and drawing of the five-key 'bass transverse flute' which indicates that it had undergone improvements in design similar to that of the concert flute.

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23 At least 100 years prior, instrument makers were solving the reach problems of larger instruments with the addition of keys.
24 Diderot et D'Alembert, “Lutherie,” *Encyclopédie* V/XXXV, plate IX, Fig. 34. Paris (1751-72).
Figure 8. “Bass Transverse Flute”, excerpt of definition and drawing from Diderot and D’Alembert *Encyclopédie* (1751-72).

The elbow, B, which joins the head joint to the rest of the instrument, is a tube of brass which fits into boxes [sockets] that are made in the ends of the pieces which it joins. The holes 1, 3, 4, and 6, which could not be reached by the fingers because of the length of the instrument, are covered by the keys opposite them. These keys are made in such a manner that when they are left to their springs, they leave the holes of which they are opposite open, and when borne down upon by a finger, they [the holes] are closed, the valves of these keys being between the hinge and the point where one applies the finger; but for the E-flat [D-sharp], it is the hinge which is between the valve and the point where one puts the finger. This instrument serves as the bass in the concerts [consorts] of the flute. Its very low pitch is a G of the clavecin [harpsichord]; that is, as was said before, a fifth below the ordinary flutes which are two feet in length. (Translation by Charles W. Smith)\(^{25}\)

Several other flutemakers, including Delusse of Paris and Wigley and MacGregor of London, were also using this system. Figure 9 is a surviving example that closely resembles the diagram shown in the Diderot *Encyclopédie*.

Figure 9. Wigley and MacGregor bass flute in G. (London 1811-1816)\(^{26}\)

\(^{25}\) Smith, 23.
The mechanical development of the alto flute was a direct result of that of the concert flute. Instrument makers first began to improve the more popular concert flute as the need developed for a viable chromatic scale with an efficient fingering system. The table in Figure 10 includes the significant modifications made to the concert flute design between 1750 and 1850, which eventually provided the basis for Boehm’s alto flute design ca. 1855.

Figure 10. Design modifications in the concert flute, 1750-1850.27

<table>
<thead>
<tr>
<th>Date</th>
<th>Flutemaker and Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ca. 1760</td>
<td>London makers Florio, Gedney and Potter all add three new keys, the G-sharp, B-flat, and F, to facilitate technique and increase the range to F3.</td>
</tr>
<tr>
<td>ca. 1790</td>
<td>The same London makers extend the foot joint to encompass low C1.</td>
</tr>
<tr>
<td>1782</td>
<td>Leipzig maker Ribock adds a key to improve intonation on the open C2.</td>
</tr>
<tr>
<td>1786</td>
<td>Leipzig maker Tromlitz adds the “long F-natural” to facilitate the E to F fingering in the right hand.</td>
</tr>
<tr>
<td>1806</td>
<td>Paris maker Laurent creates an improved method of attaching the keys to the body: the pillar attached by a screw.</td>
</tr>
<tr>
<td>1808</td>
<td>London maker Nolan patents a “ring key” system that allows for the simultaneous closing of both an open key and a regular hole with one finger.</td>
</tr>
<tr>
<td>ca. 1820</td>
<td>Munich maker Boehm experiments with improvements in acoustical design including tone hole placement and bore size.</td>
</tr>
<tr>
<td>ca. 1831</td>
<td>Boehm creates the first rod-axle system based on the Nolan ring key and the Laurent pillar.</td>
</tr>
<tr>
<td>1832-1847</td>
<td>Boehm creates two revolutionary designs, the latter</td>
</tr>
</tbody>
</table>

becoming the basis for both the modern C flute and alto flute. (See Chapter III for a more detail)

1850 to 1950

By the mid-nineteenth century, the nomenclature of the flute family had changed significantly from a hundred years prior. The primary flutes in use were the soprano in E-flat, the concert in C, the tenor in B-flat, and the bass in G. Until the octave bass flute in C became common in the first quarter of this century, the term “bass flute” still referred to the G flute. (From here forward, “alto flute” refers to the G flute).

Except for the Delusse and the Wigley/MacGregor “bass” flutes from the early nineteenth century, little documentation relating to the development of the lower flutes is available until Theobald Boehm applied his own C flute mechanism to the alto flute ca. 1855. As early as 1815, Viennese instrument makers extended the length of the C flute design, incorporating a range to low G. However the results were unsuccessful in both tone quality and facility of mechanism. To accommodate the extra length, the conical bore was diminished to a diameter of only one-quarter inch, leaving the lower tones deficient in volume and quality; in addition, the old-system keywork was cantankerous on the larger flute.

Boehm was successful in adapting a combination of the mechanical advancements made during the previous fifty years to the alto flute, and his new mechanism finally solved the difficulty of maneuvering on the longer alto flute. He chose a straight design which still left quite a distance from the embouchure to the keys, but the touchpieces of the new
mechanism were now in a comfortable position without compromising the acoustically correct position for the tone holes. Boehm’s first alto flute design was based on a bore measurement of 26 millimeters. In the opinion of nineteenth-century English flutist Richard Shepard Rockstro, the large bore of the Boehm alto flute caused it to suffer in low register tone quality and general intonation. A quote from Rockstro’s treatise sums up his thoughts on Boehm’s design:

Not long after the invention of the new head-joint, Boehm constructed a so-called bass flute, giving sounds a fourth lower than those of the ordinary flute. The bore of this instrument was much too large, and, as a consequence, the tone, though powerful, was of an exceedingly hollow character in the lowest register; most objectionably nasal in the second and third octaves, and generally heavy and inflexible. The holes were irregularly graduated in size; the tuning was grievously defective, and the instrument was altogether valueless. A few years before his death, Boehm much improved the tone of this flute by reducing the diameter of the bore, but the tuning of the later flute was as false as that of the earlier one.28

Despite the shortcomings of Boehm’s early alto flute design, none of the other C flute mechanisms of the mid-nineteenth century, including those of Card and Siccama, were ever applied to the alto or bass flute. Just prior to his first alto design, Boehm hired the respected watchmaker Carl Mendler. Mendler later became a partner in the company.

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28 Richard Shepard Rockstro, A Treatise on the Construction, the History, and the Practice of the Flute, 2nd ed. rev. 1928 (Reprint, Musica Rara: London, 1967), 400. Rockstro’s less than complimentary commentary is evidence of the professional rivalry that occurred between Boehm and Rockstro. For details on Rockstro, Welch and the famous “Boehm-Gordon Controversy” relating to the rightful inventor of the 1831 “Boehm flute” and subsequently improved 1832 “Boehm Flute,” refer to the following: Rockstro, 323-354; Bate, Appendix I; Welch, xviii-xlvi.
and together they produced numerous C flutes and the first alto flutes based on the Boehm system bearing the mark “Boehm & Mendler” as shown in Figure 11.

![Boehm & Mendler alto flute (c. 1862)](image)

Figure 11. Boehm & Mendler alto flute (c. 1862).

London flutemaker Henry Carte designed an alto flute in 1867 with a smaller bore size which was reported to have a more focused tone quality; however, his design did not correct existing intonation problems. In 1908, Carte’s son made changes to his father’s 1867 design by increasing the diameter and slightly rearranging the finger holes. His design is shown in Figure 12.

![The Carte alto flute (ca. 1908)](image)

Figure 12. The Carte alto flute (ca. 1908).

Dimensions given for the Carte alto: The length of this instrument, from the face of the stopped the open end, is 31.625 inches. The diameter of the cylindrical part of the bore is 1.035 inch; that of the narrowest part of the bore (at the stopper) is .906 inch. The diameter of the finger holes, which are of uniform size with the exception of the $C_3$-sharp and $D_3$ holes, is .744 inch.

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30 Ibid.
One of the first alto flute in the United States was a Boehm & Mendler purchased by a pupil of Boehm, Carl Wehner, who emigrated to the U.S. in the 1860s. Wehner’s alto, a silver-plated body with a thin cocuswood head and open G-sharp, is now part of the Dayton C. Miller Flute Collection at the Library of Congress. The first alto flutes to be manufactured in the U.S. were those of Alfred Badger ca. 1865. The Badger alto flute gained notoriety through the performances of Baltimore Symphony flutist Sydney Lanier, who is quoted in a letter to his wife:

I went to Badger’s day before yesterday on business and found there a magnificent great silver bass flute, running down to F below the staff: and on putting to my lips drew forth the most ravishing notes I ever heard from any instrument: (broad, noble tones, like my fine boy’s eyes--) whereupon I dilated upon a wind of inspiration and did breathe out strains thereupon in such fashion that the workmen gazed and grew sympathetic, so that now when I go there they immediately bring me the bass flute.

The specifications for this instrument include a bore of 1.25 inches; a range descending to F-sharp below middle C; and a unique design that Badger also included on his C flutes consisting of a large adjustable screw on the foot joint that regulated the height of the footjoint keys in order to simultaneously change the pitch. The body of the

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flute was made of silver-plated German silver with solid silver keys and a silver-plated brass headjoint.\textsuperscript{33}

After Badger, there is no record of an alto flute made in the United States until 1898 when George W. Haynes built a "special order" alto flute in F for organ builder Murray M. Harris in Los Angeles. This is believed to be the first flute of any kind made with drawn tone holes.\textsuperscript{34} The bore was 26 millimeters (Haynes admitted it was too large) and it was made of Mexican silver dollars.\textsuperscript{35} When Haynes moved to New York City in 1910, he had already gained the reputation as the best maker of alto flutes in the U.S. Three of his orders from this period include one for the Metropolitan Opera Orchestra; one made for Georges Barrère of the Damrosch Orchestra; and two for Dayton C. Miller.

Miller, an amateur flutist and professor of science at Case School of Applied Science in Cleveland, was the most influential proponent of the alto flute in the United States in the early twentieth century. Miller enjoyed collecting flutes of all kinds and was one of the first Americans to own an alto flute. Before many of the major orchestras or their principal flutists had purchased an alto, Miller willingly loaned his for performances of the contemporary orchestral repertoire such as Stravinsky's \textit{Le Sacre du Printemps} and Ravel's \textit{Daphnis et Chlöe}.

\textsuperscript{33} Berdahl, 253.
\textsuperscript{34} Tone holes that are extruded from the flute tube. The other method involves soldering the raised tone hole onto the body. Both methods are still used today and remain in constant debate as to which produces the best tone.
\textsuperscript{35} Berdahl, 253.
Repertoire

Repertoire for the alto flute is limited between 1750 and 1850 for several reasons. As all members of the flute family underwent tremendous transformation, the concert flute naturally received the majority of attention. It was the first to be equipped with a successful mechanism designed to facilitate the technical demands of the Classical and Romantic composers. Although Boehm’s alto flute design greatly improved the instrument, it still posed a barrier in expense and availability. The only surviving examples of nineteenth-century chamber music for alto flute are the twenty-three pieces Boehm arranged for alto flute and various accompaniments (see Appendix B). However, as orchestration changed in the mid- nineteenth century, as a result of the the influence of Hector Berlioz, and as the alto increased in availabitly, it gained recognition as a distinctive new member of the orchestral wind section.

Two early documented uses of the alto flute in the orchestra are Rimsky-Korsakov’s ballet music for Mlada (1870) and Weingartner’s Gefilde der Seligen (1897). Philip Bate offers an explanation for the “rebirth” of the alto flute in the orchestra:

Their [alto and bass flutes] use in the orchestra is in the main a modern phase which ties up with a limited revival of the ‘whole consort’ concept though with a different basic motive. No longer is the instrumental group modeled on the human voice. The new idea, of which Wagner was the
great protagonist, is to extend the available compass of characteristic tone colours. . .

An example of this “whole consort” concept re-emerging is in Verdi’s Aida (1871) where in the finale to Act I, the Sacred Dance calls for three flutes in A or flûtes d’amour, which had to be specially made for the performance. (In rehearsal they were found to be ineffective in the scoring and were abandoned in favor of concert flutes.)

