

The Five-Valve C Trumpet:  
History, Design, and Advantages

by

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## ABSTRACT

Since 1913, some of the world's finest trumpeters have utilized the advantages of specialized custom trumpets that can be played in multiple key centers through the operation of additional valves and slides. Merri Franquin (1848-1934), a leading trumpet teacher in twentieth-century Paris, patented two multiple-key trumpets: a four-piston-valve model that plays in the keys of C and D, and a five-piston-valve model that plays in the keys of A, B $\flat$ , C, and D. Thibouville-Lamy (1867-1969), a now-defunct French instrument company, built both models by adding extra valves and slides to three-valve C trumpets.

In the mid-1900s, top performers such as Roger Voisin, Armando Ghitalla, and David Hickman began using similar trumpets in performances and recordings. Regrettably, only a privileged few have had access to these instruments and the numerous advantages that they can provide. Thus, by reviewing and building upon current data on multiple-key trumpet design and performance, the author aims to unlock a vast potential for performance enhancement, waiting to be tapped by current and future trumpet performers.

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## DELIMITATIONS

The scope of this project is a particular five-valve C/D/B<sup>♯</sup>/D<sup>♭</sup> trumpet design in which a conventional three-valve C trumpet has two additional piston or rotary valves that enable the performer to change seamlessly among the four pitch centers. The following list provides examples of trumpets that are beyond the limits of the current subject:

1. Baroque (valve-less) trumpets, commonly including interchangeable crooks that alter the fundamental key.
2. Cornets and trumpets with “quick-change” valves (not intended to be used during performance), allowing the performer to change between two keys, typically A and B<sup>♭</sup>.
3. “Echo cornets” with an added valve that switches between a standard bell and a second bell that ends with a permanently-fixed, inverted cone and sounds somewhat like a cornet with a straight mute.
4. “Compensation-valve” cornets and trumpets, typically with four valves.
5. Trumpets with an additional fourth valve that extends the low range (usually a perfect fourth), most commonly found in the keys of soprano E<sup>♭</sup>, piccolo G, and piccolo B<sup>♭</sup>/A. Sometimes found on certain B<sup>♭</sup> trumpets and flugelhorns.
6. “Dual-key” trumpets, changing key by interchanging different sets of parts (bells, leadpipes, and/or slides) for each key. Common key-pairings are

soprano D/E $\flat$ , soprano E $\flat$ /E, piccolo F/G, piccolo G/A, piccolo A/B $\flat$ , and piccolo B $\flat$ /C.

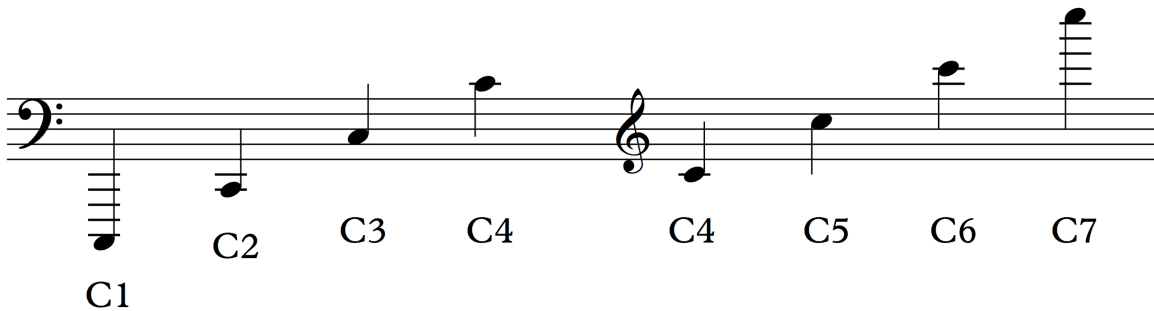
7. “Quarter-tone” trumpets, typically with an added fourth valve that lowers the pitch by one quarter-tone.
8. Double-bell trumpets, typically utilizing an added rotary valve that switches between bells. Each bell can accept a standard trumpet mute, and a common configuration is to leave the main bell open and insert a Harmon “Wa-Wa” mute in the second bell. Used most commonly by jazz trumpeters for artistic effects when switching between the main bell and a muted second bell.

## GUIDE TO NOMENCLATURE

### Octave Designations

Throughout this project, *scientific pitch class notation* specifies octave, using the nomenclature in figure 1 below. This figure depicts the first pitch of each successive octave pitch class. Therefore, the eleven chromatic pitches between successive octaves belong to the *preceding* (lower) pitch class value. For example, top space G is annotated “G5” because it is in the same octave designation as C5 (third-space C), and thus receives the same numerical value.

Figure 1: Scientific pitch notation.

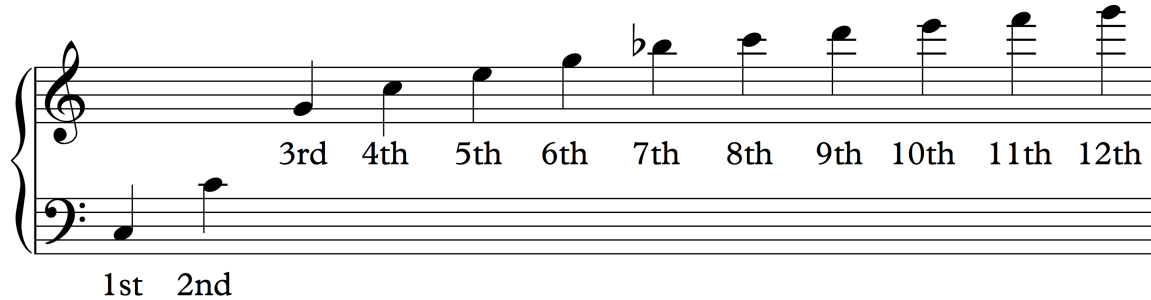


### Partials Numbering

The designation of partials, also known as natural harmonics or the notes of the overtone series, follows a similar numbering system, illustrated in figure 2 below. Each notated pitch is an “open note” on the trumpet and can be played on the trumpet without depressing valves (fingered 0). Each chromatic pitch between successive partials belongs to the *following* (higher) partial. For example, second-space A, or A4, belongs to the 4<sup>th</sup>

partial because it is in the same partial as the following notated pitch (third-space C, or C5).

Figure 2: Trumpet partials numbering system.



On a cautionary note, pitches that can be played with more than one fingering belong to one of two or more partials, depending on the fingering chosen. For example, F#4 belongs to the 3<sup>rd</sup> partial when fingered 2, but the 4<sup>th</sup> partial when fingered 1-2-3. One way to reliably identify the partial to which a given pitch belongs is to count the number of ascending half-steps before reaching the next open fingering.

To illustrate, refer to the following chromatic fingering series and count the number of successive half-steps between F#4 (fingered 2) and the next open fingering:

1-2-3 · 1-3 · 2-3 · 1-2 · 1 · 2 · 0.

Since the next open fingering is one half-step away, go to figure 2 and move chromatically up one half-step from F#4: the pitch G4 and the 3<sup>rd</sup> partial.

Repeat the procedure for the same pitch F#4, but with the alternate fingering 1-2-3. The next open fingering is six half-steps away. In figure 2, move six half-steps above first-space F# – the pitch C5 and the 4<sup>th</sup> partial.

## PREFACE

### Statement of Purpose

Modern piston-valve B<sup>b</sup> and C trumpets have incorporated no major fundamental design improvements since François Périnet invented the modern form of the piston valve, patented in 1839.<sup>1</sup> The majority of currently produced piston-valve trumpets use three, or occasionally four,<sup>2</sup> descending Périnet valves and the usual configuration of valve slides, tapered leadpipe, and bell section. However, the current number of possible design configurations is seemingly infinite. Popular design elements to be varied include overall length (pitch), constituent materials, countless leadpipe and tuning-slide designs, several different types of water keys, bell taper, bell size, bell bead, plating and finishing options, bore size (including dual-bore and multi-step bore designs), bottom valve-cap mass, and overall mass. An increasing number of instrument companies produce trumpets that allow ongoing customization through the use of brackets and sleeves that enable individual components to be interchanged.

Continuous developments in specialized manufacturing techniques and after-market services add a plethora of further options. These include precision *computer numerical control* (CNC) machined parts, precision tube bending, stress reduction, tempering, annealing, valve alignment, cryogenic freezing, leadpipe venturi adjustment, chemical cleaning, sonic cleaning, and custom bracing. Finally, the ever-growing arsenal

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<sup>1</sup> Niles Eldredge, "Mme. F. Besson and the Early History of the Périnet Valve," *The Galphin Society Journal* 56 (June 2003): 148.

<sup>2</sup> A fourth valve that extends the low register downward by a perfect fourth is a common addition to piccolo trumpets, and it can also be found on certain E<sup>b</sup> trumpets and flugelhorns.

of after-market products adds another level of complexity. Examples include weighted valve caps, metal valve guides, gold-plated trim kits, mouthpiece weights (sometimes called “tone intensifiers”), grime gutters, and lightweight finger buttons. While advances in trumpet manufacturing techniques, design options, after-market services, and after-market products create an innumerable number of different configurations, none can truly be considered a fundamental design improvement.

Nevertheless, these improvements are significant and result in trumpets that have dramatically improved playing characteristics, including intonation, tone quality, evenness of sound, valve action, slide action, and response. Perhaps most importantly, trumpets have become remarkably consistent, and the variation in playing characteristics among different trumpets within the same brand and model can sometimes be undetectable. Even so, the current, state-of-the-art level of precision craftsmanship is high enough to support more complex, delicate designs. Despite a few, very recent trumpet designs that challenge the typical three-Périnet-valve approach, trumpeters are far behind other brass instrumentalists in embracing changes that accompany evolutionary improvement.

For example, trombonists have taken advantage of some recent developments in valve and linkage design. Tuba players are accustomed to their instruments utilizing a four- or five-valve system. French hornists already have embraced double and triple horn designs, and even-newer valve designs. Euphonium players are rarely seen without an instrument that has at least four valves and are well-trained in the use of compensation-valve systems. Although many trumpeters will purchase the latest artist-endorsed trumpet in every key available, few seem to be seeking to venture beyond three-valve designs.



Even by itself, the prevalence of specialty-key trumpets—especially higher-pitched trumpets in D, E♭, F, G, A, B♭, and C—is striking evidence of a need that even the latest three-valve B♭ and C trumpets fail to fulfill. Although a growing number specialty-key trumpets feature an added fourth valve to compensate for the low range that is lost when switching to smaller trumpets, Franquin’s existing strategy of adding a fourth valve to selectively shorten tubing has been largely ignored. Despite the valid argument that adding a fourth valve constitutes an accepted, fundamental design change, the primary goal of adding a fourth, descending valve is to compensate for the low range that is lost when switching to a higher-pitched trumpet.

Although adding the fourth descending valve has resulted in the discovery of some serendipitous benefits, including several alternate fingerings for better intonation and easier trills, such trumpets preserve most of the limitations of their three-valve counterparts. Moreover, the fourth valve must be operated with the fourth finger of the right hand or the index finger of the left hand, often making technical facility difficult. To illustrate the relative usefulness of this design, imagine if the same design were applied to larger B♭ and C trumpets. Although at least one such trumpet is artist-endorsed and currently available, its primary benefit is that of extending the low register. Furthermore, adding a fourth piston valve has been known to produce unintended consequences, such as a shifted center of gravity, an awkward hand position, and a sensation of excessive resistance or “stiffness.”

The primary purpose of this project is not to point out the limitations of existing trumpet designs but to exemplify how a specific design improvement can overcome inherent deficiencies in the performance of three-valve systems. Regardless of

manufacturing improvements, trumpets with three piston valves will continue to have the same fundamental problems. However, the five-valve trumpet designs featured in this project have the potential to permanently solve numerous execution difficulties notorious to three-valve designs. Overcoming these limitations will likely reduce the need for trumpets in specialty keys, improve performance status quo, and cost the same as high-end three-valve trumpets.

### **Statement of the Problem**

In terms of technical facility, ease of tone production, intonation, and modern sound concepts, the B $\flat$  and C trumpets of today are far superior to their late twentieth-century archetypes. Most trumpeters today perform Baroque repertoire on piccolo trumpets in G, A, B $\flat$ , or C, and would find it difficult to perform the same music on Baroque trumpets, pitched up to three-octaves lower. Similarly, trumpeters usually perform the concertos by Haydn and Hummel on modern trumpets in E $\flat$ , E, or D, and would require a great deal of preparation to perform these pieces satisfactorily on the alto-range keyed trumpets for which they were written. French hornists often use double, descant, or triple French horns on the higher first horn parts of Haydn symphonies, and would probably have extreme difficulty in achieving an equal level of security on a natural French horn or three-valve single horn in F.

Realizing the difficulty of achieving current performance standards on instruments with antique designs poignantly illustrates the fact that advancements in the design and quality of instruments lead to heightened technical and musical standards. The period-instrument boom of the past several decades has heightened musicological

awareness and has made apparent the fact that modern performance standards are notoriously difficult to achieve on older instruments. For example, modern replicas of Baroque trumpets, even with the advantages brought by modern manufacturing technology and design improvements, provide little security when compared to piccolo trumpets. While Baroque-period string instruments would be drowned out in a one-hundred-piece orchestra playing the music of Richard Strauss, a Baroque trumpet in the same situation is even more useless, and this is not entirely because Baroque trumpets lack the ability to play chromatically. Thus, technological advancements in instrument design eventually become the new standard.

When comparing the technological advancements in the design of other brass instruments to those of the trumpet, the most striking observation is that trumpeters use a greater number and wider variety of instruments than all other brass instrumentalists combined. For example, within the category of piston trumpets alone, seasoned professionals likely own trumpets pitched in B $\flat$ , C, D $\flat$ , D, E $\flat$ , E, high F, high G, high A, and high B $\flat$ . Compare this plethora of specialty-keyed instruments to the standard pool of instruments used by hornists, trombonists, and tubists. The sheer number of trumpets available in specialty keys and made for specialized performances can be excessive.

The problem with having so many options occurs when the primary motivation for switching to these trumpets sometimes has to do more with technical facility than artistic goals. For example, smaller trumpets tend to project less well and have a brighter, smaller sound quality. Therefore, they are better suited to chamber music settings and tend to be ideal for soloists. However, when used in a larger ensemble, the smaller, brighter timbre and lack of projection can become problematic. In many situations,

trumpeters who choose a particular trumpet for technical facility in a specific key or security in higher registers may unintentionally sacrifice a degree of artistic quality. Being mindful of this common pitfall is reason enough to seek alternative solutions, and the five-valve trumpet outlined in the next section may be one of those solutions.

### **The Five-Valve Trumpet Solution**

By adding two rotor valves to the conventional three-piston-valve C trumpet—making it a five-valve trumpet—the player can choose among four different key options. The fourth valve, placed within or immediately after the main tuning slide, is an ascending rotor valve that raises the pitch one whole-step. The fifth valve, placed before the bell bow, is a descending rotor valve that lowers the pitch one half-step. Thus, the trumpet can play in the key of C (no rotors depressed), D (fourth valve depressed), B (fifth valve depressed), and D $\flat$  (fourth and fifth valves depressed in combination). This design gives trumpeters some of the principal advantages of trumpets in specialty keys without the necessity of switching instruments. Furthermore, because the use of the fourth and fifth valves is always optional, the player has the discretion to choose when their use is desirable.

The five-valve trumpet is intended to be used primarily as a C trumpet and not intended to be played for extended periods of time as a B, D, or D $\flat$  trumpet, although this is certainly possible. The fourth and fifth valves are intended to extend the capabilities of conventional, three-valve trumpets. Although the five-valve trumpet is not intended to replace specialty-key trumpets, it will likely reduce the need to switch to higher-pitched trumpets when doing so would be detrimental to artistic goals. For example, entire

passages that are higher than usual can be played on the D side of the five-valve trumpet to achieve greater accuracy without the necessity of switching to a D trumpet. Similarly, certain passages that are too low for the C trumpet can be played on the B side of the five-valve trumpet. For example, the pitch concert F3, as in the first movement of the *Sonata for Trumpet and Piano* by Halsey Stevens, is fingered 1-2-3 on the B side of the five-valve C trumpet, allowing the passage to be played comfortably by those who prefer performing this piece on C trumpet.