The first decade of this century provides the most famous examples of orchestral scoring for the alto flute. Both Ravel’s Daphnis et Chloé (1909-11) and Stravinsky’s Le Sacre du Printemps (1911) use the full compliment of woodwind consorts. In Daphnis, the flute section consists of flutes I, II doubling piccolo, alto flute and solo piccolo. The writing is virtuosic for each, and the alto flute is featured in a solo that appropriately utilizes its sonorous low register. The Le Sacre calls for the same scoring and the alto flute is featured in three important solo passages making use of its full pitch and color range.

Other landmark orchestral works including alto flute are Holst’s The Planets (1914-1916) in “Saturn” and “Neptune”; Bax’s Symphony Nos. I and II (1922, 1926); Britten’s Spring Symphony (1947); Shostakovich’s Symphony No. 7 (1941); Copland’s Short Symphony (1932); and Varèse’s Ameriques (1918-21). Hollywood composer

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37 Bate, pg. 176.
Robert Russell Bennett began writing for the alto flute in his orchestral movie scores of the 1930s. The directors were so pleased with its recorded sound that they requested it often. Today, the alto flute is a very common instrument in the recording industry and is heard in jazz, popular and film music.

Twentieth-century chamber music for the modern alto flute prior to 1950 is minimal. One of the earliest examples is English composer Sir Arthur Bliss’s *Suite* for winds and strings (ca. 1923) that contains a prominent obbligato line for the alto flute. The Henry Brant *Concerto for Flute* (ca. 1933) with accompaniment for an orchestra of ten flutes; and the Robert Russell Bennett *Rondo Capriccioso* for flute quartet (ca. 1936) were both premiered by the Los Angeles Flute Club between 1933 and 1936. The most notable piece utilizing alto flute from this period is Boulez’s *Éclat* (1946).

Harry Bettony of the Cundy-Bettony Co. was not only the first to offer an alto flute as a stock item, but also one of the first to publish solo music for the alto flute. Joseph La Monaca, flutist with the Philadelphia Orchestra for more than 30 years, wrote two flute quartets, *Scherzo capriccioso* and *Sonata in G*, that include alto flutes as well, and two alto flute solos, *Autumno* and *Primavera*, which Bettony published ca. 1921.40

As the orchestral repertoire increased for the alto flute, the leading Boston flutemakers began to produce their own versions. Cundy-Bettony, William S. Haynes Co., Inc., Verne Q. Powell Flutes, Inc. and the H. & A. Selmer Co., Inc. introduced their first altos in the 1920s. No major modifications in the original Boehm design were made

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40 Bate, pg. 178; De Lorenzo, pg. 12.
in the next two decades except for some differences in the size of bore. The first to experiment with a smaller bore was Powell; his first altos sold in 1929 were based on a bore of 23.75 millimeters. Powell felt that Boehm’s bore of 26 millimeters was too large to produce the most effective tone. One of the staunch objectors to this was Dayton C. Miller, who felt the smaller bore could not produce a tone full enough. In 1930, Haynes compromised between the two and produced a 25.27 millimeter-bore alto.\(^{41}\)

1950 to Present

Since 1950, the manufacture of quality alto flutes has increased significantly in both the mass-produced and handmade markets. Several pioneers in the alto flute’s contemporary design have been previously affiliated with major flutemaking companies of Europe and the United States. London flutemaker Albert Cooper, who left Rudall & Carte as a repairman in 1948 to start his own flutemaking shop, experimented in the 1960s with an alto flute design incorporating his scale and a bore measurement of 25 millimeters.\(^{42}\) He produced a total of eight alto flutes of exceptional quality which are still in use in London area.\(^{43}\)

In the 1960s, The Powell Co. employed the eminent recorder maker Friedrich von Huene to redesign certain aspects of the original 23.5 millimeter bore alto, but the range of

\(^{41}\) Berdahl, pg. 204.
\(^{42}\) Albert Cooper, *The Flute* (London: E.B. Reproductions, 1980). Cooper states that his scale is based upon many years of research on various flutes. The measurements for his own scale are an amalgam of the measurements he found on the most successful flutes he repaired for Rudall & Carte and a mathematical scale of his own design similar to the Boehm *Schema*.
\(^{43}\) Bickford Brannen, Brannen Bros. - Flutemakers, Inc. Personal interviews and correspondence (May 10 and May 29, 1997). Brannen and Cooper have collaborated since 1978.
dynamics and the scale were still severely limiting. In 1976, Bickford Brannen, then an employee of Powell, designed a new alto based on Cooper’s specifications and Powell toolmaker Solomon Ostroff executed the design. Only ten altos were produced at Powell on this new design before both Brannen and Ostroff left to form their own companies. Brannen began specializing in the 1832 Boehm system flutes (conical bore, modern mechanism and wood body) and piccolos. Ostroff then teamed with Eugene Sagerman in the ’70s and began producing the Ostroff-Sagerman alto flutes, the finest available in the United States. Ostroff left the partnership and the flutemaking business altogether c. 1980 and Sagerman, since has been making alto flutes completely by hand in Maine, producing only one per year.44

A dramatic increase in the selection, availability and price range of alto flutes occurred in the 1970s when Japanese instrument makers such as Yamaha, Altus and Jupiter were excelling in the quality of mass production. To offset the high price of solid silver handmade alto flutes, both American and Japanese makers began offering higher quality alto flutes with various options such as silver-plated nickel bodies and mechanisms, sterling silver headjoints, curved or straight headjoints and the latest variation offered by Yamaha, the brass alloy headjoint and body with silver-plated mechanism. Emerson and Gemeinhardt offer an affordable version completing a wide price range. Listed in Figure 13 are two current price lists for alto flutes; one from American distributor the Woodwind & the Brasswind, and the other from European distributor Top Wind.

44 Ibid.
Woodwind & Brasswind (US)

<table>
<thead>
<tr>
<th>Brand &amp; Description</th>
<th>Price (US Currency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerson -</td>
<td>$1,295 - $1,925</td>
</tr>
<tr>
<td>Solid silver head and silver-plated body or solid silver head and body with silver-plated keys. Curved or straight head.</td>
<td></td>
</tr>
<tr>
<td>Gemeinhardt -</td>
<td>$1,795 - $1,995</td>
</tr>
<tr>
<td>Solid silver head and silver-plated body or solid silver head and body with silver-plated keys. Curved or straight head.</td>
<td></td>
</tr>
<tr>
<td>Mönning -</td>
<td>$1,595 - $1,895</td>
</tr>
<tr>
<td>Handmade silver-plated head and body with options for B-foot and trill keys. Straight head only.</td>
<td></td>
</tr>
<tr>
<td>Yamaha -</td>
<td>$3,929 - $4,495</td>
</tr>
<tr>
<td>Gold brass alloy head, body and foot with clear epoxy finish. Silver-plated keys and soldered tone holes. Options include sterling silver lip plate, curved or straight head.</td>
<td></td>
</tr>
</tbody>
</table>

Top Wind (GB)

<table>
<thead>
<tr>
<th>Brand &amp; Description</th>
<th>Price (US Currency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altus -</td>
<td>$1,723 - $1,960</td>
</tr>
<tr>
<td>Solid silver head and silver-plated body. Curved or straight head.</td>
<td></td>
</tr>
<tr>
<td>Armstrong -</td>
<td>$1,309</td>
</tr>
<tr>
<td>Silver-plated head and body. Curved or straight head.</td>
<td></td>
</tr>
<tr>
<td>Gemeinhardt -</td>
<td>$1,187 - $1,488</td>
</tr>
<tr>
<td>Solid silver head and silver-plated body or solid silver head and body with silver-plated keys. Curved or straight head.</td>
<td></td>
</tr>
<tr>
<td>Hammig -</td>
<td>$1,630</td>
</tr>
<tr>
<td>Silverplated head and body.</td>
<td></td>
</tr>
<tr>
<td>Jupiter -</td>
<td>$1,458</td>
</tr>
<tr>
<td>Silver-plated. Curved or straight head.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 13. Alto flute price lists (1996-97).  

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45 the Woodwind & the Brasswind catalogue (Southbend, IN; Spring 1997); Top Wind catalogue. (London, 1996-1997)
Kingma -
Handmade. All with sterling silver heads. Open or closed holes. Quarter-tone available.
$5,500 - 8,300
($9,500 for quarter-tone)

Mönnig -
Handmade silver-plated head and body with options for B-foot and trill keys. Straight head only.
$1,035

Sankyo -
Silver-plated head and body. Curved or straight head.
$2,559

Yamaha -
Gold brass alloy head, body and foot with clear epoxy finish. Silver-plated keys and soldered tone holes. Options include sterling silver lip plate, curved or straight head.
$2,354

The stock items from both of these instrument distributors indicate that the demand for alto flutes is currently greater in Europe. The European market for music including alto flute has been stimulated by contemporary performers/composers such as Anne LaBerge (American living in Amsterdam); Robert Dick (American living in Switzerland); and Dutchmen Jos Zwaanenburg and Wil Offermans each of whom specializes in contemporary techniques for the alto and bass flute.

Zwaanenburg collaborated with Dutch flutemaker Eva Kingma in the creation of the first open-hole alto flutes made in the early 1980s. The project was instigated by Zwaanenburg’s desire for the ability to perform the same extended techniques available on the open-hole C flute such as glissandi and quarter tones which could only be achieved with perforated keys. Kingma was successful in producing a unique alto flute mechanism,
allowing for ergonomically placed perforated keys where the standard size and placement of the hole in the key has been modified.46

Kingma’s mechanism is based on Boehm’s original design, but she has chosen to modify the bore width. Kingma, in collaboration with London flutemaker Albert Cooper, discovered that with a bore of 24 millimeters and wider tone holes, the scale is more stable and the sonority in the third octave is greatly enhanced.47

In 1990, flutist Jon Fonville, specializing in twentieth-century music at the University of California at San Diego, approached Kingma about producing an open-hole alto flute capable of quarter-tones. Fonville had been interested in micro-tonal music since 1975 when he began working on the music of Ben Johnston48 and other twentieth-century composers such as Bartok, Boulez, Ligeti, Partch and Xenakis. Fonville found that managing the altered fingerings to accurately produce the music based on scales using as many as 72 tones per octave was very tedious. Kingma agreed to experiment with the incorporation of a new mechanism based on the Boehm system that could produce accurate micro-tones. The result is her now patented “key-on-key” system which allows the performer to use slightly altered standard Boehm system fingerings. The new keys are located on top of the standard vented keys and when operated by touching the extra key

47 Eva Kingma, Phone interview and catalogue (May 22, 1997).
48 Ben Johnston, composer and faculty member at University of Illinois, has been composing music with “extended just intonation” that involves intervals above the sixth partial. His numerous chamber works utilize the flute extensively.
levers, allow precise tuning for the traditional twelve-tone octave plus the micro-tones in between. Figure 14 shows Kingma’s design.

Figure 14. Kingma system quarter-tone alto flute. Right-hand mechanism.49

a. Key-on-key
b. D quarter-tone up lever
c. Ergonomically designed perforated key

This remarkable key-on-key system has now been incorporated by Bickford Brannen into his own design for quarter-tone C flutes and for a modified quarter-tone piccolo (made for John Fonville). Brannen Brothers - Flutemakers, Inc. of Boston and Eva Kingma Alto and Bass Flutes now offer the quarter-tone C flute which is sold as the Oston-Brannen flute with the Kingma System. At this time there are less than 10 quarter-tone C flutes and only one quarter-tone alto in use in the United States. Jennifer Higdon, flutist and Professor of Composition at the Curtis Institute, has performed on a quarter-tone C flute for the past two years and is currently working on a quarter-tone composition for its premiere at the 1997 National Flute Convention. In Europe, French solo flutist

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Patrick Gallois plays a wooden version of the quarter-tone C flute. European interest in the Kingma open-hole and quarter-tone alto flutes is rapidly increasing as flutists and composers Robert Dick, Wil Offermans and Jos Zwaanenburg compose and perform new repertoire for their own Kingma flutes.