As a generalization, an isolated note or group of notes can be played on the D, D $\flat$ , or B side of the five-valve trumpet to facilitate awkward fingerings, execution in the high register, extension of the low register, difficult trills, and out-of-tune valve combinations. Given that switching to a different trumpet for one difficult note or passage would be inadvisable, the present five-valve design provides solutions to technical problems that would otherwise be unavoidable. The use of the fourth and fifth valves always remains optional, so a trumpeter can explore the new possibilities gradually and as the situation dictates. Therefore, the five-valve trumpet should not be viewed as a peculiar instrument, but it should be considered a natural extension and enhancement of the capabilities of traditional three-valve trumpets.

# CHAPTER I

## HISTORY OF THE FIVE-VALVE TRUMPET CONCEPT

### **Jean-Baptiste Arban and Adolphe Sax**

The development of trumpets with three descending valves and one or more supplemental valves may be traced directly through generations of trumpeters, beginning with Joseph Jean-Baptist Laurent Arban (1825-1889). In 1869, Arban became the first cornet professor in history, following a seven-year-long campaign to persuade the Paris Conservatory to add a cornet class. Arban wrote his famous *Grand Method for Cornet* because the conservatory required a method book for the instrument, and no cornet method book was available at the time. As early as 1848, the first evidence exists of Arban and Adolphe Sax (1814-1894), an instrument maker in Paris, collaborating on new multiple-key cornet designs.<sup>3</sup> Arban's further collaboration with engineer L. Bouvet led to the manufacture of one of the first trumpets in two keys.<sup>4</sup> Named the *Cornet Arban*, it was patented on September 22, 1885 in Paris, and on July 10, 1888 in England.<sup>5</sup> This cornet featured not only an additional valve that changed the key from B♭ to G♯,<sup>6</sup> but two

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<sup>3</sup> Geoffrey Shamu, "Merri Franquin and His Contribution to the Art of Trumpet Playing" (DMA diss., Boston University, 2009), 82. Adolphe Sax's "Compensator Cornet," a four-valve design, featured alternate fingerings to improve intonation.

<sup>4</sup> Ibid., 84. This excludes commonplace cornets and trumpets in B♭ with quick-change mechanisms for playing in the key of A.

<sup>5</sup> Ibid., 82–84.

<sup>6</sup> Ibid., 84. "Ein 4 als Umstellungsventil von B auf G." (The fourth valve as a changeover valve from B♭ to G♯).

complete sets of slides for each of the three main valves, a similar design to modern (double) French horns.

For his special cornet, Arban wrote a second method that includes exercises extending below the range of standard cornets. In all likelihood, Arban designed the instrument with the intention of improving intonation and extending the low register, rather than providing alternate fingerings to replace awkward ones or providing greater accuracy in the upper register. In fact, using alternate fingerings from a lower fundamental (key) is likely to be detrimental to accuracy because the partials are closer together. In the end, the complexity of Arban's design negates the intonation improvements offered, as these were later solved by the mobile valve slide, a much simpler invention. Also, for today's standard trumpet literature, the extended lower register is not particularly useful. Despite the limitations of this design, the ultimate demise of the *Cornet Arban* was a result of Arban's death in April of 1889, because Jean-Jacques Mellet (1843-1910), Arban's successor, required his students to play traditional three-valve instruments.<sup>7</sup> Thus, despite the fact that Arban had been teaching the *Cornet Arban* to students at the Paris Conservatory, the instrument never prospered and was permanently shelved, along with Arban's second method book.

Despite the *Cornet Arban's* design similarity to the modern double French horn, the two systems differ in design conception. The *Cornet Arban* was designed with the primary intention of extending the lower register and improving intonation, whereas the

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<sup>7</sup> Shamu, "Merri Franquin," 85; and Edward H. Tarr, *The Trumpet*, Revised and Enlarged Edition (Chandler, AZ: Hickman Music Editions, 2008), 116.

primary design intention of the double horn was to aid accuracy in the upper register.<sup>8</sup> As mentioned above, the addition of a lower key is potentially detrimental to accuracy in the upper register. This is an important distinction because the subsequent invention of the mobile valve slide provided a much simpler and relatively inexpensive solution to the inherent intonation problems of cornets and trumpets with dependent three-valve systems. Two separate individuals developed the mobile valve slide simultaneously. Theo Charlier (1868-1944) patented a mobile valve slide device in 1900, and Alexandre Petit (1864-1925) patented a similar device in 1910.<sup>9</sup>

Since performing on the *Cornet Arban* requires the player to learn a new set of fingerings, and it provides no real benefit to technical facility or upper register accuracy, the mobile valve slide is a superior solution because of its simplicity and relatively low manufacturing cost. With the mobile valve slide, the player does not need to learn two separate sets of fingerings or switch to a more complex, expensive, larger instrument. Soon after the invention of the mobile valve slide, however, Merri Franquin, one of Arban's students at the Paris Conservatory, designed a more promising supplemental-valve design.

### **Merri Franquin and Thibouville-Lamy**

Franquin (see figure 3 and figure 4) became Professor of Trumpet at the Paris Conservatory in 1894 and designed trumpets that may have been, at some level, inspired by the *Cornet Arban*. Franquin designed two of these trumpets, both with one or more

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<sup>8</sup> Shamu, "Merri Franquin," 82.

<sup>9</sup> Ibid., 103.



valves in addition to the usual three. Both trumpets were produced and patented by Jérôme Thibouville-Lamy & Cie, located in France.



Figure 3: Photograph of Merri Franquin holding a cane (ca. 1900, Bibliothèque nationale de France).



Figure 4: Photograph of Merri Franquin playing a cornet (“Four generations after J.-B.Arban: [Arban to] Maurice Andre,” ca. 1900, Trumpetherald).<sup>10</sup>

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<sup>10</sup> [http://i608.photobucket.com/albums/tt164/etc-etc/franquin\\_cornet\\_400.jpg](http://i608.photobucket.com/albums/tt164/etc-etc/franquin_cornet_400.jpg).

Franquin's first multiple-key trumpet design was a four-piston-valve model (see figure 5) with a patent date of March 19, 1913,<sup>11</sup> and the second was a five-piston-valve model (see figure 6) with a patent date of March 14, 1921.<sup>12</sup> In contrast to the *Cornet Arban*, where the additional fourth valve increases the length of the instrument, Franquin's fourth valve decreases the length.<sup>13</sup> This valve type, called the ascending valve, is of present interest.



Figure 5: Photograph of a C/D trumpet based on Franquin's four-valve C/D trumpet design, formerly belonging to Roger Voisin ("Roger Voisin's Tribute Page," 2008, Voisin Enterprises).<sup>14</sup>

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<sup>11</sup> Shamu, "Merri Franquin," 148.

<sup>12</sup> *Ibid.*, 154.

<sup>13</sup> For a detailed history of Merri Franquin's contributions to these designs, see Shamu, "Merri Franquin."

<sup>14</sup> <https://voisinenterprises.com/music/voisin-nation/voisinnation-pictures/instruments.html>.



Figure 6: Photograph of Merri Franquin's five-valve trumpet ("Merri Franquin [Five] Valve System Trumpet," [n.d.], O.J.'s Trumpet Page).<sup>15</sup>

Franquin's four-valve model is pitched in the key of C, and the fourth valve places it in the key of D. The five-valve model is also in C, and the fourth and fifth valves place it in the keys of D and A, respectively. Franquin taught his students at the Paris Conservatory on these trumpets from c. 1918-1921, and eight of those trumpet students each took first prizes. When these trumpeters graduated, they were shunned by other trumpeters, who considered the Franquin-system trumpets to be a "secret weapon."<sup>16</sup> Older players in France may have been intimidated by the younger players who were gaining quick success on the four- and five-valve trumpets, and apparently formed a sort of boycott against those players. Similarly, young players proficient on the Franquin-system trumpets may have been accused of using the newly designed trumpets as an attempt to cover up playing deficits, or these players may have been at least fearful of such judgments.<sup>17</sup> Thus, the students who had become proficient on those trumpets

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<sup>15</sup> [http://abel.hive.no/trompet/franquin/franquin\\_5valve.jpg](http://abel.hive.no/trompet/franquin/franquin_5valve.jpg).

<sup>16</sup> H. M. Lewis Jr., "Roger Voisin: An Orchestral Legend," *International Trumpet Guild Journal* 6, no. 2 (February 1980): 6.

<sup>17</sup> The challenges faced by trumpeters using trumpets based on Franquin's design concepts are explored in Shamu, "Merri Franquin," 95-101; 119-20.

abandoned them entirely to preserve their chances of careers playing the trumpet in the music scene at that time.<sup>18</sup>

### **René and Roger Voisin**

For several decades, the stigma against Franquin's trumpets blocked any possible advancement of similar designs. Nevertheless, over thirty years later, in 1956, Roger Voisin (1918-2008) acquired one five-valve and two four-valve Thibouville-Lamy trumpets from Franquin's era. Voisin used the four-valve C/D trumpet model as the tenured Principal Trumpet of the Boston Symphony Orchestra. René Voisin, Roger's father, is responsible for giving Roger Voisin the idea of using one of Franquin's trumpets.<sup>19</sup> René was a student of Paris Conservatory cornet instructor Alexandre Petit during Franquin's tenure as the trumpet instructor, and this is where René undoubtedly became familiar with Franquin's trumpets. Thus, the history of the five-valve trumpet concept can be traced from Arban in 1885 in France to Roger Voisin over seventy years later in the United States.

### **Melvyn Broiles**

While performing as Principal Trumpet of the Metropolitan Opera Orchestra in New York, Melvyn "Mel" Broiles (1929-2003), a personal friend of Roger Voisin, sought to acquire a Franquin-system Thibouville-Lamy trumpet for himself.<sup>20</sup> In 1963, Broiles acquired a five-valve model that played well and had good intonation, but he

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<sup>18</sup> Lewis, "Roger Voisin," 6.

<sup>19</sup> Ibid.

<sup>20</sup> Shamu, "Merri Franquin," 108.

thought that the sound was unsuitable for the modern concept of sound in American orchestras.<sup>21</sup> He concluded that the design had promise but “must be tried on a larger instrument with a larger bell.”<sup>22</sup>

### **Armando Ghitalla, David Hickman, and Others**

Other American trumpeters were intrigued by Voisin’s four-valve C/D trumpet, and they had custom versions made in modern bore and bell sizes. Such trumpeters include Armando Ghitalla (1925-2001), David Hickman (b. 1950),<sup>23</sup> Edward Tarr (b. 1936), Wilfredo Cardoso (b. 1930), and Michael Chunn (b. 1954).<sup>24</sup> Armando Ghitalla was perhaps the most influential advocate of the four-valve C/D trumpet, and it has lived on largely because of his students. Ghitalla used a four-valve C/D trumpet converted from a Bach C trumpet by William Tottle (c. 1900-1976), dubbed the “Tottlephone.”<sup>25</sup> Eventually, Ghitalla had a trumpet built that featured an ascending whole-step rotor valve and an additional half-step descending rotor valve placed within the existing tuning slide, resulting in a five-valve trumpet capable of being played in the keys of C, D, D $\flat$ , and B $\natural$  (see figure 7). This is the design in which the present author sees the most potential.

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<sup>21</sup> Shamu, “Merri Franquin,” 109.

<sup>22</sup> Ibid.

<sup>23</sup> David Hickman, “Advantages of the Four-Valve C/D Trumpet,” *International Trumpet Guild Journal* 6, no. 2 (February 1980): 22-23. In this article David Hickman outlines the advantages of the C/D trumpet and provides photographic instructions on how to convert an existing three-valve C trumpet to a four-valve C/D trumpet.

<sup>24</sup> David R. Hickman, *Trumpet Pedagogy: A Compendium of Modern Teaching Techniques* (Chandler, AZ: Hickman Music Editions, 2006), 329.

<sup>25</sup> Shamu, “Merri Franquin,” 114.

Ghitalla's five-valve trumpet is similar in concept to Merri Franquin's, although Ghitalla may have been unaware of Franquin's five-valve system.<sup>26</sup> While both systems are essentially three-valve C trumpets with two additional valves, the designs have fundamental differences. For example, Franquin's system uses five piston valves, and Ghitalla's system uses three piston valves and two rotor valves.

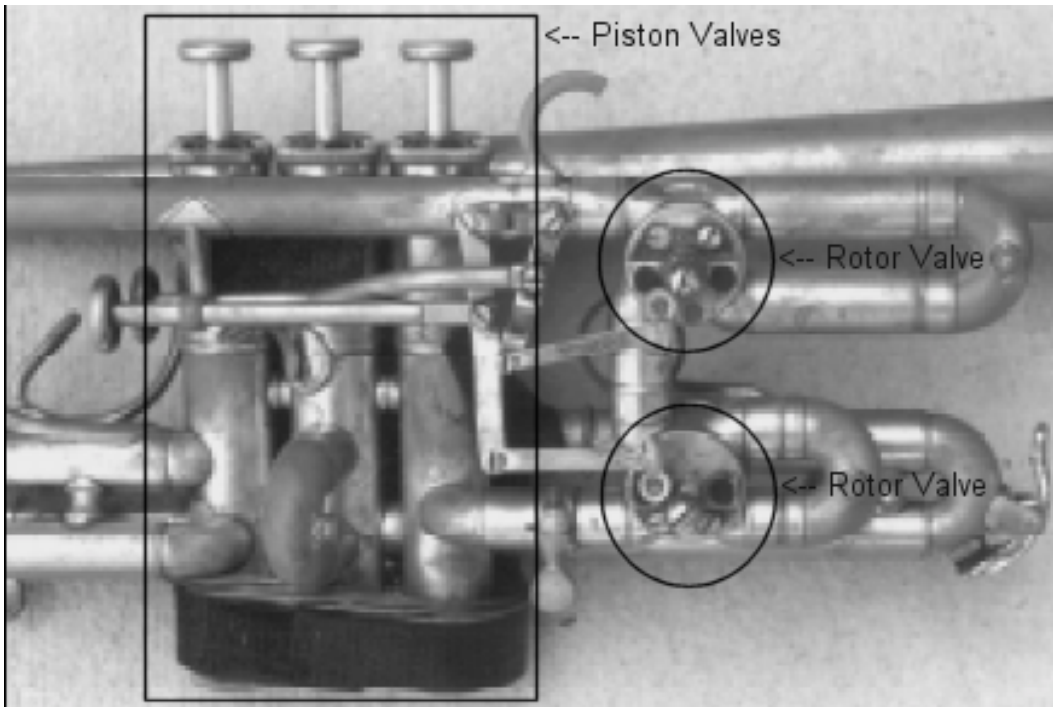


Figure 7: Photograph of Armando Ghitalla's Five-Valve Trumpet built by Kenzo Kawasaki of the Yamaha Corporation. Photo taken from Michael Tunnell's May 1997 ITG article entitled "Armando Ghitalla." [Annotations by the present author].<sup>27</sup>

The use of additional rotor valves has several possible advantages over the use of additional piston valves in five-valve designs.<sup>28</sup> The first is the simple fact that the rotor

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<sup>26</sup> Shamu, "Merri Franquin," 117.

<sup>27</sup> Michael Tunnell, "Armando Ghitalla: Master Trumpeter, Master Teacher, Master Musician," *International Trumpet Guild Journal* 21, no. 4 (May 1997): 5–16.

<sup>28</sup> *Ibid.*

valve takes up less space, allowing more flexibility in the placement of the linkages and triggers. The second is that the shorter, lighter action of the rotor valve reduces the tendency to pull the instrument away from the lips during activation.<sup>29</sup> The third is outlined in great detail by Wilfredo Cardoso: rotor valves feature a simpler, more direct tubing system and alter the sound and resistance less than piston valves.<sup>30</sup>

One similarity between the Franquin and Ghitalla systems is that both have an ascending valve placed at the midpoint of the tuning slide that changes the pitch of the trumpet from C to D. However, Franquin's fifth (piston) valve lowers the pitch to the key of A, whereas Ghitalla's fifth (rotor) valve lowers the pitch to the key of B $\natural$ .<sup>31</sup> The reason for this difference is that Franquin added the fifth valve to increase the range of the relatively-small C trumpet in order to be able to play the repertoire of lower-key trumpets. In contrast, Ghitalla added the fifth valve to increase the number of keys available in one trumpet.