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50 Brannen, Ibid.
CHAPTER III

THEOBALD BOEHM, INVENTOR

Short Biography

Theobald Boehm\(^1\) was born and lived in Munich his entire life, 1794 to 1881. His professional accomplishments are numerous in the various trades he mastered. Boehm is best known to musicians for his research and design of a universal system for proper tone-hole placement and an advanced mechanism for woodwinds; flutists know him for two significant contributions to flutemaking, the conical ring-key flute of 1832 and the acoustically designed cylindrical bore flute of 1847. He made further important inventions in the production of music boxes (ca. 1816), and piano construction (patent 1835). And in the field of metalworks, Boehm is known for his improvements in iron smelting for steel factories (patent 1835) for which he received the Knight’s Cross from King Ludwig I. His inventions in industry include a procedure for the derivation and burning of blast furnace gases (patent 1840), a spark-proof chimney for locomotives (patent 1841), and a telescope to locate fires (1841).\(^2\)

From his youth, Boehm showed interest and talent in both mechanical works and music. He began his apprenticeship at age thirteen in his father’s jewelry business and was

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1. Theobald spelled his last name in the early years with “ö”, later with “œ”. “Boehm” is used consistently throughout his publications.

soon entrusted with the most important repair work. These skills acquired at an early age were valuable later in his life when he could independently pursue the practical realization of his ideas. As a young boy, Boehm taught himself to play the flageolet which he soon gave up in favor of the flute.\(^3\)

From 1810 to 1812, Theobald was a pupil of Johann Neopomuk Kapeller (1775-1825), principal flutist of the Royal Court Orchestra in Munich. At the end of those two years, Kapeller claimed he could teach Theobald no more. Theobald won his first semi-professional playing position with the Isartor Theater in Munich. By 1818, Theobald secured a full time position in the flute section of the Royal Court Orchestra where he later served as principal flutist from 1830-1848.\(^4\) As an acclaimed soloist, he toured Europe extensively throughout his performing career. Between 1821 and 1831, he performed in Vienna, Prague, Dresden, Berlin, Leipzig, Zurich, Geneva, Venice, Strasbourg, London, and Paris.\(^5\) Boehm’s performances in London and Paris resulted in the professional association with important performers and instrument makers who were subsequently influential in the further development and marketing of his flutes.

Theobald’s flutes were awarded gold and silver medals during the industrial and world exhibitions in Munich (1834, 1835, and 1854), Leipzig (1850), London (1851), and

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\(^{3}\) Ludwig Böhm, *A Short Biography of Theobald Boehm*, 61.
Paris (1855). At the Exposition Universelle of 1867, he first exhibited his Altflöte (alto flute in G) design along with his latest C flute design. Both were received with some reservations, yet were nonetheless recognized as the best among contemporary flute designs. In 1871, he completed his treatise Das Flöte und Das Flötenspiel, which was subsequently translated into English and edited by Dayton C. Miller for the Dover publication in 1922.

Theobald Boehm spent his last years in Munich playing his alto and C flutes and promoting them through worldwide correspondence. He continued to compose and began arrange existing compositions for the alto flute. In 1873, Boehm wrote to his friend W.S. Broadwood, enthusiastic amateur flutist, “My eightieth birthday will be in a few weeks, nevertheless I play every morning on my flute in G and people like to hear it.”

Boehm’s health began to suffer in his last few years, and although he was unable to play as the elasticity left his lips, he taught up to his death and enjoyed regular games of chess and billiards. Boehm died in November 1881, leaving seven sons and one daughter. His funeral was remarkable; all classes of society attended including professional and amateur musicians, government officials, artisans, and even billiard players.

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6 Ibid.
7 Boehm student James S. Wilkins made the first English translation of the Flute and Flute Playing in 1871. Wilkins gifted the original Boehm treatise manuscript to Miller in 1907.
9 Welch, 246.
Theobald's son Dr. Karl Böhm\textsuperscript{10}, completed a 550-page chronicle of the Böhm family and bequeathed the complete Böhm Estate to the Munich Municipal Archives. Theobald's great-great-grandson Ludwig Böhm rediscovered the estate in 1983, which was for some time lost during the turbulence of world wars, and he has catalogued the inventory and founded the Theobald Böhm Archive. The archive includes programs and reviews, manuscript compositions and a list of existing instruments. Ludwig is currently collaborating with musicologist Raymond Meylan on the completion of a ten-volume \textit{Documentation about Theobald Böhm} and a fifteen-volume \textit{Complete Musical Works for Flute by Theobald Böhm} due for publication in 1997. This will be the first publication of Boehm's arrangements for alto flute.\textsuperscript{11}

\textbf{Acoustical and Mechanical Achievements 1832-1847}

From 1829 to 1839 and from 1847 to 1861, Boehm ran a workshop for flute-making in Munich under his name. In this first shop, Boehm manufactured traditional simple system C flutes under the name Boehm & Grève.\textsuperscript{12} Even from this early stage in his flutemaking business, he constantly modified his designs. His first modifications to the simple system design included the addition of tuning slides, hardened gold springs and pillars mounted with screws. By 1829, Boehm was experimenting with the first versions

\textsuperscript{10} See note 1. Family members since Theobald have used "Böhm."
\textsuperscript{12} Grève was his foreman at the time and eventually bought this shop from Boehm.
of the longitudinal rod-axle system for the connection of keys. The rod-axle system was an expansion of Nolan’s ring key principle that allowed a finger to control the closing of a key over a tone hole by a touchpiece attached by an axle to the rod. Figure 15 shows the longitudinal rods on the body of the flute that anchored several keys and operated by rotating on pillars screwed into the body.

![Diagram of flute mechanism](image)

**Figure 15.** a. Boehm’s old system mechanism with rod-axles (c. 1829). b. Pillars (profile)

On Boehm’s first concert tour to England in 1831, he made the acquaintance of virtuoso flutist Charles Nicholson. Nicholson, who played with dazzling facility and tremendous power of tone, made a lasting impression on Boehm and inspired Boehm to

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13 Bate, 117.
14 a. Toff, 51; b. Bate, 223.
begin serious acoustical redesign on his own flute. Boehm recalled the event many years later in a letter to Broadwood: “I did as well as any continental flautist could have done in London in 1831, but I could not match Nicholson in power of tone, wherefore, I set to work to remodel my flute. Had I not heard him, probably the Boehm flute would never have been made.”\(^{15}\) Boehm was apparently so inspired that he wasted no time in realizing his ideas. While still in London in 1831, he made an agreement with the workshops of Gerock and Wolf who collaborated with Boehm in the production of a prototype and accompanying descriptive pamphlet titled “Boehm’s Newly-invented Patent Flute” with an additional claim “manufactured and sold by the Patentees only, Gerock and Wolf, 79 Cornhill” (See Chapter I, n. 32). The new design encompassed only a few changes to the standard flute. The tone holes for E, F-sharp and G and the new open-hole F-natural were now placed further down on the body in a better acoustical relationship with regard to size and exact position. This “patent” flute was not well received in London, and it never went into production.\(^{16}\)

Boehm returned to Munich and in 1832 produced the first true “Boehm system” flute with an ingenious combination of recent inventions plus his own more precise acoustical calculations for the placement of tone holes. Inspired by Nicholson’s flute, Boehm’s goal was still to provide the largest tone holes possible placed in an acoustically proportionate manner on the body. In order to accomplish this, Boehm had to use an

\(^{15}\) Boehm, The Flute and Flute Playing, 8.
\(^{16}\) Bate, 118.
open-key system which would allow full venting of the holes, explaining in his *Essay on the Construction of Flutes*:

It is necessary, for obtaining a clear and strong tone, that the holes immediately below the one sounding should remain open, for the air confined in the lower end of the tube tends to flatten the notes, and renders them less free.  

To achieve this open-keyed system, Boehm combined Nolan’s ring keys, Nicholson’s larger tone holes, and his own horizontal rod-axles and thus was able to retain the old system fingering from D₁ to B₃.

Boehm introduced this flute to the public in the same year on a concert tour through Munich, London and Paris. By 1833, however, he had sold only one of his new flutes, mostly due to the reluctance of players to learn a new fingering system, and in Germany particularly, the reluctance to the more open and projecting tone quality. The 1832 flute did find acceptance in France when principal flutist Paul Camus of the Opéra Italien began playing the Boehm system in 1837.

At this point, several prominent French flutemakers were convinced that Boehm’s basic design was something of worth and they began to add their own minor refinements to his 1832 mechanism. Auguste Buffet moved all of the axles to the inner side of body using a rod and sleeve action to avoid overcrowding (each key was individually attached

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to the sleeve on the rod); created two clutch systems (overlapping lugs) for the inter-
connected key systems on E/F/F-sharp and B-natural/B-flat/F-sharp; exchanged Boehm’s
flat leaf springs for needle springs to enhance mechanical action; and added the C-sharp/D-
sharp trill key to Boehm’s original C-natural/D-natural trill. Vincent Dorus instigated the
use of a closed G-sharp key that could be adjusted to an open G-sharp at will. This
provided an easier transition for players anxious to try the Boehm flute, but who were
used to the standard closed G-sharp.18

By 1838, London flutemakers were curious about the Boehm flute and its
success in France. Cornelius Ward, flutist and flutemaker, adopted the Boehm system and
became the first British manufacturer of the new flute. John Clinton, Professor of Flute at
the Royal Academy of Music, adopted the Boehm flute in 1841 and Richard Carte and
George Rudall did in 1843.19 Rudall and Rose became the official manufacturer of
Boehm flutes in 1839 when Boehm closed his flute factory while perfecting his patented
iron smelting process.

In 1846, Boehm began two years of acoustical studies with his friend and scientific
mentor, Professor Carl von Schafhautl, at the University of Munich. Schafhautl, an

18 Although Boehm felt that the open G-sharp was superior acoustically and mechanically, players of the
old system objected to its awkwardness. Both closed and open G-sharp systems exist today; the closed G-
sharp is more popular.
19 George Rudall, renowned flute teacher and performer; Richard Carte, flutist and composer; John
Mitchell Rose, amateur flutists and flute maker. Rudall and Rose first opened a flute making business in
1821, collaborating until 1850 when they included Carte in the partnership. Upon Rose’s death, the
company changed to Rudall, Carte and Co.
enthusiastic amateur flutist, first met Boehm in 1827, and the two became friends and collaborators on several projects. Their first project in 1832 was the development of a new method for iron smelting. Schafhäutl, like Boehm, was fascinated with the principles of acoustics and their relation to the flute. Schafhäutl was traveling with Boehm on the tour that led to Boehm’s acquaintance with London flutist Charles Nicholson who was the catalyst for Boehm’s first detailed acoustical experiments. In 1843, Schafhäutl was appointed Assistant Professor at the University in Munich where Boehm studied acoustics in 1846 and 1847.

It was during these two years that Boehm, with Schafhäutl’s help, refined the acoustic and mechanical principles for the design of the patented 1847 Boehm flute, which still serves as the design in contemporary flutes. Issues that Boehm researched in the two years with Schafhäutl included bore size and shape, construction materials, embouchure size and shape, and tone hole size and placement. The result was a three-octave silver flute with the most consistent scale to date, a tone quality capable of color and projection beyond that of the wooden flute, and a new mechanism with padded keys to accommodate the larger tone holes.

In 1846 and 1847, Boehm experimented with tubes of varying dimension, made of different types of metal and wood in order to properly investigate pitch, timbre, and tone production. Boehm is quoted in Schafhäutl’s Life of Theobald Boehm as follows:
I always failed to understand why the flute alone, amongst all tubular instruments with sound-holes and a conical bore, should be blown at its thick end, it being much more natural that the air-column sections, that become shorter by increasing tone-height, should also become thinner in proportion. I therefore tried to reverse the proportion, and soon found that my view was correct.  

Thus, after much experimentation, Boehm's calculations for bore size were mathematically based upon the following assumptions:

1. That the strength, as well as the full, clear quality of the fundamental tone, is proportional to the volume of the air set in vibration.
2. The more or less important contraction in the bore of the upper part of the flute tube, and a shortening or lengthening of this contraction, have an important influence upon the production of the notes and upon the tuning of the octaves.
3. That this contraction must be made in a certain geometrical proportion, which is closely approached by the curve of the parabola.
4. That the formation of the nodes and segments of the sound waves takes place most easily and perfectly in a cylindrical flute tube, the length of which is three times its diameter, and in which the contraction begins in the upper fourth part of the length of the tube, continuing to the cork where the diameter is reduced one tenth part.