Ghitalla's system gives the player four key options: C, D (by activating the ascending rotor alone), B $\natural$  (by activating the descending rotor alone), and D $\flat$  (by activating the ascending rotor and descending rotor in combination). Ghitalla's trumpet is conceptually a C trumpet and can be played exclusively that way by using the three traditional valves. However, the added accuracy of the smaller D side, the additional key options of the B $\natural$  and D $\flat$  sides, and the multitude of alternate fingerings are tools that can

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<sup>29</sup> Shamu, "Merri Franquin," 117.

<sup>30</sup> Wilfredo Cardoso, *Ascending Trumpets: The Use of Trumpets with Ascending Valves in Symphonic Music, Opera, and Ballet*. (San Jose, Argentina: Wilfredo Cardoso, 1978), 16.

<sup>31</sup> Shamu, "Merri Franquin," 93.

facilitate the execution of difficult trumpet passages. See Chapter IV for examples from the standard literature explored in detail.

### **Conditions for Success of the Five-Valve Trumpet Concept**

As mentioned above, Arban's death was a major factor in the ultimate failure of the *Cornet Arban*. Similarly, Franquin's retirement, as well as the social dynamics in France, led to the failure of his designs. Even though Franquin's designs eventually made it all the way to the United States, only a small number of players currently own and use four- and five-valve trumpets based on these designs. One reason for this is the high level of conservatism that exists within classical music circles. This conservatism is necessary to preserve the traditions of classical music culture, but it also tends to make progress difficult in areas where change may be beneficial. Stemming from this conservatism is the phenomenon of brand loyalty and social pressure to conform within orchestra sections and other musical groups.<sup>32</sup> The brand of instrument that a trumpeter prefers may also be a deciding factor in professional auditions.

Other reasons that the five-valve trumpet concept has seen only partial success are market-related. Since most instrument companies focus on mass production, new designs have to show the necessary demand before those companies will produce the instrument in large quantities. Therefore, the instruments are not widely available for trumpeters to discover, try out, or purchase. Consequently, trumpeters who become intrigued by the design concepts are left with the dilemma of whether to invest in a custom instrument or

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<sup>32</sup> For a more detailed discussion of social conservatism and conformity as they apply to the acceptance of new instrument designs, see Shamu, "Merri Franquin," 95-101; 119-20.



somehow design and build the trumpet him/herself. Therefore, it would take a manufacturer who embraces innovation to be interested in designing such a trumpet and making it available for purchase.<sup>33</sup>

If purchasing an existing five-valve trumpet is not an option, one other possibility would be to have a custom builder convert an existing trumpet, but this option also has some challenges. A custom builder would have to agree to take the project on, the waiting period would probably be long, and the cost would be greater than a mass-produced instrument. Additionally, the trumpeter must provide the original instrument and risk the possibility of a disappointing result. Furthermore, since the parts would come from existing instruments or sources, they are not designed to be used together and may contribute to a result that is less than satisfactory. One particular problem is that existing rotor valves are harvested from either French horns or rotary trumpets. French horn rotor valves usually have a larger bore than modern trumpets, and rotary trumpet rotor valves usually have a smaller bore. Therefore, the inconsistencies in bore size will likely cause intonation problems, increased resistance or “stiffness,” and have an undesirable effect on sound quality. Such market-related issues are the primary obstacles to trumpeters who are familiar with the five-valve trumpet design.

Even in an environment that whole-heartedly encourages innovation, the costs of having a five-valve trumpet built can be prohibitive. Therefore, the widespread availability of such a trumpet by a reputable manufacturer may be a necessary prerequisite to the widespread success of the five-valve trumpet concept. Such a

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<sup>33</sup> Blackburn Trumpets is an example of a modern manufacturer that currently produces a five-valve trumpet. See Hickman, “Introducing the 5-valve C Trumpet by Blackburn Trumpets: History and Perfection of an Old Design, Advantages of the Extra Valves, Instructions, Difficult Orchestral Passages made Easy, Common Questions, and Additional Readings” for more information.

manufacturer would be able to design the instrument from the bottom up and have complete control over the materials, design, and workmanship. The necessity of manufacturing a rotor valve in the correct bore size and the necessity of having linkages that are easy to operate are both issues that can readily be addressed by such a manufacturer. That instrument maker would have the opportunity to perfect the design over several prototypes, unlike a custom builder. Furthermore, the design process would be an investment that would have to be done only once, after which any number of trumpets could be produced according to those specifications. Only a few players have experienced the advantages of five-valve trumpets. Therefore, making this type of trumpet more available to students as well as professionals will help the five-valve trumpet concept gain widespread credibility.

## CHAPTER II

### PRACTICAL ADVANTAGES OF THE FIVE-VALVE TRUMPET

When discussing the practical advantages of the five-valve trumpet, the point of departure is the types of improvements that it offers over three-valve trumpets of the same key. This chapter examines these advantages in general technical terms. For specific musical examples from standard literature, see Chapter IV. Once these primary advantages have been explored, personal discretion can be used in deciding in which particular situations the five-valve trumpet would be advantageous and also in which situations the five-valve trumpet can replace the need to use trumpets in various keys.

#### **Upper-Register Accuracy and Security**

As with existing double and triple French horns, one of the principal advantages of the five-valve trumpet is accuracy and security in the upper register. On most modern C trumpets, accuracy is quite good from the lowest notes up to G<sup>5</sup>, especially when fingering the pitch E<sup>b</sup><sub>5</sub> with the second valve alone and E<sup>5</sup> with no valves, provided that intonation is acceptable when using these fingerings. On the modern C trumpet, two pitches that are relatively unstable and prone to errors in execution are A<sup>b</sup><sub>5</sub> and A<sup>5</sup>. These two pitches tend to be particularly problematic for a few specific reasons.

First, these pitches are relatively high in the harmonic series compared to surrounding notes. For example, A<sup>b</sup><sub>5</sub> is in the eighth partial and, in the chromatic scale, comes directly after the note G<sup>5</sup>, which is in the sixth partial. This sudden shift in partials makes this note especially prone to unexpected errors in execution. Furthermore, the next

lowest pitch that uses the same 2-3 fingering as A<sup>b</sup>5 is an entire octave lower, A<sup>b</sup>4.<sup>34</sup> Similarly, A5 is in the eighth partial and the next lowest pitch that uses the same 1-2 fingering is a minor sixth lower, C<sup>#</sup>5.<sup>35</sup> Nevertheless, this sudden shift to higher partials is only part of the reason that A<sup>b</sup>5 and A5 are relatively unstable.

Other pitches in the eighth partial tend to be less problematic, such as B<sup>b</sup>5, B5, and C6. These pitches are still prone to accuracy problems because of the higher register, where partials are closer together, but they are more stable and responsive than their A<sup>b</sup>5 and A5 counterparts. The reason for this is that B<sup>b</sup>5, B5, and C6 have a shorter overall length of tubing and a relatively low number of air column disturbances. On these pitches, the air column takes a more direct route through the tubing, and the air column makes fewer changes of direction (e.g., bends in the tubing and each instance that the tubing passes through a valve). For example, B<sup>b</sup>5 and B5 both use only one piston valve and one extra bend of tubing, whereas A<sup>b</sup>5 and A5 both use two piston valves and two extra bends of tubing. Therefore, the addition of an increasing number of valves in combination causes the player to perceive increasing resistance because each additional valve that is used dramatically increases the number of disturbances in the air column as the air column winds through the bends in the valve ports and slides.

For the same reason, certain players believe that rotor valves cause fewer disturbances in the air column than piston valves. For example, Wilfredo Cardoso, a former student of Roger Voisin, recommends the use of rotor valves on a four- or five-

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<sup>34</sup> This is, of course, negating the use of the alternate fingering 2-3 for E<sup>b</sup>5 and C5.

<sup>35</sup> Similarly, this is negating the use of the alternate fingering 1-2 for E5.

valve trumpet for any additional valves beyond the initial three piston valves. Cardoso notes that the rotary valve tubing system “is easier and more direct with considerable advantages in the acoustical production. The use of a piston valve increases the number of bent slides . . . and offers more resistance. It changes the tone (smaller) and alters the timbre to a more brassy quality with a greater number of harmonics similar to those of a medium bore trumpet.”<sup>36</sup> The added resistance of pitches that are fingered with many valves in combination (i.e. valve combinations 1-2, 2-3, 1-3, and 1-2-3) causes these pitches to feel less stable and be less responsive, a condition that many trumpeters describe as “stuffiness.” Since resistance also naturally increases as the register becomes higher, using shorter lengths of tubing in the upper register can be advantageous.

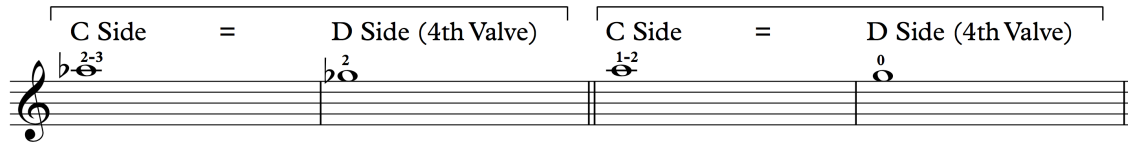
As a side note, the same 2-3 and 1-2 fingering combinations used on  $A\flat_5$  and  $A_5$ , respectively, tend to be less problematic in the lower registers because resistance in those registers is naturally less. The fourth (ascending) valve of the five-valve trumpet solves the problem of added lengths of tubing and the sudden shift to higher partials inherent to the 2-3 and 1-2 fingerings of the pitches  $A\flat_5$  and  $A_5$ . Since the fourth valve raises the fundamental by a whole-step, effectively putting the trumpet in the key of D, the  $A\flat_5$  can be fingered second valve alone ( $G\flat_5$  on the D side of the five-valve trumpet) and  $A_5$  can be fingered open ( $G_5$  on the D side). This places  $A\flat_5$  concert and  $A_5$  concert in the same stable (sixth) partial as  $G_5$  concert and also eliminates a significant length of tubing and corresponding disturbances in the air column. In fact, since the fourth valve is an ascending valve, activating the valve bypasses, rather than adds, a bend in tubing.

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<sup>36</sup> Cardoso, *Ascending Trumpets*, 16.

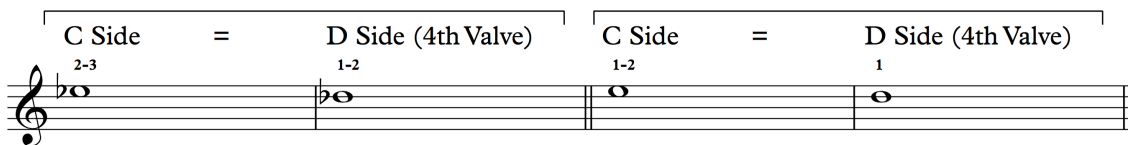
Furthermore, the relatively short length of tubing increases responsiveness on these pitches (see figure 8).

Figure 8: Concert  $A\flat_5$  and  $A_5$  on the D side of the five-valve trumpet.



The ability to utilize lower partials in the high register is also one of the main advantages offered by double and triple French horns. Since  $A\flat_5$  and  $A_5$  occur with great frequency in the standard trumpet literature,<sup>37</sup> this option alone provides an improvement to the three-valve C trumpet. The same concept can be used on other pitches that are prone to accuracy problems. For example, if intonation requires a trumpeter to play  $E\flat_5$  with the relatively unstable alternate fingering 2-3 (sixth partial), the trumpeter can substitute the more-stable fingering 1-2 (fifth partial) by using the D side of the five-valve trumpet. Similarly, the alternate fingering 1-2 for  $E_5$  (sixth partial) can be replaced with the fingering 1 (fifth partial) using the D side of the five-valve trumpet (see figure 9).

Figure 9: Concert  $E\flat_5$  and  $E_5$  on the D side of the five-valve trumpet.



On a related note, most modern C trumpet manufacturers have solved the intonation problems on  $E\flat_5$  and  $E_5$ , and these pitches should be played with their natural

<sup>37</sup> For examples from standard literature edited for performance on the Five-Valve Trumpet, see Chapter IV.

fingerings—2 and open, respectively—whenever possible. Many other options exist for using the D side of the five-valve trumpet to utilize a lower partial and reduce tubing length. This concept can be continued upward or downward at the discretion of the performer.

## **Intonation**

The majority of the intonation problems on the trumpet occur because of two main issues. These two issues are particularly relevant to the design of a five-valve trumpet. The first is that certain partials in the harmonic series are naturally sharp or flat. Notably, the sixth partial is slightly sharp and, depending on the design of the leadpipe, the fifth partial is slightly or moderately flat. The second reason for intonation problems on the trumpet is that, in general, the greater the number of valves depressed in combination, the sharper the pitch. Movable valve slides, a standard feature of the first and third valve slides on most professional trumpets, allow the player the option to correct pitches downward without the need for “lipping.” In addition to the first and third valve slide triggers, several instrument manufacturers offer the option for pitch correction through the installation of a main tuning slide trigger (also called a “Pitch Finder”).<sup>38</sup> When using one of these devices, the trumpeter may make small adjustments on any pitch, regardless of fingering.

The sixth partial pitches tend to be only slightly sharp and relatively easy to correct by means of lipping. However, in certain situations where these pitches need to be placed lower in pitch, the five-valve trumpet provides other options. For example, by

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<sup>38</sup> Hickman, *Trumpet Pedagogy*, 289.

using the fourth valve, the pitch G5 can be played first valve (F5 on the D side), giving the player the option of tuning that pitch with the first valve slide. Similarly, the pitch F<sup>#</sup>5 can be fingered 1-2 (E5 on the D side) with the fourth valve depressed, tuning the pitch with the first valve slide. These are only a few examples of the many options that the five-valve trumpet provides.

As mentioned above, the nature of dependent-valve systems in brass instruments is that the greater the number of valves that are depressed in combination, the sharper the intonation becomes. To lower any pitch by a semitone, the length of tubing must increase approximately 5.95 percent.<sup>39</sup> Each corresponding length of tubing needs to be proportionally longer. This is the reason that, on a trombone, the distance from sixth to seventh position is significantly larger than the distance from first to second positions, even though both are exactly one half-step apart. The same concept applies to string instruments. For example, the frets on a guitar are placed further and further apart the lower on the neck they go.

However, in a dependent-valve system, the problem arises in that the correct length for each valve slide used alone is too short for any two valve slides used in combination. On a B<sup>b</sup> trumpet (approximately 53 inches long), lowering the pitch by exactly six semitones requires using all three valves in combination and necessitates a total length increase of 21.96 inches. However, David Hickman explains: “the correct lengths of tubing for each valve used singularly (3.15 in. + 6.49 in. + 10.03 in.) total only

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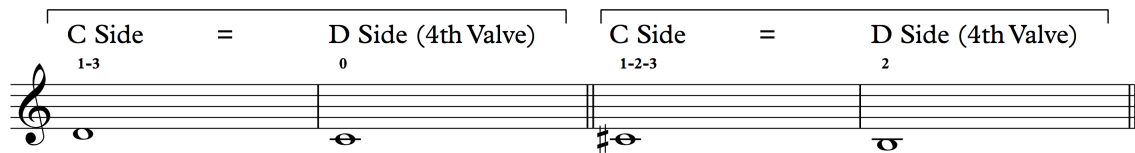
<sup>39</sup> Hickman, *Trumpet Pedagogy*, 286.



19.67 inches. Because the tubing is 2.29 inches too short, manufacturers must decide whether to make the single-valve notes or the combination-valve notes better in-tune.”<sup>40</sup>

Many of the pitches that are fingered 2-3 require no slide manipulation, but those that do require minimal adjustment. Therefore, the fingerings that have the greatest intonation problems are 1-3 and 1-2-3—because they result in the largest increase in tubing length. By using the fourth valve, these fingerings can be eliminated, except for the two lowest chromatic pitches of the three-valve trumpet. For example, with the fourth valve depressed, D2 can be played open (C2 on the D side) and C<sup>#</sup>2 can be fingered second valve (B1 on the D side). See figure 10.

Figure 10: Concert D2 and C<sup>#</sup>2 on the D side of the five-valve trumpet.