When experimenting with different materials, Boehm claimed that more than the actual material itself, the mass of the flute tube determined how easily the tones on a flute could be produced. On a silver flute which weighed 129 grams, Boehm found that the

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20 Welch, 213.
21 Boehm, _The Flute and Flute Playing_, 16.
brightest and fullest tone could be produced and maintained much longer without fatiguing the player than could be produced on a wooden flute, which even in its thinnest state still weighed 227.5 grams, or twice the weight of the silver.22

With regard to timbre, Boehm found that the only material which produced a tone which could rival the traditional hardwood that fine flutes had been made of for over 300 hundred years was that of sterling or German silver. Boehm compares wood and silver in the following quote:

The silver flute is preferable for playing in very large rooms because of its great ability for tone modulation, and for the unsurpassed brilliancy and sonorousness of its tone. But on account of its unusually easy tone production, very often it is overblown, causing the tone to become hard and shrill; hence its advantages are fully realized only through a very good embouchure and diligent tone practice. For this reason wooden flutes on my system are also made, which are better adapted to the embouchures of most flute players; and the wood flutes possess a full and pleasant quality of tone, which is valued especially in Germany.23

Boehm also made assumptions regarding the calculation of tone hole size:

1. Free and therefore powerful tones can be obtained only from large holes which are placed as nearly as possible in their acoustically correct positions.
2. If the holes are small and are considerably removed from their proper places, the formation of the nodes of vibration

22 Ibid, 53-54. Miller points out in an editorial comment following that Boehm was referring to the weights of the tubes only. Boehm’s complete silver flute weighed about 330 grams; the wooden flute about 440 grams.
23 Ibid, 54-55.
is disturbed and rendered uncertain; the tone is produced with difficulty, and often breaks into other tones corresponding to the other aliquot parts of the air column [harmonics].

3. The smaller the holes, the more distorted become the tone waves, rendering the tone dull and of poor quality.

4. The pure intonation of the third octave depends particularly upon the correct position of the holes.

From accurate investigations it is shown that the disadvantages just mentioned, become imperceptible when the size of the holes is, at the least, three-fourths of the diameter of the tube. I finally chose a constant diameter for all the twelve tone-holes from C₃ to C₄, which for silver flutes is 13.5 millimeters, and for wooden flutes 13 millimeters.²⁴

These larger tone holes could be no longer covered by the finger alone. So Boehm made a mechanism of covered keys for every tone hole which allowed the fingers to press lightly on the touch pad to form a firm seal. This arrangement rendered playing technique more fluid since the fingers no longer had the responsibility of covering the complete tone hole. Boehm maintained the "open" key concept from the 1832 flute realizing that the flute's tone quality was improved with the most venting possible. The open key also facilitated the movement of the lifting fingers and lightened the spring tension needed to lift the key weight. These new keys, however, presented a new challenge: how to pad the underside to create a consistent seal over the tone-hole. Boehm gives specifications for pad materials in his treatise *Die Flöte und das Flötenspiel in akustischer, technischer und*

²⁴Ibid, 26-27.
artistisher Beziehung (1871), explaining that the key pads should be made of fine felt wool then covered by a thin animal membrane that is doubled for strength. The pads should be covered on the back side with card and then punched through to allow a screw and washer to hold the pad firmly in place inside the key cup. To adjust the level of the pads, he advocated adding more layers of paper inside the cup, and to correct particular areas along the pad by adding smaller crescent shaped pieces where needed. Above all, secure closure of each key pad was imperative on this new system.

With the refinements in the mechanism made by the French makers and Boehm’s new acoustical design, the 1847 flute was by now close to its pinnacle in design. Two more important additions in 1848 have remained part of the contemporary flute’s design. In 1848, Boehm sold the British rights to Rudall & Rose of London and the French rights to Clair Godfroy and Louis Lot of Paris. Godfroy and Lot reintroduced the “ring key” concept to provide even more venting for the tone. They perforated the Boehm padded keys for A, G, F-sharp, E and D (those covered by a finger) thus creating the “French model” or “open hole” flute; and in 1850, Giulio Briccialdi, an Italian flutist living in London, created an alternate fingering for B-flat using the thumb and left-hand first finger.

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25 translation: The Flute and Flute Playing in Artistic, Technical and Artistic Aspects. Boehm’s Die Flöte und Das Flötenspiel was first translated into English by an American pupil James S. Wilkins (see Chapter IV, “The Teacher”); the next English version was translated and edited by Dayton C. Miller for Dover Publications in 1922. The current Dover reprint with a forward by Sam Baron was published in 1964. All references in this paper are from the 1964 reprint, hereafter referred to as The Flute and Flute Playing.
for added convenience in flat key signatures. Since 1848, little has changed in the basic design and manufacture of all flutes.

The Schema

At the Exposition Universelle of 1855 in Paris, Boehm was awarded the Grande Médaille d'Honneur for his work in reforming the system of construction for flutes, oboes, clarinets and bassoons. His first silver Altflöte or alto flute, also completed in 1855, was not formally introduced, however, until the Exposition Universelle of 1867, during which he also presented a diagram and explanation for the "Scheme for the Determination of Tone-hole positions on Wind Instruments" or Schema. Both the alto flute and the Schema represented compilations of Boehm's more than 40 years of work in flutemaking.

After the success of the 1847 cylindrical bore flute, Boehm realized that his system was becoming popular and that the explanations for its use would have to be available for other flutemakers. His first attempt at designing a schematic drawing with an accompanying description for the system was prior to the International Exhibition of London in 1862 where he was to serve as a juror, but because of ill health, he declined to attend; he did, however, send in his absence the geometric drawing and explanations for the Schema. The other jury members, who already held Boehm in high esteem, received the Schema with interest, but the information proved too complex for the jury to decipher.

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26 Toff, 56. Boehm also devised his own similar thumb Bb key, but situated in reverse order and not as ergonomically secure. Briccialdi's design has survived in contemporary flute design.
Nonetheless, the jury paid their respects as eloquently as possible to the Boehm system in the following testimonial:

At the former exhibition, the Boehm system was accepted almost universally. Its advantages, namely: beauty and nobility of tone, greater tonal power in the lower-most and greater purity in the uppermost register, have come to proof since the last ten years so strikingly that one feels entitled to assume that the former system has outlived itself.

We would be much too late here to explicate the principle of Boehm's flute construction or to praise the great benefits of this invention. Being powerful in tone, easily speaking in the altissimo register, full and yielding at the bottom notes, Mr. Boehm's flute will no doubt make its way through the world by virtue of one great advantage: it is kind to the lungs of the player. The drawbacks of Boehm's flute shall not be held back; they are, however, not of a strictly musical nature. At first, there is its far higher price to be mentioned, then the difficulties of repair since the majority of the European instrument makers are not yet familiar with it. These two disadvantages will doubtlessly diminish with time. The adherents of the comfortable, inexpensive old flute will see their favourite instrument vanish with the same just grief as our grandparents saw the mail-coach disappear when the steam engines of a new age came about. We admire piety for a good thing of old but can never dissuade a younger generation from turning towards the new and better.\footnote{Ventzke, 29.}

Boehm's treatise devotes an entire chapter each to the explanation of the acoustical principles of making a flute and to the Schema. The geometric diagram of the
Schema was to facilitate visually what was represented algebraically in tables which contain acoustical calculations determine the vibrations and length of air column for each pitch in the octave.

In the section on acoustical proportions, Boehm provides two tables which illustrate his method for deriving the geometric progression of the pitches within one equally tempered octave on a flute tube. Figure 16 illustrates the progression for the relative frequencies found in gradually shortened string lengths which provided Boehm with the calculations necessary to find absolute pitch vibrations and finally air column lengths for the flute measuring from the end of the cork to the center of each tone hole.

Figure 16. Boehm’s geometrical progression of an octave based on the division of a string.  

<table>
<thead>
<tr>
<th>Tones</th>
<th>Relative Vibration Numbers</th>
<th>Relative String Lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₅+1</td>
<td>2.000000</td>
<td>0.500000</td>
</tr>
<tr>
<td>B</td>
<td>1.887749</td>
<td>0.529732</td>
</tr>
<tr>
<td>B♭ or A♯</td>
<td>1.781797</td>
<td>0.561231</td>
</tr>
<tr>
<td>A</td>
<td>1.681793</td>
<td>0.594604</td>
</tr>
<tr>
<td>A♭ or G♯</td>
<td>1.587401</td>
<td>0.629960</td>
</tr>
<tr>
<td>G</td>
<td>1.498307</td>
<td>0.667420</td>
</tr>
<tr>
<td>G♭ or F♯</td>
<td>1.414214</td>
<td>0.707107</td>
</tr>
<tr>
<td>F</td>
<td>1.334840</td>
<td>0.749154</td>
</tr>
<tr>
<td>E</td>
<td>1.259921</td>
<td>0.793701</td>
</tr>
<tr>
<td>E♭ or D♯</td>
<td>1.189207</td>
<td>0.840896</td>
</tr>
<tr>
<td>D</td>
<td>1.122462</td>
<td>0.890899</td>
</tr>
<tr>
<td>D♭ or C♯</td>
<td>1.059463</td>
<td>0.943874</td>
</tr>
<tr>
<td>C₅</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

28 Boehm, The Flute and Flute Playing, 32.
The absolute vibration numbers are easy to calculate because any given vibration number bears the same proportion to each interval as the relative number corresponding to the tone bears to the relative numbers of the other intervals. Boehm offers this formula for calculating absolute vibration numbers:

Figure 17. Boehm’s calculation of absolute vibrations using $A_3 = 435$ vibrations per second.\(^{29}\)

\[
\begin{align*}
\text{relative } A_3 : \text{relative } C_3 &= \text{absolute } A_3 : \text{absolute } C_3 \\
1.681793 : 1.000000 &= 435 : x \\
\frac{435 \times 1.000000}{1.681793} &= 258.65
\end{align*}
\]

By multiplying the absolute number 258.65 by each of the relative vibration numbers of the above table in Figure 15, one obtains the absolute vibration numbers of all the tones in one octave of the scale from $C_3$ to $C_4$.

Boehm then explains that the vibration numbers and theoretical proportions of lengths for all instruments remain the same, but the actual lengths of the air column vary widely among wind instruments. For example, the oboe and the clarinet have shorter air column lengths than the flute due to the flattening effect of the mouthpieces and the bore size. Every wind instrument must have a calculated correction for its stopped end, the

\(^{29}\) Ibid, 33.
tone holes and the bore dimensions when determining the tone hole placements for the upper octave. Boehm calculated the flute’s closed-end correction at 51.5 millimeters, and in Table II, column III, the actual lengths of the air column are the basis from which Boehm created the Schema.

Figure 18. Boehm’s calculation of actual air column lengths for the C flute.\textsuperscript{30}

<table>
<thead>
<tr>
<th>Tones</th>
<th>Absolute Vibration Numbers</th>
<th>Theoretical Lengths of Air Column</th>
<th>Actual Lengths of Air Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>C\textsubscript{4}</td>
<td>517.31</td>
<td>335.00mm</td>
<td>283.50mm</td>
</tr>
<tr>
<td>B\textsubscript{3}</td>
<td>488.27</td>
<td>354.92</td>
<td>303.42</td>
</tr>
<tr>
<td>B\textsubscript{3}\textsuperscript{b} A\textsubscript{4}\textsuperscript{#}</td>
<td>460.87</td>
<td>376.02</td>
<td>324.52</td>
</tr>
<tr>
<td>A\textsubscript{4}</td>
<td>435.00</td>
<td>398.38</td>
<td>346.88</td>
</tr>
<tr>
<td>A\textsubscript{4}\textsuperscript{b} G\textsubscript{5}\textsuperscript{#}</td>
<td>410.59</td>
<td>422.07</td>
<td>370.57</td>
</tr>
<tr>
<td>G\textsubscript{5}</td>
<td>387.54</td>
<td>447.17</td>
<td>395.67</td>
</tr>
<tr>
<td>G\textsubscript{5}\textsuperscript{b} F\textsubscript{6}\textsuperscript{#}</td>
<td>365.79</td>
<td>473.76</td>
<td>422.26</td>
</tr>
<tr>
<td>F\textsubscript{6}</td>
<td>345.26</td>
<td>501.93</td>
<td>450.43</td>
</tr>
<tr>
<td>E\textsubscript{6}</td>
<td>325.88</td>
<td>531.78</td>
<td>480.28</td>
</tr>
<tr>
<td>E\textsubscript{6}\textsuperscript{b} D\textsubscript{7}\textsuperscript{#}</td>
<td>307.59</td>
<td>563.40</td>
<td>511.90</td>
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<td>D\textsubscript{7}</td>
<td>290.33</td>
<td>596.90</td>
<td>545.40</td>
</tr>
<tr>
<td>D\textsubscript{7}\textsuperscript{b} C\textsubscript{8}\textsuperscript{#}</td>
<td>274.03</td>
<td>632.40</td>
<td>580.90</td>
</tr>
<tr>
<td>C\textsubscript{8}</td>
<td>258.65</td>
<td>670.00</td>
<td>618.50</td>
</tr>
</tbody>
</table>

Boehm produced the Schema not only to facilitate the use of his system for others, but also to simplify the method of calculation for tone-hole placement to accomodate pitch standards differing from A = 435. Boehm explains in his treatise:

\textsuperscript{30} Ibid, 35.
Since the normal pitch [now known as International low pitch: A = 435] is by no means in universal use, it is often necessary to have measurements corresponding to various given pitches, but the labor required to make the necessary calculations of dimensions involves much time and trouble.

These inconveniences have caused me to design a Schema in which the basis of all the calculations for measurements of length is graphically represented. In this diagram the geometrical proportions of the lengths of a string, corresponding to the reciprocals of the vibration numbers in the equally tempered scale, are represented by the intersection of horizontal and vertical lines; while diagonal lines indicate the geometrical progression in which the measures of length may be varied without disturbing their reciprocal proportions to the vibration numbers.

This graphic method was suggested by the plan of a monochord, on which, by means of a moveable bridge, the stretched string may be successively shortened to half of its original length, thereby producing all the intervals of one octave.

Now these proportions remain constant from the highest to the lowest musical tones, and the transition from one interval to the next can therefore be represented graphically, and my Schema has been founded upon these considerations. With its help and without calculation, the centers of the tone holes of all wind instruments constructed on my system, as well as the positions of the so-called frets of guitars, mandolins, zithers, etc., may be easily and quickly determined.31

Line B of the Schema represents the flute tube tuned to $A = 435$. When Boehm needed to create a flute based on a pitch standard different than $A = 435$, the Schema could calculate in proportion within a range from $A = 460.9$ (A-sharp), represented by Line A on the graph, to $A = 410.6$ (A-flat), represented by line C on the graph. The full-size portion of the Schema seen in Figure 20, illustrates this concept. Horizontal lines A, B, and C represent the three pitch standards $A = 460.9$; $A = 435$; and $A = 410.6$. Diagonal lines drawn from Line A to Line C provide the exact tone hole placement where they intersect the horizontal lines. The two additional vertical lines in Figure 20 (located between A-B and B-C) are calculated by dividing the distance between A-B and A-C by 2 or 4 for a quarter-tone or eighth-tone adjustment higher or lower. Then each new tone

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32 Ibid, 41.
hole calculation is found at the new intersections of the diagonal and horizontal lines at a proportionate measurement \( A = 445, 8.96 \text{ mm}; A = 430, 4.63 \text{ mm} \) from the original tone hole placement.

Figure 20. Full size portion of the *Schema.*

The *Altsflöte*

Although surrounded by controversy and dispute over its accuracy at its presentation at the *Exposition Universelle* of 1867, Boehm’s *Schema* has subsequently been proven through comparison and measurement against hundreds of specimens to be

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\(^{33}\) Ibid, 45.
scientifically sound and effective for the production of a reliable scale on any size flute.  

The alto flute was an excellent vehicle for Boehm to test his *Schema* and its ability to correctly calculate tone hole placement on different sized flutes: the C flute and the new alto flute in G.

After the proven success of the Boehm C flute in London, Paris and the United States, Boehm turned his attention to a long contemplated project. In *The Flute and Flute Playing*, Boehm concluded with a section devoted to his most recent development, the alto flute, which he referred to as the *Altflöte*, meaning in German “bass flute.” (The modern octave C bass flute was not perfected until c. 1911.) He began by writing:

> In closing I feel that I ought to mention one of the most recently perfected, and therefore little known, developments of the flute, to the construction of which I was led by the great facility of vibration and easy speech of my silver flute in C; I refer to the “Alt-Flöte” in G which is pitched a major fourth below the flute in C.

The exact date of Boehm’s first alto flute is uncertain; however, Boehm refers to it as being well-established in correspondence dating from 1865; and in *Zur Erinnerung an Theobald Boehm* (1898) written by Theobald’s eldest daughter Maria who chronicled Theobald’s work, she writes, “In his sixtieth year Boehm made his *Altflöte* which

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34 See Boehm 45-50, Rockstro, 169; Welch, cxviii.
See Boehm 45-50, Rockstro, 169; Welch, cxviii.
produces a remarkable effect." This statement would make the year 1854 or 1855.  

Boehm’s manufacturing records indicate that he sold his first alto flute to Mr. Heinz Ciemirsky of Lemberg in January 1858.  

Boehm himself found great personal satisfaction in playing his new creation. Not since the Baroque flutes of lower pitch had flutist’s had a quality instrument with which to produce the sonorous low tones of the alto range. Boehm’s reliable methods for producing flutes of all sizes, insured that the alto flute could be built with a good scale and facile mechanism. His primary contribution to the alto flute’s design was the combination of the proportioning of the tube in order to produce the desired characteristic tone-quality together with a key mechanism that was operated on the same fingering system as the C flute.  

During Boehm’s acoustical experimentations of 1847, he made flutes with a range as low as E₂, but he found difficulty in adapting the mechanism to a flute larger than the G flute. In calculating the proportions for the air column of the alto flute, Boehm gave preference to the lower tones which he found to be very malleable in tone quality and strength and thus very expressive. Boehm’s manuscript of Die Flöte und Das Flötenspiel did not include specifications for the alto flute Schema or its dimensions, but Dayton C. Miller does include them in his 1922 edition.  

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36 Ibid, 119.  
37 Letter from Ludwig Böhm to the author, April 28, 1997.  
38
Boehm’s alto flute had a bore of 26 millimeters in diameter, tone-holes of 19.3 millimeters, and a rise between the tone-holes and the keys of about 6 millimeters. The embouchure was made slightly larger than that of the C flute with a distance from the cork to the center of the embouchure that measured 20.5 millimeters. Boehm calculated the closed-end correction for the alto flute at 68 millimeters and then based his table of air column measurements (Figure 21) from that figure.

Figure 21. Boehm’s calculations for air column lengths for the alto flute.\[39\]

<table>
<thead>
<tr>
<th>Tones</th>
<th>Absolute Vibration Numbers</th>
<th>Theoretical Lengths of Air Column</th>
<th>Actual Lengths of Air Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>G	extsubscript{3}</td>
<td>387.54</td>
<td>442.50mm</td>
<td>374.50mm</td>
</tr>
<tr>
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<td>365.79</td>
<td>468.81</td>
<td>400.81</td>
</tr>
<tr>
<td>F	extsubscript{3}</td>
<td>345.26</td>
<td>496.68</td>
<td>428.68</td>
</tr>
<tr>
<td>E	extsubscript{3}</td>
<td>325.88</td>
<td>526.22</td>
<td>458.22</td>
</tr>
<tr>
<td>E\textsubscript{3}\textsuperscript{b} D	extsubscript{3}\textsuperscript{b}</td>
<td>307.59</td>
<td>557.51</td>
<td>489.51</td>
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<tr>
<td>D	extsubscript{3}</td>
<td>290.33</td>
<td>590.66</td>
<td>522.66</td>
</tr>
<tr>
<td>D\textsubscript{3}\textsuperscript{b} C	extsubscript{3}\textsuperscript{b}</td>
<td>274.03</td>
<td>625.78</td>
<td>557.78</td>
</tr>
<tr>
<td>C	extsubscript{3}</td>
<td>258.65</td>
<td>663.00</td>
<td>595.00</td>
</tr>
<tr>
<td>B	extsubscript{3}</td>
<td>244.14</td>
<td>702.42</td>
<td>634.42</td>
</tr>
<tr>
<td>B\textsubscript{3}\textsuperscript{b} A	extsubscript{3}\textsuperscript{b}</td>
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</tr>
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<td>G\textsubscript{2}</td>
<td>193.77</td>
<td>885.00</td>
<td>817.00</td>
</tr>
</tbody>
</table>

\[39\] Boehm, 126.
Other corrections in the air column calculations were needed for the alto flute due
to its increased size. For example, Boehm made an "open-end" correction from the cork
to the end of the flute of 10.5 millimeters giving the lowest tone G₂ the calculation
\[ 817 + 10.5 = 827.5 \] millimeters. Similar corrections were made for the F-sharp, C-sharp
keys and the D-natural trill key. The specimen in Figure 22 was made according to the
specifications in Figure 19 for the pitch A = 440.

Figure 22. Boehm & Mendler alto flute (ca. 1862).[^40]

The mechanism of Boehm’s alto flute was very similar to that of the C flute.
However, due to the length of the flute from the embouchure to the first tone hole, the left
hand mechanism was adjusted considerably by a lengthening of the rods and axles for the
holes governing C-sharp down to G-sharp. Figure 23 shows this adjustment to the left

[^40]: Ibid, 121.
hand mechanism in detail. Note that Boehm was not utilizing Buffet’s mechanism with all rods located on the inner side of the flute, or the Briccialdi B-flat, both advancements made to his 1847 C flute that were now standard. Subsequent alto flute designs by early twentieth-century flute makers were based on the French version of the Boehm system.

![Diagram of left hand mechanism for the Boehm alto flute](image)

**Figure 23.** Left hand mechanism for the Boehm alto flute

Legend: T, 1, 2, 3, 4 - Left-hand thumb and fingers.

*s - Schliefklappe or octave key

**D Tr - D-natural trill key

Boehm also uses the schliefklappe or octave key on the alto flute. Operated by the left-hand thumb, the octave key vented a small tone-hole just above the C-sharp key providing easier articulation and a pure tone in the D-sharp and E-flat of the second octave and the

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41 Ibid, 127.
D-natural, D-sharp, E-flat, and A of the third octave.\textsuperscript{42} Boehm includes in his treatise two tables on the use of the octave key and of the D trill key shown here in Figure 24.

Figure 24. a. Application of the Octave Key  
b. Application of the Trill Key\textsuperscript{43}

\textsuperscript{42}Boehm included the \textit{schliefkappe} on his C flute design of 1847. This key is a necessity on reed instruments where the formation of the overtones is not as certain as on the flute. Boehm found the key very useful in producing the D-sharps of the second and third octaves as well as the A-natural of the third octave at a pianissimo dynamic level and without being flat. The Boehm & Mendler flutes were produced with the octave key, but at the turn of the twentieth-century, flutemakers dropped the key from the mechanism due to the negligible effect.\textit{Ibid}, 128.

\textsuperscript{43}Boehm, 129.
When Boehm presented his *Altflöte* and *Schema* to the jury of the *Exposition Universelle* in 1867, he received the following commentary from the jury member Monsieur Cavaillé-Coll who reviewed Boehm’s work:

> ... Summing up, and despite those slight miscalculations (which by the way, may have resulted from the difference of the frequency of the tone taken as a base by the author of the Scheme), one should recognize that this scale-dividing graph has been worked out by the author with greatest care and discrimination, whereas, according to the statements of most makers questioned by us, the measures of their instruments were hitherto arrived at by trial-and-error methods.

> ... We are inclined to take [the alto flute] for an experimental [example], being somewhat colossal and clumsy to handle, meant to demonstrate that it is possible, with the same acoustical dimensions, to make flutes as low-toned as anyone would call for. All the admiration for the ingenuity of the inventor cannot make us forget that his G flute sounds poorly. Anyway, the tone of a flute is deteriorating when the instrument goes down beyond low D. ... But, at World Exhibitions, Boehm’s flute does prevail, and we have now doubt that the future will be on its part.