The above example improves not only intonation but also response and resistance due to the decreased length of tubing and fewer disruptions in the air column.<sup>41</sup> Intonation, sound quality, and response are also improved. The resulting increase in confidence for passages like the opening trumpet solo of Mahler’s *Symphony No. 5* can be valuable. These intonation improvements also tend to enhance other areas, such as accuracy, sound quality, response, consistency, and, ultimately, musicality.

<sup>40</sup> Hickman, *Trumpet Pedagogy*, 287.

<sup>41</sup> One of the most notable examples appears in Mahler’s *Symphony No. 5* (see Chapter IV).

## Response

The intonation improvements described above help to improve response because they allow the player to articulate the pitch consistently in the exact center of the pitch. The further away from the pitch center that a note begins, the less responsive the note becomes. Additionally, the softer in dynamic, the more centered the note must begin to achieve good response. This is one of the primary reasons for the response improvements of the five-valve trumpet. One of the other reasons was mentioned in the section *Upper Register Accuracy and Security*. Reducing the overall tubing length and the number of disturbances in the air column both tend to improve response, especially in the high register. Examples of this concept abound in the standard literature.<sup>42</sup>

Three especially poignant examples are the pitches A<sup>5</sup>, A<sup>b5</sup>, and C<sup>#2</sup>. Each of these examples is discussed above, but they are again mentioned here to emphasize their inherent response difficulties. A<sup>5</sup> and A<sup>b5</sup> are the highest pitches on the trumpet that normally require the fingerings 1-2 and 2-3. Thus, the fact that these pitches tend to be less stable and less responsive than the surrounding pitches is no meaningless coincidence. By using the fourth valve for these two pitches, the trumpet is shortened and air column disturbances are reduced, thus improving response. Many examples from the standard literature illustrate this phenomenon.<sup>43</sup>

Similarly, the pitch C<sup>#2</sup> is the highest note on the trumpet that requires the fingering 1-2-3. Since this fingering tends to be problematic because of the overall length

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<sup>42</sup> See Chapter IV for examples.

<sup>43</sup> See Chapter IV for examples.

of tubing and the number of disturbances in the air column, the fourth valve is a long-awaited solution. Both tubing length and air column disturbances cause response difficulties, and the extension of the third-valve slide must be extremely precise so that the note begins exactly in the center of the pitch for best response, especially for soft entrances. When C#2 is fingered second valve with the fourth valve depressed (B on the D side), response, sound quality, and intonation are improved.

### **Difficult Trills**

As exemplified above, the five-valve trumpet provides many options to improve the accuracy, intonation, response, and resistance for individual pitches. The five-valve trumpet provides other advantages that have not yet been discussed, such as solutions for trills that are inherently difficult to execute. Many trills are challenging either because the upper note of the trill belongs to a higher partial or because the fingering is difficult to execute with the requisite precision and/or velocity. Since so many examples exist, some are discussed in detail here, and others are listed separately in the *Difficult Trills Catalog* in Appendix A. Trills that have alternate fingerings on the three-valve trumpet that are comparably superior to the extra five-valve trumpet options are omitted. Note that the difficulty of each trill depends on many factors, and discretion should be used in deciding the option best suited for the specific situation. Even if a particular trill is not problematic on the three-valve trumpet, the corresponding five-valve trumpet fingering is still listed in the *Difficult Trills Catalog* in Appendix A. Note also that, as the partials become closer together in the upper register, lip trilling must eventually replace valve trilling.

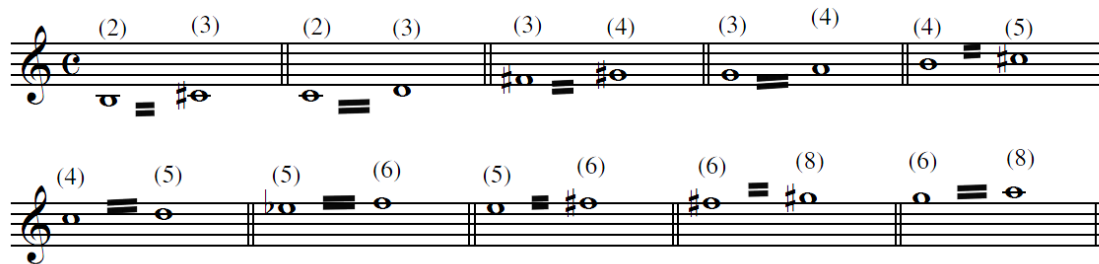
Trills with difficult fingerings are challenging to trumpeters at all levels. The five-valve trumpet provides a number of improvements. Difficult trill fingerings are usually those in which one valve must be depressed at the same time that one or both of the other two valves comes up (or vice versa). These fingering combinations include 1 to 2, 2-3 to 1, and 1-3 to 2-3. Three other trill fingerings that can be awkward are open (0) to 1-3, open (0) to 1-2-3, and 2 to 1-2-3 because multiple valves must be completely in sync, which can be difficult to achieve. Furthermore, the potential for awkward fingerings exists whenever the third finger is involved because it is, for most trumpeters, less agile than the first two fingers (see figure 11). For the same reason, the fingering 2 to 2-3 can also feel less fluid than desired. The fourth and fifth valves provide alternate fingerings for all of these trills and many others. See the *Difficult Trills Catalog* in Appendix A for a complete range of options.

Figure 11: Awkward trill fingering combinations.



In addition to trills that are difficult because of their fingerings, other trills are challenging for other reasons. For example, trills in which the higher pitch belongs to a higher partial than the lower pitch tend to be more difficult than those in which both pitches stay within the same partial. Figure 12 depicts examples of whole-step trills in this category.

Figure 12: Whole-step trills across partials. Note: Each number in parentheses denotes the partial to which that pitch belongs.



Half-step trills tend to be less difficult than their whole-step counterparts, but they still tend to be more challenging than trills where both pitches are in the same partial.

Therefore, many of these trills can be executed successfully on three-valve trumpets but tend to be easier to execute and sound smoother on the five-valve trumpet. Figure 13 depicts examples of half-step trills in this category.

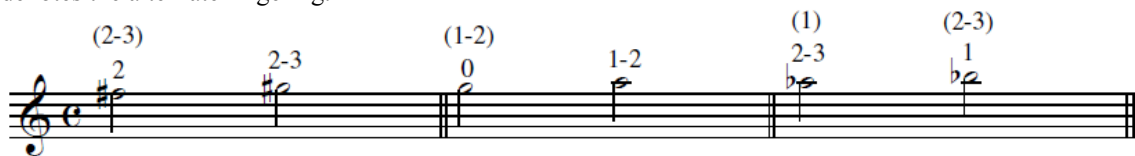
Figure 13: Half-step trills across partials. Note: Each number in parentheses denotes the partial to which that pitch belongs.



Similarly, other trills are difficult because the lower pitch can be played using the same fingering as the upper pitch. These trills include F#5 to G#5 and G5 to A5. For example, F#5 is normally played 2 and G#5 is normally played 2-3, but F#5 can also be played 2-3. Because of this, the player could be using the correct fingering on both pitches, but not actually change pitches – resulting in a valve tremolo. Still, other trills are difficult because both pitches can be played using *either* fingering. This includes all

whole-step trills from  $A\flat_5$  to  $B\flat_5$  upward (see figure 14). Better results are typically obtained by using lip trills in these instances, but the five-valve trumpet allows more of these trills to be played with the help of valves. This can be not only technically but also musically advantageous because even the best-executed lip trills tend to sound qualitatively different from valve trills. This is also one of the reasons that smaller trumpets in special keys have gained popularity.<sup>44</sup>

Figure 14: Trills between pitches with duplicate alternate fingerings. Note: Each number in parentheses denotes the alternate fingering.



One of the advantages of the five-valve trumpet is that the use of the fourth and fifth valves is always optional, and the trumpeter may decide when to use the extra fourth- and fifth-valve options.

### Technical Facility and Difficult Fingerings

Avoiding difficult trill fingerings is only one example of the numerous alternate fingering possibilities of the five-valve trumpet. For example, some keys on the trumpet sound less fluid and are more prone to fingering mistakes than others. While the goal of being able to play in all keys with the same speed and fluidity is laudable, the musical result is the ultimate goal, not technique for technique's sake. Facility in all keys should

<sup>44</sup> Perhaps the most notable example is the use of the  $E\flat$  trumpet for the trumpet concertos by Haydn, Hummel, and Neruda, all of which contain the whole-step trill from concert F5 to G5. On the  $B\flat$  trumpet, this trill is G5 to A5, where the top note is in a higher partial and the bottom note can be played with the same fingering as the top note. However, on the  $E\flat$  trumpet, the trill becomes D5 to E5, which has an easy fingering and stays in the same partial.

be maintained when using the five-valve trumpet. However, alternate fingerings on the five-valve trumpet can improve performance in especially difficult passages.

One top performer who used the five-valve trumpet in this way was Armando Ghitalla. In performances of Tomasi's *Concerto for Trumpet and Orchestra*, Ghitalla, by activating both the ascending rotor and the descending rotor, put the trumpet in the key of  $D\flat$  and converted "all of the difficult scale passages in the key of  $D\flat$  and  $G\flat$  [to] just plain C and F."<sup>45</sup> The point of this specific example is not to reduce the number of keys in which one needs to be proficient but to increase the ease at which especially challenging passages can be executed, and thus allow the performer to focus more attention on higher musical goals.

The above example of how Armando Ghitalla used the five-valve trumpet is especially significant because his status as a world-class trumpeter supposes that his choice to change the key of those particular passages was not motivated by deficiencies in technique but by the desire to overcome the unfortunate awkwardness of those passages and achieve the best possible musical result. By changing the fundamental key of the trumpet to  $D\flat$ , Ghitalla turned remarkably difficult passages into ones that were relatively easy by eliminating certain fingerings that are awkward because of human physiology.

Since difficult and awkward fingerings occur more often in certain keys than in others, a plethora of trumpets in different keys could be used depending on the key of a particular passage. However, as is the case with Tomasi's *Concerto for Trumpet and Orchestra*, switching to a  $D\flat$  trumpet for a few extremely difficult passages can be

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<sup>45</sup> Tunnell, "Armando Ghitalla," 12.

undesirable or problematic. Consequently, the five-valve trumpet allows these difficult passages to be fingered in a different key without switching trumpets.

## **Conclusion**

The five-valve trumpet can provide solutions for certain problems, although utilization of the five-valve trumpet is not intended to be a substitute for practice and skill development. Thus, a solid technical foundation is essential. One method for exploring the new possibilities of the five-valve trumpet is to begin with pieces that have already been learned on three-valve trumpets and experiment with different solutions for notes or passages that had posed problems. For learning new pieces, the initial work can best be done with the normal fingerings, after which the five-valve trumpet options can be explored. Improvements in one area will often overlap with other areas, as has been observed in the above suggestions. For example, improvements in technical facility often carry over to sound quality and musicality.

Many of the suggestions presented in this chapter and subsequent chapters can be applied to a multitude of situations. The learning curve on the five-valve trumpet can be rapid, but remaining open-minded in the very beginning can be beneficial when learning new ways of performing. When a certain five-valve trumpet technique is successfully employed in one situation, such as using an alternate fingering for improved accuracy and/or intonation, other situations where the same technique is useful will quickly become apparent. At some point, these options will become second nature and no longer require deliberate thought and experimentation. The above suggestions are by no means exhaustive but are intended to illustrate the broad base of techniques and corresponding



musical possibilities that a trumpeter may achieve on the five-valve trumpet. Refer to Chapter IV for specific musical examples from the standard trumpet repertoire.

## CHAPTER III

### DESIGN CONSIDERATIONS FOR BUILDING A MODERN FIVE-VALVE TRUMPET AND THE PROCESS OF INTERACTIVE PROTOTYPING

The acceptance of the five-valve trumpet design has social and market-related challenges; consequently, creating the best possible finished product is important. A final design that would be made by a professional instrument manufacturing company should be free of defects and peculiarities. Such peculiarities may apply to playing characteristics, position of the hands, weight, balance, and appearance. Ideally, any five-valve trumpet design that is to be mass-produced and marketed should have no disadvantages in comparison to the competing three-valve C and B $\flat$  trumpets. In other words, it should perform at the same level as top-of-the-line C or B $\flat$  trumpets before even considering the additional capabilities of the fourth and fifth valves. Toward this aim, multiple design considerations for building a prototype for the purposes of this paper are outlined in this chapter, followed by a discussion of the process that the author undertook to build a five-valve trumpet prototype.<sup>46</sup>

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<sup>46</sup> In 2013, the author built a prototype for the research purposes of this project. These purposes include proof-of-concept and a working five-valve trumpet for use in the editing of standard orchestral trumpet passages for use on such a trumpet. Therefore, the author does not go into great detail about five-valve trumpets that were constructed following the author's completion of his own five-valve trumpet prototype because this information is beyond the scope of the research methodology of this document. For information about one such five-valve trumpet produced by Clifford Blackburn, refer to: David Hickman, "Introducing the 5-valve C Trumpet by Blackburn Trumpets: History and Perfection of an Old Design, Advantages of the Extra Valves, Instructions, Difficult Orchestral Passages made Easy, Common Questions, and Additional Readings" (Chandler, AZ: Hickman Music Editions, 2014). For information about Blackburn Trumpets, see the Blackburn Trumpet Website: <http://www.blackburntrumpets.com>. For information about Clifford Blackburn, see David R. Hickman, *Trumpet Greats: A Biographical Dictionary* (Chandler, AZ: Hickman Music Editions, 2013).

## **Design Considerations for Building a Modern Five-Valve Trumpet**

The design considerations in this project include the following:

1. Appearance
2. Weight and Balance
3. Hand Position, Placement of Triggers, and Linkages
4. Intonation and Length of Valve Slides
5. Overall Performance Characteristics

### **Appearance**

Since aesthetic factors should be considered, appearance is a feature that can be an asset to the design. Merri Franquin's five-valve trumpet design (see figure 6 in Chapter I) has a peculiar appearance because it includes two extra piston valves placed horizontally, a fourth valve slide the same length as the first valve slide, and a fifth valve slide the same length as the third valve slide. Ghitalla's five-valve alterations (see figure 7 in Chapter I), however, are less conspicuous because his trumpet uses rotor valves and a fifth-valve slide that is the same length as the second valve slide. Since the latter design has other advantages, as discussed in previous sections, it shows the most promise as an archetype of a modern five-valve trumpet.

Furthermore, the design of the trim, rotors, triggers, additional slides, and linkages should be visually appealing. A range of finishes should be available, including silver and gold plating. Engraving on the leadpipe, bell, and rotors may enhance the visual attractiveness of the trumpet. The end goal is for the appearance of the five-valve trumpet

to reflect the fact that it is a complete and refined design from leadpipe to bell. If the maker has complete control over the process from design conception to completion, the builder may ensure a seamless design that is visually appealing. This is in contrast to trumpet conversions that utilize parts from a multitude of sources that have the appearance of being—and indeed frequently are—mismatched and incompatible.<sup>47</sup> The appearance of the trumpet should reflect the meticulous effort of the design process and may prove to be crucial to market acceptance. As with all standards, the appearance should meet or exceed that of top-of-the-line three-valve trumpets.

### **Weight and Balance**

The overall weight of the trumpet is also a consideration. Franquin's design adds considerable weight with its two additional piston valves and extended lengths of extra tubing. Furthermore, the extra weight is at the bell end of the trumpet, making the instrument more bell-heavy than three-valve C trumpets. In contrast, Ghitalla's design uses only minimal extra tubing and lighter (rotor) valves; however, it places both rotor valves and all of the associated tubing on the bell end of the trumpet, also making it more bell-heavy. To improve balance, the modern five-valve trumpet design should add minimal weight, like in Ghitalla's design, but distribute the weight evenly. Therefore, the fifth rotor valve may be placed in the bell stem, directly before the bell bow. Since this

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<sup>47</sup> The author's prototype uses parts from several different sources and, therefore, can be said to have this limitation. However, this limitation does not prevent the author's prototype from fulfilling the purposes of this paper.

approach places approximately half of the extra weight at the mouthpiece end of the trumpet, the weight balance of the instrument is preserved.<sup>48</sup>

### **Hand Position, Placement of Triggers, and Linkages**

Another important factor that can make a considerable difference in the acceptance of a new design is hand position. Franquin's five-valve design requires an awkward, unnatural hand position because of the placement of the piston valves and additional slides. Ghitalla's design allows for a relatively natural hand position but requires both the fourth and fifth valve triggers to be operated by the thumb of the right hand, which may be uncomfortable for performers who support the trumpet under the leadpipe with the right thumb.