Because the alto flute was one of Boehm’s last contributions, he did not live to see the impact the alto flute would make upon the orchestral and chamber repertoire of the

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44 Cavaillé-Coll first claimed that Boehm’s calculations were made without regard to temperature. He then later admitted that he had jumped to conclusions before realizing that Boehm had correctly formulated the *Schema* on air column vibrations at the mean temperature of the flute tube after being raised by the performers breath.

45 Ventzke, 30.
twentieth century. But, he relished playing upon it, regardless of the controversy it stirred, and was perhaps fully satisfied knowing personally that he had successfully established an important member of the modern flute family.
CHAPTER IV

THEOBALD BOEHM - MUSICIAN

Virtuoso

Boehm’s contributions to the advancement of the modern flute were inspired by his unique combination of talents as an ingenious inventor and a sensitive performer. Theobald still operated his father’s jewelry business in 1818 when he secured his first professional performing position in the Royal Court Orchestra in Munich and began forming a formidable career as a soloist. By 1821, when he took his first solo tour through Europe, Theobald considered leaving the jewelry business in order to devote himself to establishing his name amidst the steadily growing number of young professional virtuosi.

At an age when virtuosity for its own sake seemed to prevail, Boehm’s style offered a uniquely different quality that gave his performances depth. His ultimate goal in expression was to “sing” upon his flute, believing that the true artist was concerned with the phrasing of the music and not the technical aspects of producing it. He says in his treatise: “It is much easier to win applause by a brilliant execution, than to reach the hearts of the hearers through a cantabile.” Perhaps Boehm’s best tribute was paid by his friend Karl Schäfhauml: “The peculiarity of Boehm, one in
which he stands unsurpassed, was the charm, the soul of his phrasing. He would sometimes practice for days the interpretation of a musical phrase until his maestro would say ‘well, that is singing.’”

The essence of Boehm’s aspirations as a performer is exemplified in the chapter in The Flute and Flute Playing titled “Musical Interpretation,” where his opening statement pays homage to the great vocalists of his time including, Brizzi, Rubini, Malibran and Catalani. He wrote:

It fills me with great joy to remember their artistic and splendid performances; they have all come forth from the good old Italian school of song, which today, as in the past hundred years, gives the foundation for a good voice formation, and leads to a correct understanding of style, which is an essential for the instrumentalist as well as for the singer.2

Boehm’s success in the flute making business was aided by his popularity as a virtuoso. The merits of Boehm’s flute playing are apparent in the reviews of his successful solo tours throughout Europe between 1820 and 1832 and from comments made by the conductors whom Boehm served as flutist with the Royal Court Orchestra in Munich from 1818 until 1848. One of the earliest commentaries on Boehm’s abilities as an orchestral flutist comes from the conductor of the Court orchestra, Paul Winter, who recognized immediately that Boehm displayed qualities of musical virtuosity. Winter especially

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2 Ibid, 145.
respected Boehm's technique in reading and phrasing, qualities he felt were paramount to tasteful musical interpretation.

Boehm made many friends on his concert tours in Switzerland, where he also vacationed each year. An English lord, who vacationed in Switzerland, became a loyal patron of Boehm and enjoyed his playing so much that he offered to take Boehm and his family on a trip through Italy with an allowance to charge anything as long as Boehm would occasionally take out his flute and play for the nobleman. Unfortunately, Boehm did not accept due to the sudden illness and death of his father that same year.

By 1822, after a successful solo tour of Europe, Boehm received enough requests to join other orchestras that he approached the director of the Court orchestra in Munich for a substantial raise. The Munich orchestra would not let Boehm go under any circumstances and thus Boehm was given enough salary to support his family without the need to maintain his goldsmith business. He then devoted his entire energy to performing.

That same year, Boehm made the acquaintance of a young talented violinist named Bernhard Molique (1802-69), who was under the tutelage of first violinist of the Court orchestra, Pietro Rovelli. Molique and Boehm formed a strong friendship, sharing in common the noble aims of superior musicianship.\(^3\) Boehm and Molique toured together in 1823 in Northern Germany. The following excerpt from a concert review of December 1823 in Nuremberg refers to the musicians' performance:

\(^3\) Welch, 165.
Mr. Böhm, as a flutist, made himself known quite differently. His execution is characterized by tender display of a mild elegiac emotion; a beautiful romantic yearning; his ‘singing' on the instrument is supported by a deeply feeling heart. His mastery exploits all the nuances in the melancholic, deeply moving charm of his playing assigns him a first place among the first flutists of Europe. One was afraid to breathe, in order not to disturb the soulful amalgamation of the notes, not to interrupt the magic spell. It was a feast to listen to these two artists alternating; for each one excelled in his own particular way; for such is the splendid, not to be marred by an equivalent, but it keeps up with anything and, by elevating, is elevated itself. May our deepest gratitude, which we have the honour to express publicly, give pleasure to the two already far away.\(^4\)

Molique, also a composer, wrote *Fantasie on themes from Der Freischütz* for flute and violin for one of their performances and the *Concerto for Flute*, Op. 69, from which the popular *Andante* is currently taken. When the two performed together in Berlin on the same tour, the comments were made:

Molique displayed pure intonation, a grand tone, great technique, a fine bow, and much precision in *legato* and *staccato* passages; Boehm excelled in a full tone, in tender delivery and technique, especially in doubles.

*Allgemein Musikalische Zeitung*  
(February 26, 1824, pp. 109-170)

Molique is especially praised for his soft and fine, frequently surprisingly beautiful delivery. Herr Böhm’s playing, too, is solid, that is to say pure and clever, with a beautiful, soft, yet full tone, and in the very difficult task of Drouet’s variations he acquitted himself so creditably and with so

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\(^4\) *Correspondant von und für Deutschland*, No. 249, (December 15, 1823). A concert review.
much good taste, that we owed the artists a highly enjoyable evening.

*Allgemein Musikalische Zeitung*  
(January 13, 1824, p. 206)

When Boehm later toured England on his own in 1831, he met with success from the critics who made the following comments:

Mr. Boehm is a very superior flutist, with an excellent tone, and his composition was, comparatively speaking, highly respectable. His style differs from that of Nicholson and Drouet, inasmuch as he rather strives to touch the heart than to astonish.5

His playing, in *adagio*, is the tender and passionate song of a profoundly feeling soul; in *allegro*, it is lustrous, brilliant, but precise to the highest degree; elegant and with the most meaningful expression which he will never sacrifice in favour of a void mechanical dexterity that, to him, serves merely as a means of artistic interpretation as it should be.6

A revealing review from the same summary indicates that, restrained in character as Boehm was by all accounts, he was not above relishing the attention of his audience and exhibiting the important ingredient necessary in every great stage performer - a projected air of confidence and a sense for marketing oneself:

It is true that also he, like almost all virtuosi, does not disdain the audience’s applause, and just for that his performance will never be found quite clear of mannerisms.

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5 *The Harmonicon* (June 1831: London).  
6 Ventzke, 60.
which are alien to the psyche, only exciting the admiring mind; however, such things having become fashionable, he looks upon them as mere details of fashion that must always appear to be of some importance to the cultivated artist insofar as they enable him to attract the crowd around him, taking the opportunity to confer a touch of noble and true art to the common and ordinary.7

The Teacher

Boehm’s legacy was not only perpetuated in Europe, but as his 1847 flute became popular in the United States, the proponents of Boehm’s design and musicianship were vocal about his virtues. Henry Clay Wysham (1828-1902), American solo flutist of the Baltimore and Boston symphony orchestras and one of the first American flutists to adopt the Boehm flute and promote it, authored The Evolution of the Boehm Flute: An Essay on the Development of the “Reed Primeval” to the Perfect System of Theobald Boehm in 1898. In the essay, Wysham writes of Boehm,

Boehm was undoubtedly the best teacher, as he was admittedly the best player of his time - probably the best that ever lived. He, of all others, seemed to understand that the play of the lips makes the soul of the tone, and with his tremendous embouchure, which enabled him to rise a half tone above the ordinary player, and with a perfect mechanism of his own at command, the effects he produced and the expression he elicited, his volume of tone and brilliancy of delivery never failed to call forth enormous applause.8

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7 Ibid.
Wysham had great respect for Boehm as a teacher, and although he never studied with Boehm himself, he was a contemporary of the Boehm students who came to America in the early twentieth century.

Boehm gave private lessons in flute for much of his later career, and mentions in his *Ueber den Flöttenblau* (1882) having tutored “at least 100 pupils.” He attracted amateurs and professionals not only from Munich but also from England, France, Russia and the United States. He demanded true talent from every student, and when he did not recognize it he sought to persuade them to some other business. Figure 24 lists the flute virtuosi known to have been trained by Boehm:

Figure 25. Virtuoso pupils of Boehm.11

- August Freitag, Munich
- Moritz Fürstenau, Dresden
- Eduard Heindl, Vienna and Boston
- Max Kretzschmar, Frankfort on Main
- Karl Krüger, Stuttgart
- Georg Neuhofer, Basle
- Sebastian Ott, Hanover
- Rudolf Tillmetz, Munich
- E. Th. Weimershaus, Cologne
- Carl Whener, St. Petersburg, Hanover and New York
- Eugene Weiner, New York
- James S. Wilkins, Philadelphia
- Johann Wunderlich, Stuttgart
- Sigmund Zaduck, Munich
- Wilhelm Zink, Munich

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9 translation: *On the Construction of Flutes* was first published in 1882 by Boehm’s close friend, Englishman W.S. Broadwood.

10 *Maria Böhm, Zur Erinnerung an Theobald Böhm* (Munchen, 1898). Maria is Theobald’s daughter.

11 Ventzke, 60.
All of these pupils had successful careers as performers, teachers and authors. They all played a part in passing on Boehm’s philosophy. Of these pupils, three were influential in promoting Boehm’s legacy in America. James S. Wilkins, a native of Philadelphia, traveled extensively collecting flutes and studying with virtuosi. He played an important role in the translation of Boehm’s 1871 treatise *Die Flöte und das Flötenspiel*. Dayton C. Miller, who translated and edited the second English version of 1992, received two letters from Wilkins:

Dear Sir: I saw the notice of your work on the Flute, and it interested me for I lived in Munich for three years (beginning in May, 1871) and studied flute under Mr. Boehm. I also worked one winter (1872-73) in the shop with Mendler. At that time I translated Mr. Boehm’s work on the flute, “Die Flöte und das Flötenspiel,” and for doing this he gave me the original manuscript in his own handwriting.¹²

(April 7, 1909)

I appreciate your efforts in doing reverence to Boehm, to the extent that, at the first safe opportunity I shall send you the original manuscript of “Die Flöte und das Flötenspiel,” as a token, in Boehm’s name, of my appreciation of the labor you have devoted to his work, and for your excellent translation. I know it would have pleased Mr. Boehm for you to receive it. . . . I also send you as a part of your collection, a boxwood “Alt-Flöte” tube, without keys, made in Mendler’s shop; this was given to me by Boehm; it is a sample of a thinned-wood tube with raised finger holes.¹³

(May, 1909)

¹² *Boehm, The Flute and Flute Playing*, xi.
¹³ Ibid.
The other European born pupils who came to America include Eugene Weiner, Hungarian flutist and member of the Bilse-Orchester in Berlin, who was invited to play in Theodor Thomas’s orchestra in Chicago; and Carl Whener, who became the most professionally active in America, was first invited to play for Theodor Thomas in New York and then became first flutist of the New York Philharmonic and Metropolitan Opera House. Whener came to study with Boehm at the request of an archduke who claimed Whener was a young virtuoso. Boehm’s belief in Whener’s capabilities was apparent when the archduke never rendered payment for Whener’s lessons and Boehm continued to teach the young Whener for no charge. Whener adopted the open G-sharp Boehm system wood flute, but refused to ever play on the silver flute. Wysham in *The Development of the Boehm Flute* says of Whener’s playing, “He is a thoroughly legitimate player - with a tone clear, resonant and very sympathetic - his orchestral playing distinguished for precision and unfailing accuracy in attack.” Edward Heindl, who adopted the Boehm silver flute with an ebonite head joint, was principal flutist of the Boston Symphony and the Mendelssohn Quintet Club. Wysham also wrote on Heindl’s playing style: “His tone was singularly pure and his execution faultless. Another feature of his playing was the appearance of perfect ease and absence of difficulty.”

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14 De Lorenzo, 149-150.
15 Wysham, 33.
his succeeding generation. He successfully instilled in his pupils he principals of good flute playing.

Unlike his German predecessors, J.J. Quantz and J. G. Tromlitz or his contemporaries A.B. Fürstenau, Toulou, Drouet and Nicholson, Boehm never wrote a comprehensive tutor on flute playing. Although many instructional books for the Boehm flute were written in the last quarter of the nineteenth century, Boehm always preferred the Hugot/Wunderlich method of 1804. He claimed that special instruction books for his system were unnecessary and that the Hugot/Wunderlich method would give guidance to clear playing and good delivery, suitable to any kind of flute.16 Boehm did, however, write three étude books and one daily exercise book which he claimed encompassed “all of the practicable difficulties for the flute.”

What Boehm does include in The Flute and Flute Playing are efficient methods for achieving good skills in flute playing and musicianship. Boehm prioritized his discussion on flute playing into categories subtitled “The Development of Tone,” “Finger Exercises,” “The Method of Practicing” and “Musical Interpretation.” On the subject of tone, Boehm called it the “essential requisite.” He believed that the flutist’s priority was to develop a keen appreciation for a beautiful tone and to maintain a strong and supple embouchure necessary to produce it. His tone exercise emphasizes slow and careful transitions from one note to its neighboring half-step beginning at pianissimo and gradually swelling to a forte and then returning. Miller’s edition of the treatise ends the section on tone with this

16 Ventzke, 60.
quote from the autograph manuscript, “The one who takes care in practicing every note will be at the end a good player.” An accomplished professional throughout a multifaceted career, Boehm exercised great self-discipline and utilized his time well. His suggestions for proper practice of technique substantiate this philosophy:

When a short phrase is found difficult, it is evidently a waste of time to repeat the entire passage containing the ‘stumbling block’ in the greater part of which one has already acquired facility; one should practice the few troublesome notes till the difficult tone-combination is mastered. By such a judicious use of time I have brought many scholars in a year’s practice to a thoroughly correct interpretation (execution) of a piece of music which others with far greater talent, but without patience and perseverance, would never acquire.\textsuperscript{17}

To illustrate his points about musical expression in the treatise, Boehm used excerpts from Schubert songs, six of which he arranged for C flute and three for alto flute. He describes the art of articulation as the vehicle by which the flutist must express what a singer can do in words:

[The student] will learn by the study of good song music when and why a note should be played staccato, or be slurred with the next following; and when an accent or a crescendo or diminuendo in the tone strength, is necessary to bestow upon the music an expression corresponding to the work; and when a breath can be taken without breaking the correct declamation.\textsuperscript{18}

\textsuperscript{17} Ibid, 139. 
\textsuperscript{18} Ibid, 147.
Boehm places great importance on the proper execution of ornaments such as the mordent, the *schneller*, the trill and *pralltriller*, appogiaturas, and use of *portamento di voce* (discussed further in Appendix A). His adherence to the finer details of interpretation and to the vocal traditions of his predecessors are characteristics seen throughout his career as a performer, teacher and composer.

The Composer

Boehm's compositional *oeuvre* encompasses over eighty works; 47 original works for C flute and piano with opus numbers; and 14 transcriptions for C flute and piano, plus 23 arrangements for alto flute (see Appendix B) that are not marked with opus numbers.

Boehm began compositional studies shortly after his appointment as principal flutist with the Royal Court Orchestra in Munich in 1818. He bartered for composition lessons with the conductor Paul Winter by offering to make figurines for Winter, a collector who spent his leisure hours amusing himself with a large set of figures representing the life of Christ. Winter also promised a concerto for flute to Boehm, and when Boehm received neither the lessons or the concerto, he turned to a more serious tutor of counterpoint, Joseph Graz. To save money, Boehm shared his lessons with three other pupils, but when Graz became aware of Boehm's talents, he offered him individual help free of charge. Some years later, Maestro Stuntz, the conductor of the Court Orchestra immediately following Winter, instructed Boehm in orchestration.19

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19 Welch, 155-156.
By 1822, Boehm premiered his first composition, the *Concerto in G Major* which he dedicated to contemporary Anton B. Fürstenau, solo flutist with the Royal Chapel Orchestra of Dresden. Joseph Aibl, family friend and music publisher, became the sole representative for the *Concerto* and all of Boehm's subsequent published compositions.

Thanks to Boehm and his contemporaries that traveled as virtuosi/composers such as Jean-Louis Toulou, Louis Drouet, Anton Fürstenau and Franz Doppler, the flute by the end of the nineteenth century was a respected concert solo instrument. It was common among the afore mentioned flutists and other virtuosi such as Liszt and Paganini to use popular eighteenth and nineteenth century pieces as a basis for variations, fantasias or simple arrangements that could emphasize their strengths as performers. Over half of Boehm's compositional *oeuvre* is either a transcription or an arrangement of a previous work.

Boehm lived when the aesthetics of Early Romanticism permeated his experiences. Whereas in the eighteenth century, the elements of pitch and rhythm created the framework for formal structure, the romantics introduced the element of timbre as a device for delineating phrase structure and musical form. This preoccupation with instrumental and vocal timbres is precluded by the free forms in the harpsichord preludes of Couperin and Bach. The whole idea behind these improvisatory pieces was to put the instrument to the test much like the highly ornamented vocal arias of the eighteenth century.20  

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acoustical advancements were an inspiration to create his compositions that put his improved 1847 C flute and ultimately his beloved *Altsflöte* to its test in tonal and technical capabilities.

Boehm’s contemporaries knew him as both a performer and composer, however, his composing years outlived his performing years. The succeeding generation associated Boehm primarily with his 1847 flute and the surviving compositions as stated in Richard Shepard Rockstro’s 1890 treatise:

In Munich, Boehm was held in great esteem as a flute-player, but his reputation as a composer of fantasias and studies for his instrument was much more widely extended. In writing solos calculated to show off the good points of the new flute and the defects of the old one, he evinced considerable talent. His brilliant variations on *The Swiss Boy*, in the key of C, were at one time so frequently played in public by those who had adopted the new fingering, that many persons began to express their doubts as to the possibility of rapid passages being properly executed on the instrument in any other key. Boehm replied promptly by writing a difficult *Fantasia on Schunsueht’s Waltz* (attributed to Beethoven) in A-flat and an *Introduction and Variations on Du! Du! liegst mir am Herzen*, in E, neither of which could be effectively played on the old flute.21

Another more contemporary view of his compositions from 1835 refers to Boehm’s compositions as “. . .containing movements which cannot possibly serve to anything better than gain a player a wealth of cold admiration for this practical mastery; divertissements and potpourris, flattering to the ear, and definitely meant as nothing but pleasant

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21 Rockstro, 617-618.
According to Ludwig Böhm’s most current research, the dates of Theobald’s compositions indicate that he composed consistently throughout his career. His early compositions (1822-1838) exhibit more virtuosity and preference for the bravura style associated with variations and divertissements. Boehm used these compositions as a vehicle for promoting himself as a virtuoso concert flutist on his European tours. Compositions from 1830 forward focus on less technical flair and more on melodic content. *Souvenirs des Alpes*, Op. 27-32 (1852) for C flute and piano is a set of six folk songs; their titles suggest a more serene expression of the *cantabile* style that Boehm speaks of in the treatise, for example, *Andante sostenuto*, *Andantino Romance* and *Andante Pastorale*.

**The Arrangements for Alto Flute**

Boehm’s preference for lyrical pieces coincides with his creation of the alto flute, which he felt surpassed the C flute in its expressive ability. Boehm expressed to his friend W. S. Broadwood in a letter dated August, 1871:

> My ideal of tone, large, sonorous, and powerful, admitting of every gradation from *pianissimo* to *fortissimo*, is still the tone of my silver flute in G. The effect I have repeatedly produced, when playing it, although now I am an old man of

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22 Ventzke, 60.
78 years, is such that I only regret that I did not make this flute forty years ago.24

Boehm realized the need for appropriate solo repertoire for his creation and set about to find music that was well-suited to the alto flute's range. He chose eight pieces he had previously arranged for C flute and the rest he arranged from the repertoire of Bach, Haydn, Himmel, Mozart, Rossini, Scheidemeyer, Walter, and Weber (See Appendix B). Two of the arrangements include soprano voice. He discussed the alto flute's idiom in *The Flute and Flute Playing* on page 120, "Because of the great facility for modulation of the full, sonorous tones of this flute, it is adapted to music in the song style, and for accompanying a soprano voice. A player will, after a very little practice, be in a position to bring out [certain] effects which are impossible upon the C flute." All of the alto flute arrangements were completed ca. 1858, the same year Boehm sold his first alto flute. Boehm was not concertizing at that time in his career, and there is no record of any of Boehm's contemporaries performing on the alto flute. Ironically, the Germans were the last to adopt Boehm's innovations to the C flute and to this day, some still prefer the wooden version of the modern design. The adherence to tradition in his homeland and the lukewarm reception the alto flute met in London and at the *Exposition Universelle* of 1867 explain the forty year interval before the alto flute was recognized by composers and performers for its unique tonal capabilities.

Boehm’s final group of compositions (1871-1880) were for C flute and also encompass miscellaneous transcriptions and arrangements of Mozart, Beethoven, Mendelssohn and Schubert and others. Boehm revered his predecessors and took great pride in the art of interpreting their music. He writes in the treatise:

The interpretation of a piece of music should evidently give to the hearer what the composer has endeavored to express in notes. The Player himself must therefore, in order to be intelligible, first clearly comprehend the sense and spirit of the composition.25

Boehm’s true contribution as a composer lay in his ability to interpret through the flute the great music of the Classical and Romantic eras through transcriptions and arrangements.

Summary

Boehm’s friend and collaborator for 54 years, Karl Schafhautl, offers the most appropriate eulogy on behalf of Theobald Boehm:

He was a thinker, a clever, ingenious, indefatigable worker, a good man and a good citizen, moreover a virtuoso and a creative artist, who has delighted and will delight thousands with his compositions. At the conclusion of this long life he could with complacency look back on the troubles and the fruits of an activity of sixty years; and I can now lay down my pen with a certain satisfaction, having given a faithful image of the life and mind of a very remarkable man, whose name will always be appreciated in the world of music.26

26 Welch, 248-249.
Theobald Boehm is known more widely today as the inventor of the modern C flute and for improved mechanical and acoustical design in woodwind instrument making than he is the inventor of the modern alto flute or a Romantic composer of merit. This perception is currently changing since the alto flute has made a noticeable impact in the twentieth century orchestral, chamber and solo repertoire. The recent well-publicized innovations of Eva Kingma, the steadily growing repertoire, and the availability of quality lower-priced alto flutes are securing its future in music education and performance.

The purpose of this publication is to perpetuate the historical significance of the modern alto flute, its inventor Theobald Boehm, and the repertoire he created for it. Students and professional flutists should be aware of the importance Theobald Boehm placed on the qualities of tone and lyricism he found intrinsic to the alto flute. By introducing Boehm’s arrangement for alto flute and piano of Beethoven’s *Largo* from the *Concerto for Piano*, Op. 15, No. 1, and the list of Boehm’s works for alto flute, flutists are exposed to Romantic repertoire for alto flute and its unique style, thus expanding the notion of what is idiomatic for the alto flute.
CHAPTER V

BOEHM'S LARGO FROM BEETHOVEN'S CONCERTO FOR PIANO,

OP. 15, NO. 1

Compositional Trends in the Romantic Era

The modernization of the alto flute was concurrent with that of all musical instruments. There was a fascination with the scope of sound now available in improved instruments which inspired composers to seek the maximum expansion of pitch, dynamic and timbral ranges. The new instruments also possessed greater resonance and precision of intonation that allowed composers to explore a greater range in key modulation. Melody and harmony occupied different roles now that counterpoint was less the compositional focus than the expression of ideas through instrumentation that now offered a new palette of nuance and timbral effect. An article in the Allgemeine musikalische Zeitung of 1807 reflects on this focus on timbre saying, "Music has within itself a great means for powerful effectiveness: various instruments that can be used not only for different works but also within a single composition. How varied are the musical instruments in their character, their expression, their range, their strength, their charm."