The modern five-valve trumpet should feature rotors placed in such a way that no changes in hand position need to be made for most players. If the new trumpet can be held and operated in the same manner to which the player is accustomed, the advantages will likely outweigh the initial unfamiliarity. For this reason, the placement of the triggers for the fourth and fifth valve and the feather-light action of their linkages is essential. The fourth valve trigger should be operated by the index finger of the left hand because this position holds the most potential for preserving hand position. The right thumb should operate the fifth valve trigger, and the trigger should be close to the first valve casing and just under the leadpipe. In this position, trumpet players who support the weight of the instrument with the right thumb under the leadpipe can operate it without difficulty. Other placements of the triggers are possible, according to the desire of individual

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<sup>48</sup> See figure 28 at the end of this chapter for a demonstration of the balance of the author's five-valve trumpet prototype that places the fifth rotor valve in this location.

players, but the overall goal is that hand position and ease of operation should have no major disadvantages as compared to three-valve trumpets.

### **Intonation and Length of Valve Slides**

Since the five-valve trumpet can perform in four different fundamental keys, decisions about valve slide length are an important design consideration. In order to provide full use of all four keys and the possibility of maintaining good intonation, the slides should be cut to accommodate the shortest side of the trumpet, the D side. However, if the slides were cut to normal D-trumpet length, performing with good intonation would require continuous movement of the movable valve slides. Although the player would over time be able to acquire the necessary slide technique to accommodate the use of D-trumpet-length valve slides in the fundamental keys of C, D $\flat$ , and B $\natural$ , certain compromises are possible.

One of these other possibilities is to cut the slides for the D $\flat$  side. If the slides are cut in this manner, they will need to be manipulated less (compared to D-trumpet-length slides) when playing on the C side, but intonation may suffer on certain pitches on the D side. For example, A $\flat$ <sub>4</sub>, D<sub>5</sub>, and E $\flat$ <sub>5</sub> are typically flat in pitch, and the intonation for these pitches may become unsatisfactory with the longer D $\flat$ -trumpet-length slides. However, the intonation may improve on pitches that are sharp, such as E<sub>4</sub>, A<sub>4</sub>, and F<sub>5</sub>.

Although cutting the slides for the key of D $\flat$  may be a good compromise, the author uses a different option on his five-valve trumpet prototype. On the final five-valve trumpet prototype (see figure 24 at the end of this chapter), the author has cut the first-,

second-, and third-valve slides to a length intermediate between D and D $\flat$ . Through play-testing, the author came to believe that this intermediate length is a satisfactory compromise. The result is that naturally flat pitches still have acceptable intonation on the D side of the five-valve trumpet, but the movable valve-slides are long enough to comfortably make the intonation adjustments necessary for the B $\natural$  side.

### **Overall Performance Characteristics**

As mentioned above, many of the earlier five-valve trumpets were not ultimately successful on a large scale. This was due in part to certain problems with the overall performance characteristics of these instruments. Individual design peculiarities, especially in trumpets made from combinations of existing parts (conversions), tend to create abnormal playing characteristics. Differences in materials such as alloy ratios, metal thickness, bore size, annealing, and tempering are always present in converted horns because the craftsman, in this situation, has little control over the materials employed.

Probably the most limiting problem of five-valve trumpets manufactured prior to 2013 is the difference in the bore size of the piston and rotor<sup>49</sup> valves. This causes disturbances in the air column and increases the resistance of the trumpet, resulting in what trumpeters perceive as “stiffness.” While this effect may be minimal, depending on the relative success of the design at hand, any perceivable deficit in playing characteristics will probably be attributed by the trumpet player to the presence of the extra valves and tubing, instead of a design flaw itself. This is the reason that conversion

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<sup>49</sup> The author’s five-valve trumpet prototype uses rotor valves that are the same bore size as the piston valves. See Appendix C for a list of parts used and their corresponding bore sizes.

trumpets are risky and that the modern five-valve trumpet design requires control over all of the materials as well as the time required to perfect it. These inconsistencies also affect response negatively because abrupt changes in bore size cause excessive feedback to the player's lips.

Similarly, changes in metal hardness, thickness, and density affect the way that the metal vibrates, which may negatively impact the playing characteristics, including causing poor response. Sometimes characteristics like poor response are only apparent on certain pitches or at certain dynamic levels. If one or more rotor valves are placed in the main tuning slide, as is the case with Ghitalla's five-valve trumpet, special consideration must be given to ensuring consistency in the bore-size and balance in the weight distribution. The effects of placing a rotor valve within the main tuning slide are not necessarily detrimental but should be carefully balanced and fine-tuned with the other design characteristics. For example, leadpipe venturi, leadpipe taper, annealing, tempering, thickness of metal, and weight distribution in key areas all need to be balanced to create the optimal response and other performance characteristics.

The most important attribute of a viable modern five-valve trumpet design would probably be its intonation throughout all registers and all four keys. Since the instrument performs in four different key centers, intonation must be satisfactory. Inconsistencies like those described above, especially abrupt changes in bore size, can have a detrimental effect on intonation and tone color. This is especially true if the bore-size change happens to occur at a nodal point.<sup>50</sup> Design flaws like sudden changes in bore size sometimes only

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<sup>50</sup> A nodal point is a location in the tubing of the trumpet that marks the end of a standing wave at the particular pitch frequency. Increasing the inside diameter of the tubing at that point lowers the pitch slightly on all pitches that share the particular nodal point. Decreasing the diameter raises the pitch. In



affect only one or two pitches, depending on the location of the inconsistency. However, the additional key centers of the five-valve trumpet multiply the number of pitches that could be affected by a given bore inconsistency at a nodal point.

In general, the closer to the mouthpiece that a bore irregularity resides, the greater the effects will be. Therefore, the placement of a rotor valve within the main tuning slide must be carefully engineered. Alternatively, the rotor valve could be placed after the tuning slide to maximize the length of undisturbed tubing from the leadpipe to the first rotor valve.<sup>51</sup> Furthermore, the design of the leadpipe, especially its length and taper, is of prime importance in determining playing characteristics. When possible, the leadpipe should be engineered specifically for the special requirements of the five-valve trumpet.

### **The Interactive Prototyping Process**

Through a nine-month period of interactive prototyping, the author tested many of the theoretical design concepts discussed in the previous chapters. This interactive process consisted of four phases:

Phase 1: Graphical Prototyping

Phase 2: Parts and Skills Acquisition

Phase 3: Building the Prototype

Phase 4: Play-Testing and Finishing the Prototype

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Shamu, “Merri Franquin,” 79, Geoff Shamu notes: “this type of harmonic manipulation...tends to affect the tone color adversely.”

<sup>51</sup> The author’s five-valve trumpet prototype is an example of this rotor-valve placement (see figure 24 at the end of the current chapter).

## Phase 1: Graphical Prototyping

At this point in the process, the goal was to devise a number of viable five-valve trumpet configurations and decide upon the one that would most likely yield the desired results. During this phase, the author sketched several different possible configurations, taking into account the available information, including how the existing four- and five-valve trumpets are configured, the known problems and peculiarities of these trumpets, and the parts that would be available to the author for building the final prototype. In these sketches, dimensions are strictly relative and approximate (not to scale).

### Graphical Prototype A

The first of these designs (see figure 15) is based upon an existing trumpet design that is commonly used for smaller trumpets, most notably D and E $\flat$ . This configuration features a fourth piston-valve that is intended to extend the low register of higher-pitched trumpets.

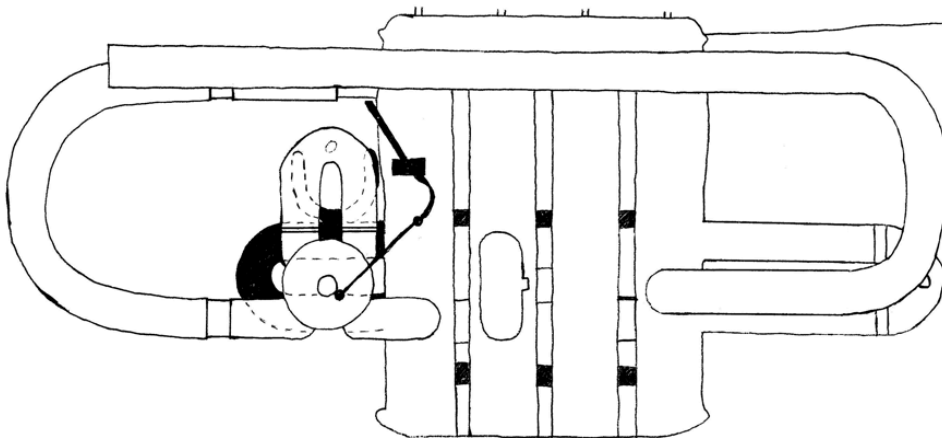


Figure 15: Graphical Prototype A: five-valve C trumpet with four piston valves and one rotor valve. Sketch by the author (March 17, 2011).

For most of the trumpets with a four piston-valve configuration, the purpose of the fourth valve is to extend the low range; however, in prototype A, the fourth piston valve is an ascending whole-step valve, intended to change the fundamental key of the instrument from C to D. Because the fourth valve is an ascending valve, the accompanying fourth valve slide acts as the main tuning slide. Along with the four piston-valves, the fifth valve is a half-step descending rotor valve placed directly before the bell bow. This valve is intended to change the fundamental key of the instrument from C to B<sup>♯</sup> and from D to D<sup>♭</sup>. Furthermore, although most of the trumpets with a four piston-valve configuration have a tunable bell, in which the entire bell is moved to adjust the tuning, prototype A integrates the corresponding tuning slide<sup>52</sup> into the bell bow.

An additional peculiarity of the configuration of prototype A is that the bell port and the first-valve-slide exit ports are reversed (see figure 16). This was an attempt to solve the challenge of placing a rotor valve and accompanying linkage in close proximity to the first valve slide. Although some extant piccolo trumpets and older B<sup>♭</sup> trumpets use this port configuration, this practice is extremely rare, making this aspect of the design less desirable in terms of procuring parts for building the final prototype.

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<sup>52</sup> In the case of prototype A, this slide adjusts the tuning of the D side of the instrument.

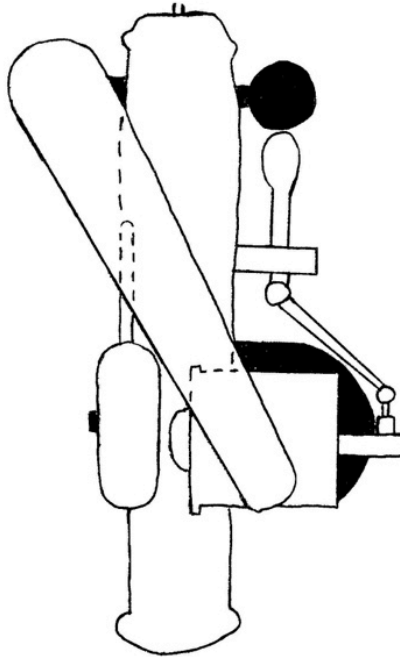


Figure 16: Graphical Prototype A: five-valve C trumpet with four piston valves and one rotor valve (alternate x-ray view). Sketch by the author (March 17, 2011).

In prototype A above, the fifth valve is placed directly before the bell bow in an attempt to preserve the consistency of the tubing from the beginning of the leadpipe through the leadpipe port in the third valve.

### Graphical Prototype B

The fifth valve could otherwise be placed directly after the leadpipe as in prototype B (see figure 17).

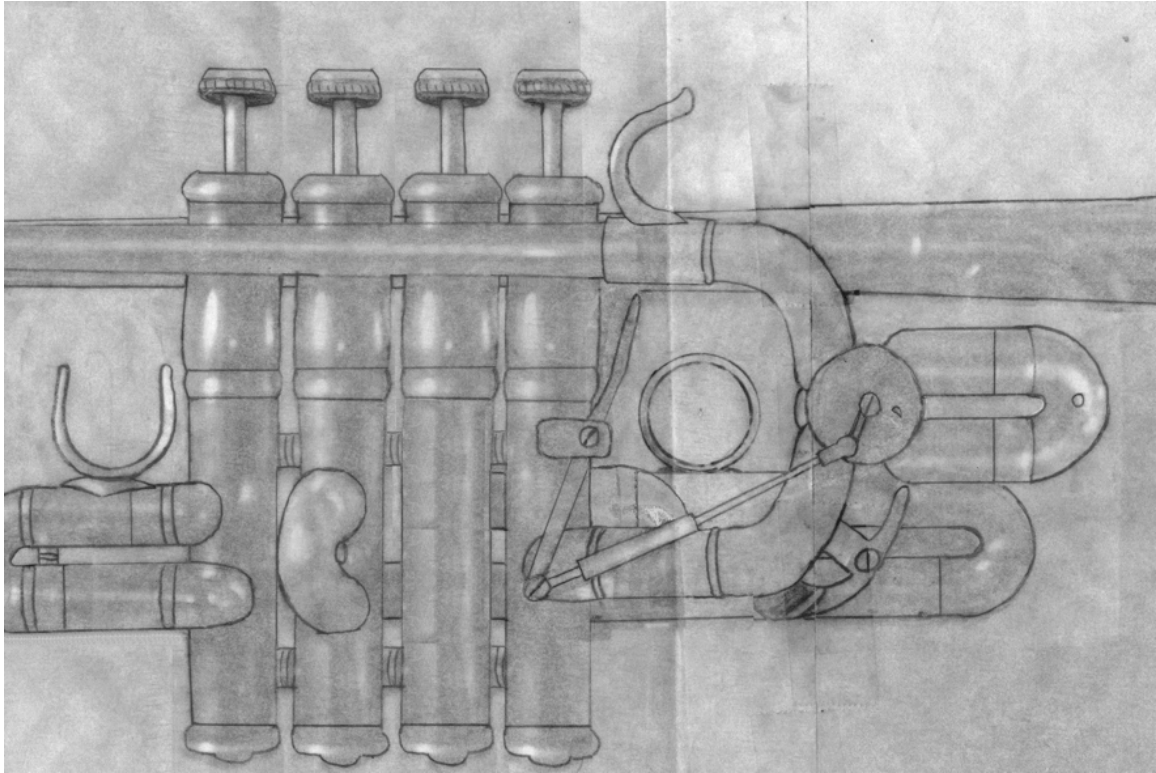


Figure 17: Graphical Prototype B: five-valve C trumpet with four piston valves and one rotor valve.

In prototype B, the tuning slide for the D side of the instrument is placed directly after the leadpipe,<sup>53</sup> and the fifth valve is placed within the tubing of the tuning slide. An example of an existing trumpet that has rotor valves placed in a similar location is Armando Ghitalla's five-valve C trumpet that was discussed in Chapter I (see figure 18).

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<sup>53</sup> This tuning slide placement is in contrast to the tuning slide placement in prototype A, where the tuning slide for the D side is placed in the bell bow.

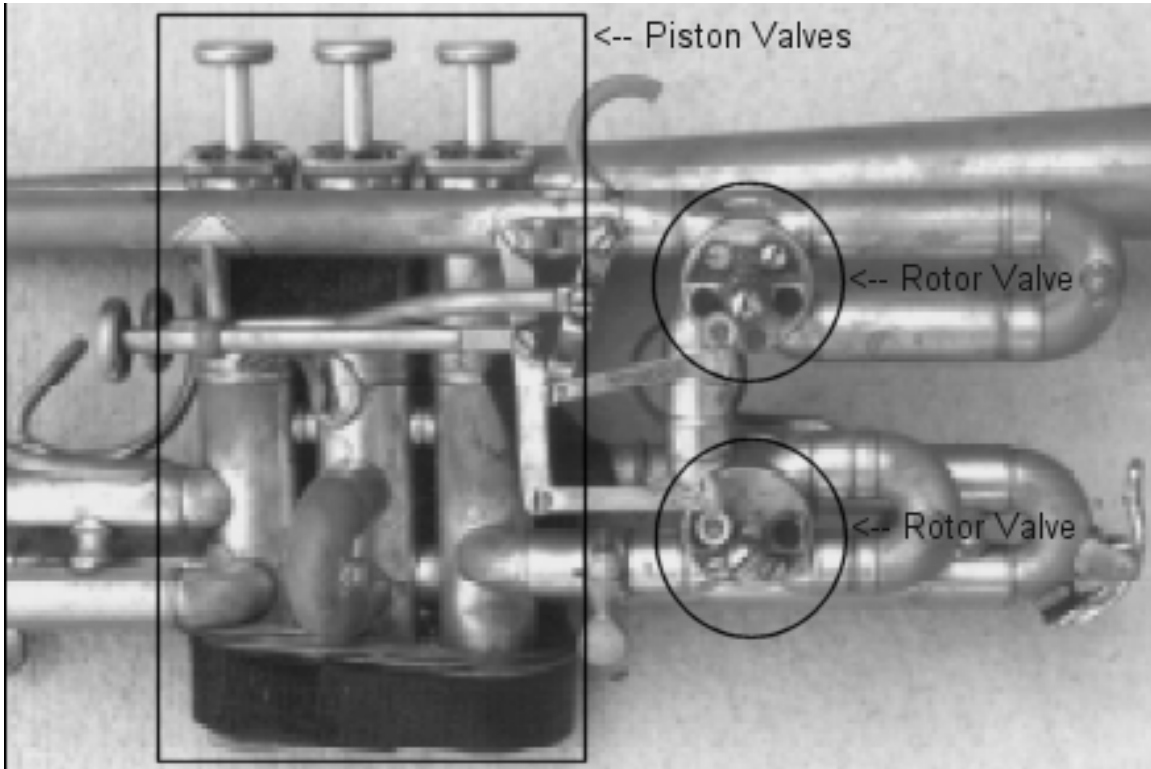


Figure 18: Photograph of Armando Ghitalla's Five-Valve Trumpet from Michael Tunnell's May 1997 ITG article "Armando Ghitalla." [Annotations by the present author].

Ghitalla's five-valve C trumpet features two rotor valves located directly after the leadpipe. In contrast to prototype A, prototype B features a normal first valve slide port and bell port configuration. Although prototype B is a viable configuration, special attention needs to be made to the consistency of tubing through the rotor valve(s) to ensure good intonation and other playing characteristics. Since the author has limited resources in terms of available parts, the configuration of prototype B would pose formidable challenges.

### Graphical Prototype C

While prototype A and B both feature configurations with four piston valves and one rotor valve, prototype C features another viable configuration: the combination of

three piston valves with two rotor valves. The two rotor valves could potentially be placed in one or more locations, but prototype C places them directly before the bell bow (see figure 19).

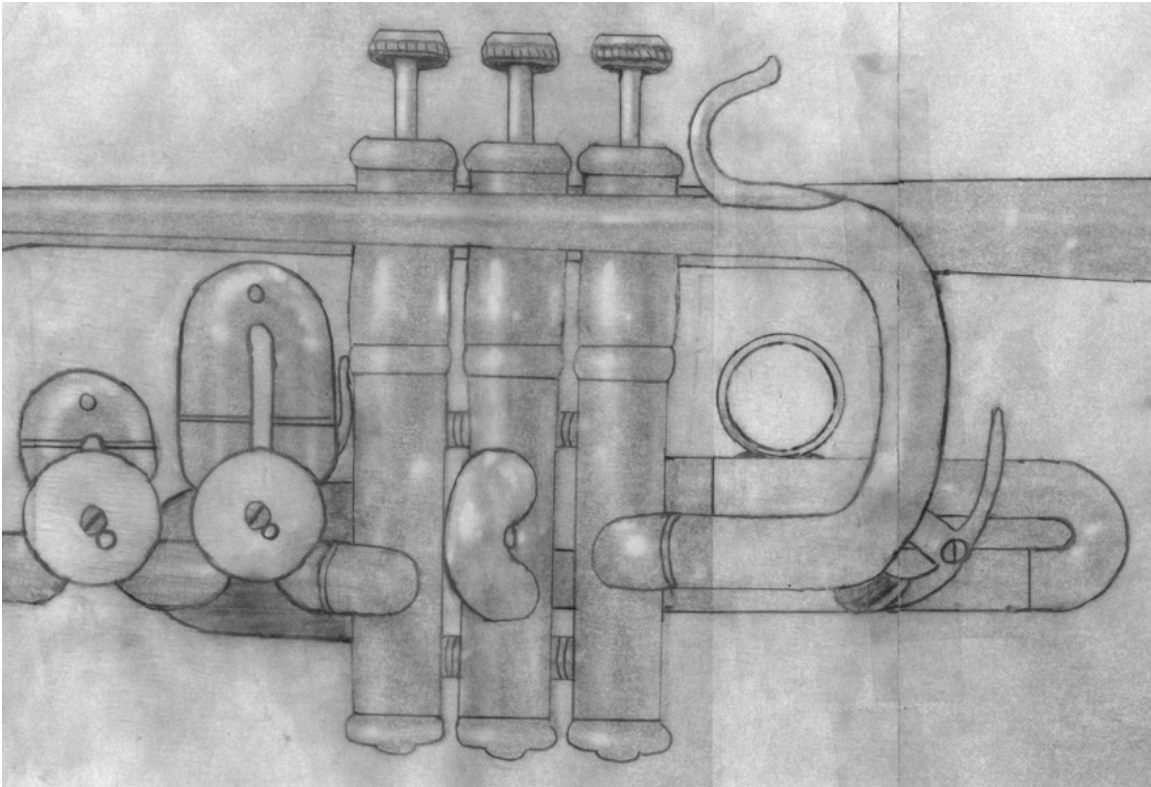


Figure 19: Graphical Prototype C: five-valve C trumpet with three piston valves and two rotor valves. Sketch by the author (May 22, 2011).

In prototype C, the fourth valve is a whole-step ascending valve placed directly after the bell exit port out of the first slide. The fourth valve slide functions, in effect, as the main tuning slide.<sup>54</sup> The fifth valve is a half-step descending valve placed directly after the fourth valve.

Although placing the valves in this location preserves the consistency of the tubing from the beginning of the leadpipe through the leadpipe entrance port into the

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<sup>54</sup> Note that figure 19 does not indicate the location of the tuning slide for the D side of the horn, which could be placed directly after the leadpipe or integrated into the bell bow.

third valve, prototype C uses a reversed bell tube port and first valve port configuration. As mentioned above, this unusual configuration would pose challenges to parts acquisition and building. One notable advantage of prototype C is the simplification of linkage construction. Since the rotor valves are adjacent to each other and in an accessible location, simple triggers and levers would suffice. Figure 20 depicts a possible double-trigger configuration for the linkages in prototype C.

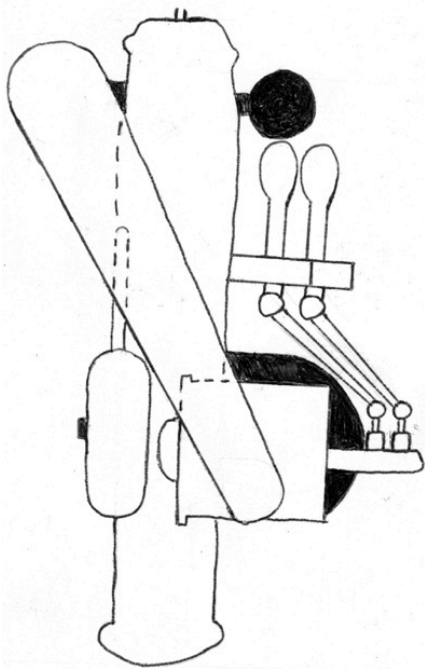


Figure 20: Graphical Prototype C: five-valve C trumpet with three piston valves and two rotor valves (alternate x-ray view with linkages). Sketch by the author (May 22, 2011).

Although the above configuration of prototype C may have theoretical design advantages, parts acquisition would be a formidable challenge, especially locating a usable valve block that has the reversed bell port and first valve ports and is also in a modern bore size. Therefore, a revised configuration is needed that maximizes design elements that are



likely to be advantageous while also taking into account the parts that would be available to the author in building the final prototype.

### Graphical Prototype D

Prototype D (see figure 21) is intended to bridge the gap between what would be theoretically ideal and what is most feasible.

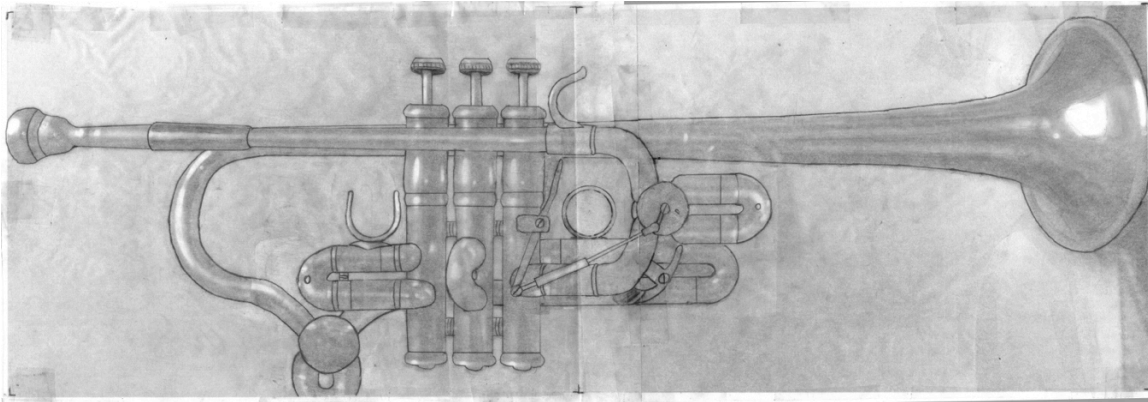


Figure 21: Graphical Prototype D: five-valve C trumpet with three piston valves and two rotor valves. Sketch by the author (May 22, 2011).

Prototype D incorporates elements of the previous prototypes in a way that would be practical for the author to build. The fourth valve is an ascending whole-step valve that is placed directly after the leadpipe and within the tuning slide for the D side of the instrument. The fifth valve is placed directly before the bell bow, using the typical configuration for the bell tube port and first slide ports.<sup>55</sup> Finally, the fifth valve linkage

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<sup>55</sup> Although prototype D is the final graphical prototype, the final physical prototype that the author built features two minor changes to the placement of the rotor valves (see figure 24 at the end of this chapter). During construction of the instrument, the author chose to place the fourth valve in a different orientation with the slide pointing downward and in a slightly different location just before the leadpipe port into the third valve. The goal of this change is to preserve the consistency of the tubing from the beginning of the leadpipe to the end of the tuning slide. This minor alteration is intended to provide improved intonation, resistance, and other playing characteristics. Additionally, the final physical prototype features a straight bell tube in place of the curved portions of the bell tube leading to and from the fifth

and trigger are not depicted in figure 21, but a linkage and trigger design like the one depicted in figure 20 would suffice.

## **Phase 2: Parts and Skills Acquisition**

Having had no previous brass instrument building experience, the author spent several months acquiring the parts, skills, and tools needed to build the final physical prototype. To begin this process, the author purchased several used brass instruments to disassemble and reassemble with the intention of acquiring the skills necessary to harvest parts from existing horns and to eventually reassemble them as the final prototype. These instruments included B♭ trumpets by Courtois, F. Besson, and Getzen; B♭ cornets by Conn, Olds, and Wurlitzer; a German E♭ rotary trumpet by Cerveny; and a double French horn (F/B♭) by Bach. In addition to these instruments, the author acquired the necessary tools and materials (see Appendix B for lists of both). The author also harvested parts from several used brass instruments in addition to those listed above (see Appendix C for information about the donor instruments and acquired parts).

## **Phase 3: Building the Prototype**

For each of the donor instruments listed above, the author disassembled, thoroughly cleaned, buffed, and measured the inside diameter (bore size) of all parts to be used in building the prototype. Following this process, the author trimmed each slide and bell tube to the appropriate lengths. After ensuring that each component part was the

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valve as depicted in figure 21. The goal of this change is to simplify construction of that section of the instrument.

correct length, the author fitted the slides and bell tube onto the harvested valve-block assembly using appropriate ferrules that the author machined (expanded) when necessary by using adjustable reamers. Finally, the author assembled and soldered the parts (see figure 22).

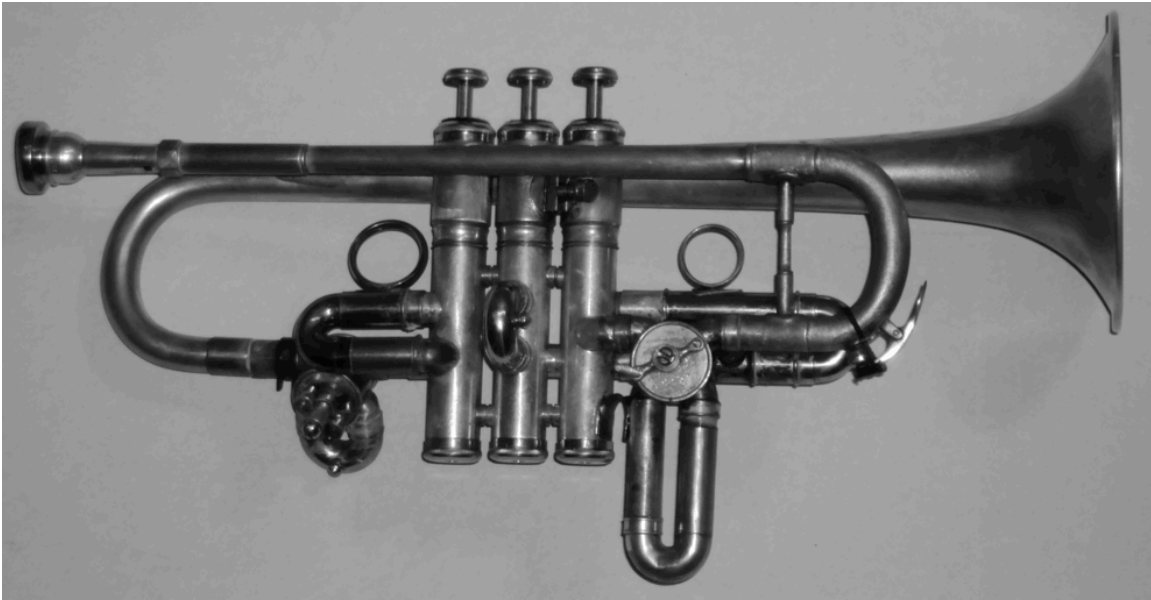


Figure 22: The author's five-valve trumpet prototype at an intermediate stage of assembly, photographed on June 13, 2013.

Following assembly, the author also tested the trumpet for balance at this intermediate stage by inserting a mouthpiece and hanging the trumpet from a string tied to the second valve stem. The author was satisfied with the balance of the design (see figure 23).



Figure 23: Demonstration of the balanced weight distribution of the author's five-valve trumpet prototype at an intermediate stage of assembly,<sup>56</sup> photographed on June 13, 2013.

#### **Phase 4: Play-Testing and Completion of the Prototype**

At this intermediate stage in building the prototype, the author play-tested the instrument briefly as a way to identify possible design improvements before committing to the parts to be used. The author made two changes based on intonation and resistance. First, the author noticed that pitches fingered 2-3 were consistently sharp. Since the author had previously cut the third slide to be the proper length for a D trumpet, pitches that used the third valve were exceedingly sharp, especially on the C, D $\flat$ , and B $\natural$  sides of the instrument. Thus, the author harvested an additional third valve slide from the previously used Vincent Bach large bore trumpet and cut this slide to a length intermediate between C-trumpet and the previous D-trumpet length.

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<sup>56</sup> See figure 28 at the end of the current chapter for a demonstration of the balanced weight distribution of the author's finalized prototype.