The archtypical Romantic composers such as Wagner and Liszt found that the concert grand piano and an expanded orchestra offered the greatest capabilities for timbral effect. The lighter textures of the eighteenth-century string quartet and the
interplay of tutti and solo in the concerto and symphony were overshadowed in the
nineteenth century by the preference for heavier textures. Some Romantic composers
such as Brahms and Schumann did express their Romantic concepts in chamber music, but
this still represents only a small fraction of the total output compared to the composers of
the eighteenth century. The flute, along with other woodwind instruments, experienced a
new appreciation in the orchestra, but its chamber repertoire dwindled in the wake of the
master composers’ focus on the powerful capabilities of the larger ensembles necessary for
the opera, symphony, ballet and concerto.

Nineteenth-century chamber music for flute was inspired both by the professional
virtuoso’s need for self-promotion and by the expanding number of bourgeois amateurs
who enjoyed playing arrangements of the popular opera, Lied, and concerto repertoire at
home. Boehm was exclusively a composer of flute music, not unusual for a man of his
vocation as it was also for other nineteenth-century flute virtuosi and composers of flute
music such as Demersseman, Doppler, Fürstenau and Toulou. He was a good
businessman and by producing many arrangements of the most popular melodies of the
day, he could win the favor of his audience as well as promote his latest model of flute.

Form and Style in the Largo

Beethoven wrote his Concerto for Piano, Op. 15, No. 1 (1797) during what is
commonly designated as his first style period, when he still adhered to traditional forms. It
is in the slow movements of this early period that Beethoven’s genius is first revealed.
The equilibrium between harmonic and thematic development so often found in Haydn and Mozart is less apparent in early Beethoven where thematic contrast and transformation seem to outweigh all other interests. The *Largo* foreshadows the music of the early Romantics; its slow winding melody in symmetrical phrase structure over a simple accompaniment is more reminiscent of Bellini, Weber and Schubert than of the Classical masters Beethoven admired.

It seems logical then, that Theobald Boehm, being solidly influenced by the song style of his generation, arranged this sublime piece for his beloved alto flute. What the alto flute offers this melody is the ability to sustain a sonorous tone modulation through the phrase, an option not available on the decaying action of a piano.

The *Largo* is an *aria*, the typical second movement concerto form inherited from the Classical era. Beethoven's masterful technique in variation is apparent in this movement where a simple melodic line is tastefully embellished or set off by a different accompaniment upon each return in an A-B-A-Coda form. (The following comments are referring to the score located in Appendix A.) A simplified statement of the main melody opens the A Section, mm. 1-18, firmly establishing the key of A-flat Major. The B Section at m. 19 in the dominant key of E-flat Major marks the first elaboration of the melodic line. Although the B Section establishes a new character with much more elaborate melodic textures (mm. 19-25), and developmental sequences (mm. 30-33 and mm. 44-52), it is still very similar in overall design to the melodic line of Section A.

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Measures 44-52 serve as a transition to Section A1, where the primary melody returns but in now more elaborate embellishment and with a new rhythmic accompaniment from the piano in chordal triplets. The Coda beginning in measure 81 re-introduces the primary melody, but with yet another new accompaniment setting, arpeggiated triplets. There is an extension of the phrase at m. 89 where the harmony moves toward the deceptive key area of F minor followed by various chromatic leading tone chords and a short diversion into the subdominant key area of D-flat major. Then measure 100 returns to A-flat major and the movement begins to wind down to a very peaceful ending.

Boehm preserves Beethoven's original embellishments except for a few instances where the original was not idiomatic for the alto flute, or where the pianist's fingers are occupied accommodating the condensed melody and harmony of the orchestral reduction. Overall, Boehm successfully incorporated the tutti and solo sections into this arrangement with clever voice leading and register exchanges.

Because ornamentation had been customarily written out since the Classical era, Boehm did not need to embellish further what Beethoven had already so skillfully written. However, to play this facsimile arrangement as Boehm would have himself, one should be aware of Boehm's philosophy regarding the proper execution of ornaments which he refers to as coloratures. (Figure 26)
Figure 26. Coloratures in the *Largo*.

<table>
<thead>
<tr>
<th>Ornament</th>
<th>Example in flute score</th>
<th>Boehm's directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mordent</td>
<td>m. 3</td>
<td>The true mordent (gruppetto) is a group of three or four small notes which move within the compass of a minor third, and consists of a note first above and then below the given note.</td>
</tr>
<tr>
<td>Double Appoggiatura</td>
<td>m. 6</td>
<td>The simplest ornament is the accented appogiatura which moves either upwards or downwards, and is designated by a small note; and for equally divided notes it takes one-half of the time value of the principal note, and for unequal division takes one-third. The double appogiatura, consisting of two or three small notes, is to be treated in a similar manner.</td>
</tr>
<tr>
<td>Cadence Trill</td>
<td>m. 108</td>
<td>Following the best old Italian school of song, the trill should commence upon the principal note, and not upon the auxiliary note; the two notes must have equal tone strength, and exactly equal time value, and the alternation should be slower in Adagio, and more rapid in Allegro. For a final cadence, or fermata, it should gradually increase in speed, and there should be a swelling out and a diminishing of the tone strength. . . . All trills must begin slowly, and very gradually become more rapid, a perfect equality of the notes being maintained throughout.</td>
</tr>
<tr>
<td>Runs (Roulades)</td>
<td>m. 109</td>
<td>Played in exact time and manner of expression as the fundamental tone. The notes of the run may be played with <em>tenuto</em>, with <em>crescendo</em>, or with <em>diminuendo</em>.</td>
</tr>
<tr>
<td>Espressivo (Portamento)</td>
<td>m. 18</td>
<td><em>Portamento</em> is derived from the Italian <em>cantare legato</em> in which all the intermediate tones [in a phrase] are smoothly connected together, like a series of pearls by a connecting thread which is represented by the air stream.</td>
</tr>
</tbody>
</table>

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Performance Suggestions

The *Largo* encompasses the alto flute's full range (D₁ to A₃-flat), so the performer should tune thoroughly in all three octaves with the piano before playing. Particularly important to the intonation and tone color in the third octave is performer’s ability to hear the fundamental of each pitch. To gain the optimum control over this octave, the performer should practice exercises in harmonics on the alto flute to become acquainted with the idiosyncrasies in the alto flute’s harmonic series and particularly how it differs from the harmonic series of the C flute. The performer should strive to vary the character of the tone between the statements of the A theme and to maintain evenness of tone particularly in the wide interval leaps from register to register.

A tempo no faster than  \( \text{♩} = \text{ca. 54} \) is suggested to ensure that the beauty of the melody is not obscured by virtuosity but rather gently enhanced by delicate embellishments. Boehm chose to retitle the arrangement *Andante*, indicating that he preferred a slightly faster tempo than *Largo* implies. Boehm was sensitive to the challenge of proper phrasing on the alto flute, which requires very accurate control of the air column; a *Largo* tempo would make this very difficult.

The following score is a facsimile made from the original that is now a part of the Dayton C. Miller Collection at the Library of Congress. An unidentified copyist is responsible for all of the alto flute scores in the Miller Collection which have served as the
basis from which *Boehm's Complete Works* edition is now being created\(^3\). In order to preserve the original appearance of the facsimile, the few additions and corrections to the parts have been made in brackets. Some detail has been enhanced for clearer reproduction.

\(^3\)Ludwig Böhm, great-great grandson of Theobald and curator of the Theobald Böhm Archive, is collaborating with musicologist Raymond Myelin on the 10-volume *Documentation on Theobald Böhm* and *Complete Musical Works for flute by Theobald Böhm*. 
APPENDIX A

FACSIMILE OF THE LARGO
APPENDIX B

COMPLETE LIST OF BOEHM'S WORKS FOR ALTO FLUTE
LIST OF BOEHM'S WORKS FOR ALTO FLUTE

<table>
<thead>
<tr>
<th>Work No.²</th>
<th>Composer and Title of Arrangement</th>
<th>Instrumentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Bach, <em>Air</em> from the <em>Suite for Orchestra</em>, No. 3 in D Major, BWV 1068</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>16</td>
<td>Beethoven, <em>Largo</em> from the <em>Concerto for Piano</em>, Op. 15, No. 1</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>17</td>
<td>Beethoven, <em>Andante with Variations</em> from the <em>Serenade</em> for flute, violon and viola, Op. 25</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>19</td>
<td>Boehm, <em>Vivace</em> from the 24 <em>Études for Flute and Piano</em>, Op. 37, No. 2</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>20</td>
<td>Boehm, <em>Andante</em> from the 24 <em>Études for Flute and Piano</em>, Op. 37, No. 2</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>21</td>
<td>Haydn, &quot;God Preserve the Emperor&quot; from the <em>String Quartet</em>, Hob. III-77</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>22</td>
<td>Himmel, <em>Adagio and Rondo</em> from the <em>Sonata for Piano, Flute and Violin</em>, Op. 14</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>23</td>
<td>Mozart, <em>Andantino cantabile</em> from the <em>Sonata for Piano and Violin</em>, K. 379</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>24</td>
<td>Mozart, <em>Rondo</em> for piano, K.511</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>25</td>
<td>Mozart, <em>Larghetto</em> from the <em>Clarinet Quintet</em>, K.581</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>26</td>
<td>Pergolesi, <em>Tre giorni son que Nina dorme</em>, aria for C flute and piano</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>27</td>
<td>Rossini, <em>Cuius animam</em>, aria from the <em>Stabat mater</em></td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>28</td>
<td>Rossini, &quot;La Pesca,&quot; nocturne for 2 Soprano Voices and Piano from <em>Les Soirées musicales</em></td>
<td>C flute, alto flute, piano</td>
</tr>
<tr>
<td>29</td>
<td>Rossini, &quot;La Serenata,&quot; nocturne for 2 Soprano Voices and Piano from <em>Les Soirées musicales</em></td>
<td>C flute, alto flute, piano</td>
</tr>
<tr>
<td>30</td>
<td>Schubert, &quot;Ständchen&quot; from <em>Schwanengesang</em>, D.957-4</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>31</td>
<td>Schubert, &quot;Das Fischermädchen&quot; from <em>Schwanengesang</em>, D.957-10</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>32</td>
<td>Schubert, &quot;Am Meer&quot; from <em>Schwanengesang</em>, D.957-12</td>
<td>alto flute, piano</td>
</tr>
</tbody>
</table>

¹Ludwig Böhm, Letter to the author, April 28, 1997. Above list is taken from Ludwig Böhm who has compiled a revised list of Boehm's works for alto flute that includes all of the still existing arrangements (some are missing). The alto flute works were never assigned opus numbers.

²The numbering of the works for alto flute are in sequence after the works for C flute that do not have opus numbers.
<table>
<thead>
<tr>
<th></th>
<th>Composer</th>
<th>Work Details</th>
<th>Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Vogler</td>
<td>Cantabile from 32 Préludes for Organ or Piano, No. 2</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>34</td>
<td>Vogler</td>
<td>Cantabile from 32 Préludes for Organ or Piano, No. 2</td>
<td>2 C flutes, alto flute, piano or C flute, 2 alto flutes, piano</td>
</tr>
<tr>
<td>35</td>
<td>Walter</td>
<td>Graduale</td>
<td>alto flute, piano</td>
</tr>
<tr>
<td>36</td>
<td>Weber</td>
<td>Sonatine from Six Petites Pièces Faciles for Piano, Four Hands, Op. 3, No. 1</td>
<td>C flute, alto flute, piano</td>
</tr>
<tr>
<td>37</td>
<td>Weber</td>
<td>Romance from Six Petites Pièces Faciles for Piano, Four Hands, Op. 3, No. 2</td>
<td>C flute, alto flute, piano</td>
</tr>
</tbody>
</table>
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