Furthermore, the author thought that the instrument was too resistant and had other intonation problems in addition to the ones caused by the third valve slide being too short. Specifically, the pitches concert G4 and E5 were both more than 15 cents flat, and the pitches concert C4 and G5 were both more than 15 cents sharp. To solve these additional resistance and intonation problems, the author play-tested the instrument with various leadpipes and tuning slides, eventually settling on a Clifford Blackburn model 19 leadpipe with corresponding Blackburn squared tuning slide. The author then shortened the tuning slide to the appropriate length for use on the five-valve prototype. Finally, the author assembled these finalized parts.

Following the basic assembly of the prototype, the author then constructed appropriate linkage assemblies using the mini-ball linkages from the Lidl posthorn and the clock spring triggers from the Cerveny rotary trumpet. The author sized the parts using a micro mill, connected the mini-ball linkages by threading the parts using various taps and dies, and finally soldered the clock spring trigger mounts onto the valve block. Figure 24 shows the finished prototype.



Figure 24: The author's five-valve trumpet prototype (View #1), photographed on August 14, 2013.

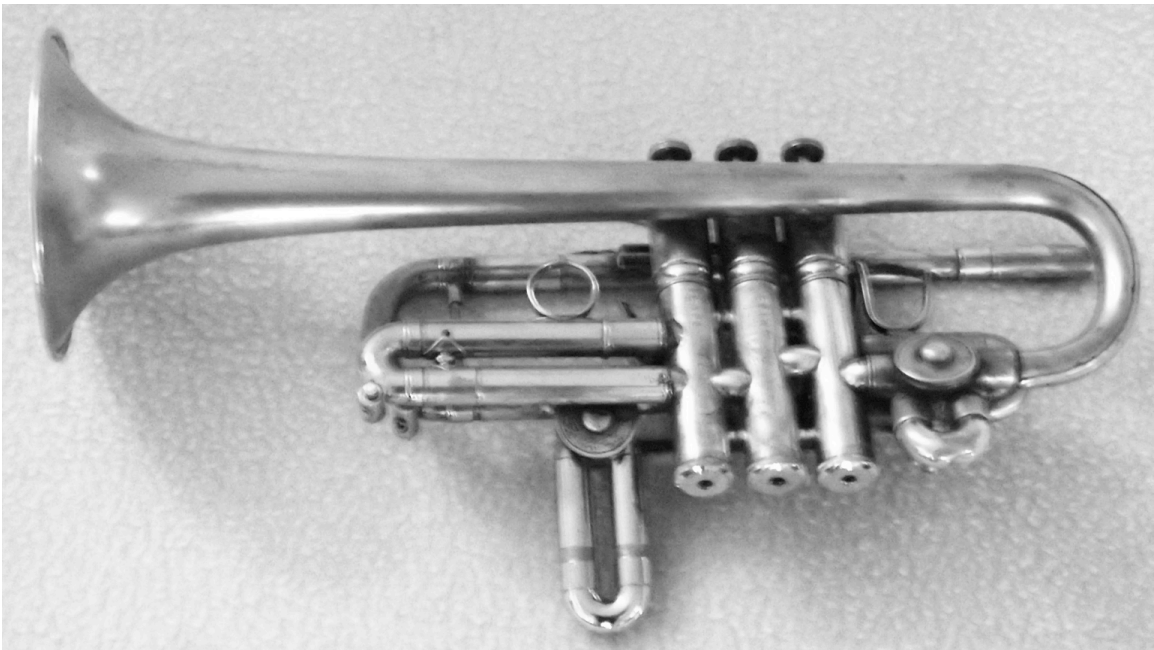


Figure 25: The author's five-valve trumpet prototype (View #2), photographed on August 14, 2013.



Figure 26: The author's five-valve trumpet prototype (inscription), photographed on August 14, 2013.<sup>57</sup>



Figure 27: The author's five-valve trumpet prototype (View #3), photographed on August 14, 2013.

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<sup>57</sup> The inscription reads: EWING –  
5 – VALVE – 0014 [Serial Number]  
TEMPE – AZ – 2013



Figure 28: Demonstration of the balanced weight distribution<sup>58</sup> of the author's completed five-valve trumpet prototype, photographed on August 14, 2013.

This finished prototype serves as proof-of-concept for this particular five-valve trumpet design. The prototype also serves as a working five-valve trumpet that the author has used for the purpose of editing standard orchestral trumpet passages for use on such a trumpet (see Chapter IV).<sup>59</sup>

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<sup>58</sup> In the author's completed five-valve trumpet prototype, the weight distribution is slightly heavier on the bell side. The author believes this balance to be preferable to the somewhat more even weight distribution of the trumpet during the intermediate stage of construction (compare figure 23 to figure 28). The author believes that the completed trumpet's slight angle downward is a more natural playing position.

<sup>59</sup> Others interested in the advantages of the five-valve trumpet design concept may use, in the development of future designs, the information that is provided above about the author's five-valve trumpet prototype. An example of a manufacturer who has produced a five-valve trumpet during the author's completion of this document is Blackburn Trumpets. David Hickman commissioned the Blackburn Five-Valve Trumpet in 2014 (See figure 29 in Chapter IV). Although the author acknowledges the existence of the five-valve trumpet produced by Blackburn Trumpets, the author does not go into further detail about five-valve trumpets that were constructed following the author's completion of the self-made five-valve trumpet prototype because this information is beyond the scope of the research methodology of this document.



## CHAPTER IV

### EXAMPLES FROM STANDARD LITERATURE

The previous chapters contain information about the advantages of the five-valve trumpet, including information on theoretical design concepts, market viability, performance technique, and historical context. In the present chapter, the author presents a variety of ways in which the five-valve trumpet may be implemented in the performance of standard orchestral literature. Each musical passage incorporates at least one of the techniques or advantages that were discussed in the previous chapters. Although the author used his personal five-valve trumpet prototype in the design of these musical examples, slight differences exist in how the five-valve trumpet options can best be implemented due to differences in the designs of particular five-valve trumpets.

#### **General Suggestions**

- (1) Keep in mind that five-valve trumpets vary in design, resulting in somewhat differing performance techniques.
- (2) Experiment with as many different five-valve trumpet techniques as possible because it may improve overall musicianship and technique, even if any particular suggestion is eventually discarded.
- (3) To perform with good intonation throughout all of the four fundamental keys of the five-valve trumpet, the first and third valve slides may need to be used more extensively than on three-valved instruments.

- (4) Compare the result of performing each unaltered excerpt with its accompanying five-valve trumpet versions presented below.
- (5) Find the places in the music where the change to the extra (fourth and fifth) valves may be made without any accompanying valve changes.

### **Guide to Notation**

Each of the following selected musical passages is first presented in the original key and then again in one or more additional versions designed specifically for the five-valve trumpet. Each five-valve trumpet version has been transposed to the indicated key, and the brackets indicate when the fourth and fifth valves should be used individually or in combination. The key indicated within each bracket informs the performer which additional valve(s) should be used, as summarized in table 1 below. The music is presented in this manner because the five-valve trumpet techniques may most clearly be conceptualized within the context of different keyed trumpets and transpositions. See figures 29 through 31 and tables 1 through 3 for three examples of five-valve trumpets and accompanying charts that show which keys correspond to which valves.

### Three Example Five-Valve Trumpets

#### Five-Valve Trumpet by Blackburn Trumpets

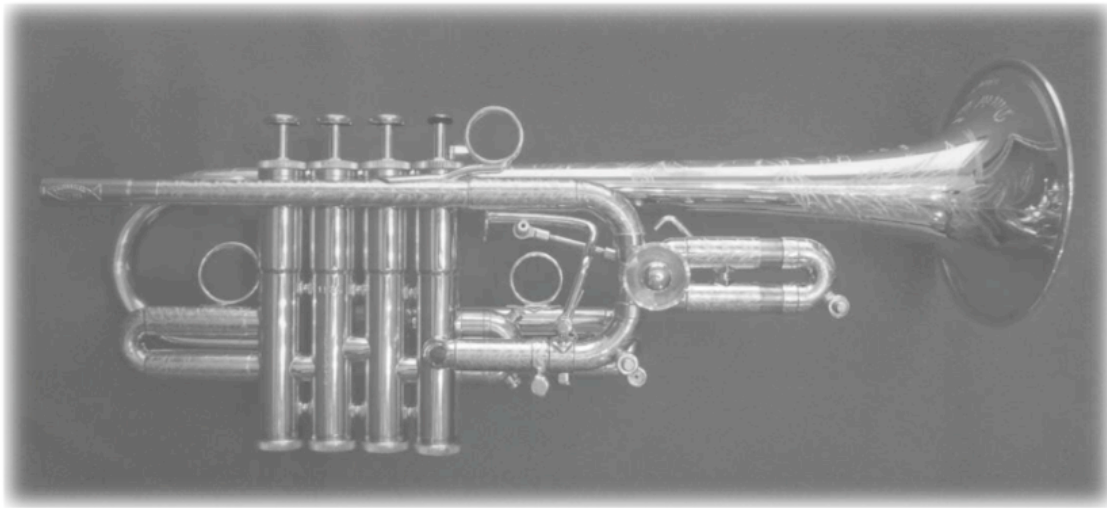


Figure 29: Five-valve C/D/B $\natural$ /D $\flat$  trumpet commissioned by David Hickman and manufactured by Blackburn Trumpets.<sup>60</sup>

Table 1. Hickman-Blackburn five-valve C/D/B $\natural$ /D $\flat$  trumpet: keys and fingerings

<b>Key</b>	<b>Depressed Valve(s)</b>	<b>Depressed Valves Operated By</b>
“in D”	Fourth	Left Index Finger
“in B $\natural$ ”	Fifth	Right Fourth Finger
“in D $\flat$ ”	Fourth and Fifth	Left Index Finger and Right Fourth Finger

<sup>60</sup> David R. Hickman, “Perfecting an Older Design: The Five-Valve C Trumpet,” *International Trumpet Guild Journal* 39, no. 2 (January 2015): 20–26.

Five-Valve Trumpet by Bryan Ewing

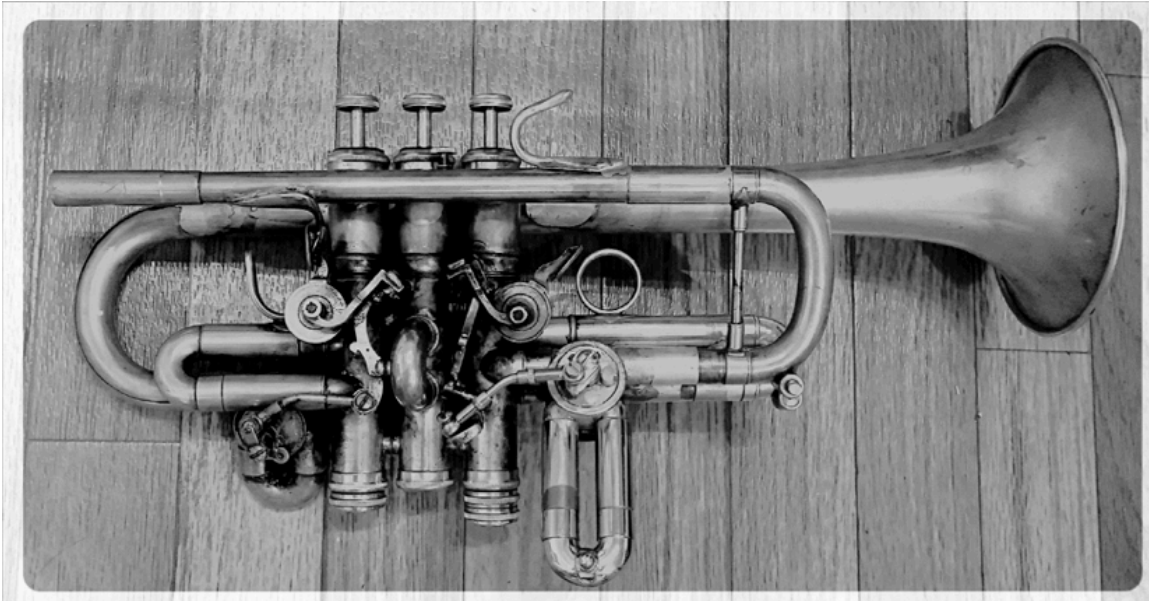


Figure 30: The author's five-valve  $C/D/B^{\sharp}/D^{\flat}$  trumpet prototype, photographed on August 14, 2013.

Table 2. The author's five-valve  $C/D/B^{\sharp}/D^{\flat}$  trumpet prototype: keys and fingerings

<b>Key</b>	<b>Depressed Valve(s)</b>	<b>Depressed Valves Operated By</b>
"in D"	Fourth	Left Index Finger
"in B $^{\sharp}$ "	Fifth	Right Thumb
"in D $^{\flat}$ "	Fourth and Fifth	Left Index Finger and Right Thumb

Five-Valve Trumpet by Yamaha

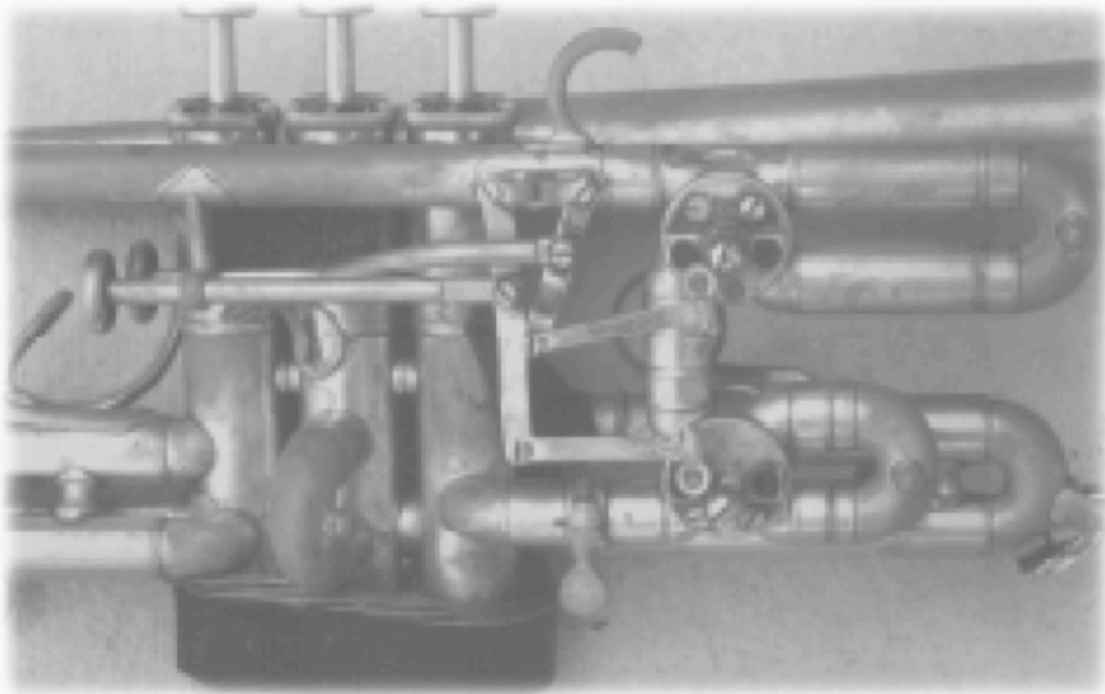


Figure 31: Five-valve C/D/B $\natural$ /D $\flat$  trumpet owned by Armando Ghitalla; manufactured by Yamaha.

Table 3. Ghitalla’s five-valve C/D/B $\natural$ /D $\flat$  trumpet: keys and fingerings

<b>Key</b>	<b>Depressed Valve(s)</b>	<b>Depressed Valves Operated By</b>
“in D”	Fourth	Right Thumb (trigger nearest the valve casing)
“in B $\natural$ ”	Fifth	Right Thumb (trigger nearest the palm of the right hand)
“in D $\flat$ ”	Fourth and Fifth	Right Thumb (both triggers depressed at the same time)

## PASSAGES FOR THE FIVE-VALVE TRUMPET

**Excerpt:** Ludwig van Beethoven, *Symphony No. 9*: Trumpet 1, Movement 4, Excerpt #1 beginning at measure 1 and Excerpt #2 beginning at Rehearsal **B**.

**Five-Valve Trumpet Advantages:** For the following part in D, the D side of the five-valve trumpet may be helpful. Advantages may be observed in intonation, accuracy, and clarity of articulation. In the case of intonation, playing in the key of D-major on trumpet has certain intonation tendencies that may be problematic. For example, both octaves of the tonic tend to be out of tune (D3 tends to be sharp and D4 tends to be flat), all three octaves of the fifth tend to be sharp (A3, A4, and A5), and the top octave third (F#5), a pitch that must be lowered to be in-tune in major chords, tends to be sharp. However, on the D side of the five-valve trumpet, the tonic pitches (C4 and C5) are better in tune; the top 5<sup>th</sup> (G5) is only slightly sharp, which can actually be advantageous in major chords; and the top 3<sup>rd</sup> (E5) is slightly flat, which is also advantageous in major chords.

### Original Excerpt #1: Trumpet in D

Musical notation for Original Excerpt #1: Trumpet in D. The notation is in 3/4 time, marked Presto and ff. It consists of two staves of music. The first staff begins with 'in D' and 'Presto' above the staff, and 'ff' below the staff. The second staff continues the melody.

### Five-Valve Trumpet Excerpt #1 in D

Musical notation for Five-Valve Trumpet Excerpt #1 in D. The notation is in 3/4 time, marked Presto and ff. It consists of one staff of music. The staff begins with 'in D' and 'Presto' above the staff, and 'ff' below the staff.



Original Excerpt #2: Trumpet in D



Five-Valve Trumpet Excerpt #2 in D



**Excerpt:** Johannes Brahms, *Symphony No. 2 in D Major*: Trumpet 1, Movement 4, beginning at the nineteenth measure of Rehearsal P.

**Five-Valve Trumpet Advantages:** The following shows one way that the five-valve trumpet may be used on an excerpt for trumpet in D. Alternatively, the entire excerpt may be played on the D side. As with the Beethoven excerpts, advantages include improved intonation, accuracy, and clarity of articulation. In this excerpt, the D side of the five-valve trumpet may be used to help achieve a brilliant, in-tune ending to the symphony.

Original: Trumpet in D

in D  
*f*  
*ff*

Five-Valve Trumpet Version in C and D

in C  
*f*  
in D  
*ff*

**Excerpt:** Anton Bruckner, *Symphony No. 7 in E Major*: Trumpet 1, Movement 1, beginning at the second measure before Rehearsal G.

**Five-Valve Trumpet Advantages:** This excerpt provides an opportunity to use the D side of the five-valve trumpet to improve the stability and intonation of the pitch concert A5. When performed on the D side, this pitch is G5 (fingered open). The shorter overall



length of tubing and fingerings with improved intonation help the trumpeter achieve a centered, brilliant tone. Articulation clarity is also improved because of the quicker response.

Original: Trumpet in F

Five-Valve Trumpet Version in C and D

The image displays two musical staves for comparison. The top staff is labeled 'Original: Trumpet in F' and shows a melodic line in F major with dynamics *ff*, *cresc.*, and *fff*. The bottom staff is labeled 'Five-Valve Trumpet Version in C and D' and shows the same melodic line but with a change in key signature to C major for the first part and D major for the final notes, indicated by a bracket and the label 'in D'. The dynamics *ff*, *cresc.*, and *fff* are also present. Below each melodic line is a rhythmic accompaniment consisting of eighth-note patterns.

**Excerpt:** Anton Bruckner, *Symphony No. 7 in E Major*: Trumpet 1, Movement 1, beginning at the fourth measure of Rehearsal V.

**Five-Valve Trumpet Advantages:** In the following excerpt, the D side of the five-valve trumpet is used to improve execution on the pitches concert A<sub>5</sub> and A<sup>b</sup><sub>5</sub>. When performing this passage on the five-valve trumpet as notated below, advantages are in security of the top notes, intonation, and the quality of articulation. This is due to the shorter overall length of tubing, utilization of lower partials, and utilization of fingerings that use fewer valve slides.

Original: Trumpet in F

The image shows two staves of musical notation for a trumpet part in F major. The first staff is labeled 'in F' and contains the notation for the first half of the excerpt, marked with a forte dynamic (*ff*) and the instruction 'marc. sempre'. The second staff continues the notation for the second half, marked with a fortissimo dynamic (*fff*).

Five-Valve Trumpet Version in C and D

The image shows two staves of musical notation for a five-valve trumpet version. The first staff is labeled 'in C' and contains the notation for the first half of the excerpt, marked with a forte dynamic (*ff*) and the instruction 'marc. sempre'. A box highlights a specific note with the label 'in D'. The second staff continues the notation for the second half, marked with a fortissimo dynamic (*fff*). Another box highlights a specific note with the label 'in D'.

**Excerpt:** Claude Debussy, *Nocturnes: II. "Fêtes,"* Trumpets 1, 2, and 3, beginning at the ninth measure of Rehearsal 10.

**Five-Valve Trumpet Advantages:** The following excerpt shows various five-valve trumpet options in a section setting. Although very playable as written, the options below provide certain advantages. In Trumpet 1, the five-valve trumpet provides alternate fingerings to improve the ease of execution in the first half of the excerpt. Later in the excerpt, using the D side provides options that increase security, especially through the avoidance of the 2-3 fingering on concert  $A\flat_5$ . In Trumpet 2, response is also improved through the use of fingerings that feature a shorter overall length of tubing and fewer air column disturbances. Especially helpful is the avoidance of the many 2-3 fingerings. In

Trumpet 3, the B $\flat$  side of the five-valve trumpet is used to allow the player to use fingerings that are easier to execute cleanly.

Original: Trumpet in F

Animé mais toujours très rythmé  
con sord.

F Tpt. 1  
*pp*

F Tpt. 2  
*pp*

F Tpt. 3  
*pp*

un peu rapproché

F Tpt. 1  
*p*

F Tpt. 2  
*p*

F Tpt. 3  
*p*

F Tpt. 1  
*p*

F Tpt. 2  
*p*

F Tpt. 3  
*p*

Five-Valve Trumpet Version in C, B $\flat$ , D $\flat$ , and D

Animé mais toujours très rythmé

con sord. *pp*

C Tpt. 1  
C Tpt. 2  
C Tpt. 3

un peu rapproché

C Tpt. 1  
C Tpt. 2  
C Tpt. 3

C Tpt. 1  
C Tpt. 2  
C Tpt. 3

**Excerpt:** Paul Dukas, *L'Apprenti Sorcier*: Trumpet 1, beginning at Rehearsal 32.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet provides alternate fingerings to improve technical facility and ease of execution in this extremely fast passage.

Original: Trumpet in C

Solo

in C

*f* mais léger et très détaché

*p*

Five-Valve Trumpet Version in D $\flat$

in D $\flat$

Solo

*f* mais léger et très détaché

*p*

**Excerpt:** Gustav Mahler, *Symphony No. 1 in D Major*: Trumpet 1, Movement 1, beginning at Rehearsal 23.

**Five-Valve Trumpet Advantages:** Provides alternate fingerings that may increase the ease of execution and accuracy. In Version #1, the D side of the five-valve trumpet provides alternate fingerings that may improve the ease of execution and accuracy. The pitch concert A $\flat$ 5 is more reliable when played on the D side as G $\flat$ 5. In Version #2, the pitch concert A $\flat$ 5 is more reliable when played on the D $\flat$  side of the five-valve trumpet

as a G5. Version #2 allows the player to use the same A-major fingerings as in the previous appearances of this figure in the symphony.

Original: Trumpet in F

**a tempo**  
**Mit Dämpfer** *ff* **zurückhaltend**

Five-Valve Trumpet Version #1 in D

**a tempo**  
**Mit Dämpfer** *ff* **zurückhaltend**

Five-Valve Trumpet Version #2 in B $\flat$  and D $\flat$

**a tempo**  
**Mit Dämpfer** *ff* **zurückhaltend**

**Excerpt:** Gustav Mahler, *Symphony No. 1 in D Major*: Trumpet 1, Movement 1, beginning at the ninth measure after Rehearsal 25.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet provides alternate fingerings that may improve the ease of execution and accuracy. The pitch concert A5 is more reliable when played on the D side as G5. Execution of the triplet figures that alternate between the pitches concert E5 and concert F $\sharp$ 5 may be facilitated by using the D side, where the pitches become D5 and E5, allowing the two notes to be played in the same (lower) partial.

Original: Trumpet in F

Five-Valve Trumpet Version in C and D

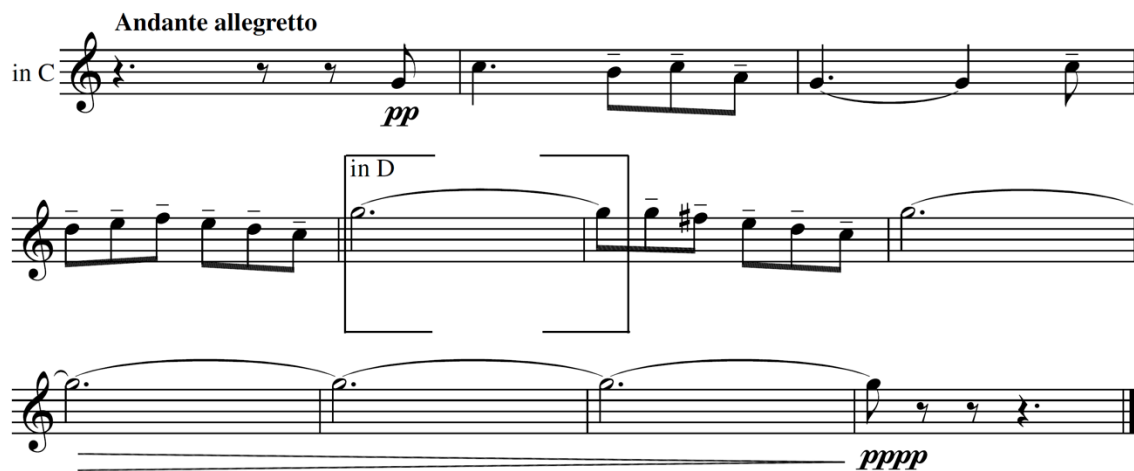
**Excerpt:** Gustav Mahler, *Symphony No. 1 in D Major*: Trumpet 1, Optional Movement 2, “Blumine,” beginning three measures before Rehearsal 2.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet provides an alternate fingering that may improve the ease of execution and accuracy. The pitch concert A5 is more reliable when played on the D side as G5.

Original: Trumpet in C



Five-Valve Trumpet Version in C and D



**Excerpt:** Gustav Mahler, *Symphony No. 2 in C Minor*: Trumpet 1, Movement 3, beginning at the measure before Rehearsal 49.

**Five-Valve Trumpet Advantages:** This excerpt uses an alternate trill fingering that allows both of the trilled pitches to remain within the same partial, replacing a difficult trill with a remarkably easy one. Switching to the D side earlier, as in Five-Valve Trumpet Version #2, may be more comfortable for some players.

Original: Trumpet in F





ff fp fff

dim. pp f

Wieder unmerklich zuruckhaltend.

mf dim. p pp

Five-Valve Trumpet Version #1 in C and D

in C <sup>offen</sup>

ff mf

fp fff fp fff fp

ff fff

fp fff

in D

dim. pp f

Wieder unmerklich zuruckhaltend.

mf dim. p pp

Five-Valve Trumpet Version #2 in C and D

in C <sup>offen</sup>

ff mf

The image shows a musical score for trumpet in D minor, consisting of four staves. The first staff begins with a dynamic marking of *fp* and includes a bracketed section marked "in D" with a *fff* dynamic. The second staff features *ff*, *fp*, and *fff* dynamics, along with a trill marked "tr". The third staff shows a dynamic progression from *dim.* to *pp* to *f*. The fourth staff is marked "Wieder unmerklich zuruckhaltend." and includes dynamics of *mf*, *dim.*, *p*, and *pp*.

**Excerpt:** Gustav Mahler, *Symphony No. 3 in D Minor*: “Posthorn Solo,” Offstage Trumpet, Movement 3, beginning at the eighth measure of Rehearsal 15.

**Five-Valve Trumpet Advantages:** This example utilizes an alternate fingering from the D side of the trumpet for an especially long and difficult trill. On the three-valve C trumpet that is most commonly used for this excerpt, the difficult C5 to D5 trill becomes the remarkably easy B $\flat$  to C trill, with both pitches in the same partial. Intonation is improved because D5 tends to be flat. Note that the fourth valve should first be depressed on the upper note of the trill to avoid a break in the sound. Alternatively, as in Five-Valve Trumpet Version #2, the switch to the fourth valve may be placed earlier, between two notes of the same fingering. Five-Valve Trumpet Version #2 also shows the additional option of using the D side for the leap up to the written concert A5. On the D side of the horn, this pitch becomes G5, which is in a lower partial, uses less tubing, and has better

response and accuracy than A5. Additionally, the last pitch of this excerpt, marked with an asterisk (\*), may be fingered open on the D<sup>b</sup> side of the trumpet or second valve on the D side, placing the pitch in a lower partial.

Original: Trumpet in B<sup>b</sup>

in B<sup>b</sup>

wie aus der Ferne (sich etwas nähernd)      Zeit lassen

*ppp* < *express.* < > >

*tr* ~~~~~

Zurückhaltend.

zurückhaltend      a tempo

*rit.* ~~~~~ *ppp*

Five-Valve Trumpet Version #1 in C and D

in C

wie aus der Ferne (sich etwas nähernd) ,      Zeit lassen

*ppp* < *express.* < > >

in D  
*tr* ~~~~~

Zurückhaltend.

zurückhaltend      a tempo

*rit.* ~~~~~ *ppp*

Five-Valve Trumpet Version #2 in C and D

**Excerpt:** Gustav Mahler, *Symphony No. 3 in D Minor*: Trumpet 1, Movement 1, beginning at Rehearsal 74.

**Five-Valve Trumpet Advantages:** This example utilizes lower partials that have greater accuracy and easier fingerings. The slurred, octave leap at the beginning would normally be played as an  $A\flat_5$  on the C trumpet, fingered 2-3. By switching to the  $D\flat$  side of the trumpet, this becomes  $G_5$ , a pitch that falls into a lower partial and is more stable. Next, due to the extremely fast tempo, the concert  $G\flat$ -major arpeggios become much easier when fingered on the  $D\flat$  side of the trumpet in the key of F-major. The trill at the end of the excerpt may be played on the  $D\flat$  side as  $C\sharp$  to  $D\sharp$  as indicated, or on the C side as D to E.

# Original: Trumpet in B $\flat$

in B $\flat$

Etwas gehaltener  
Schalltrichter in die Höhe

zeit lassen

Wieder vorwärts

*f* < *fff* *ff*

Drängend

*ff*

Sehr drängend  
Schalltrichter in die Höhe

*fff* stark hervortretend

*dim.* *p*

# Five-Valve Trumpet Version in C and D $\flat$

in C

Etwas gehaltener  
Schalltrichter in die Höhe

zeit lassen  
in D $\flat$

Wieder vorwärts

*f* < *fff* *ff*

Drängend

*ff*

Sehr drängend  
Schalltrichter in die Höhe

*fff* stark hervortretend

*dim.* *p*

**Excerpt:** Gustav Mahler, *Symphony No. 4 in G Major*: Trumpets 1, 2, and 3, Movement 1, beginning at the third measure of Rehearsal 16.

**Five-Valve Trumpet Advantages:** The following excerpt shows how the five-valve trumpet may be used in a section setting. In the first trumpet, all instances of the pitches A5, A<sup>b</sup>5, and D<sup>b</sup>4 are played on the D side as G5, F<sup>#</sup>5, and B3, respectively. The shorter overall length of tubing and use of lower partials make these pitches relatively secure and reliable. In the second trumpet, a rather long passage may be played entirely on the D side, improving intonation and fingerings, and also aiding response in the diminuendo to *ppp* on the final note. Additionally, the final passage in Trumpet 1 may be performed on the D side to use the advantage of a lower partial on the top note E5 on the D side (fingered open).

Original: Trumpet in F

Bedächtig. Nicht eilen.

Tpt. 1 in F

The musical score consists of three staves for Trumpets 1, 2, and 3, all in F major. The first staff (Tpt. 1) begins with a dynamic of *ff* and includes the instruction "Bedächtig. Nicht eilen." above the staff. The second staff (Tpt. 2) also starts with *ff* and includes "Schalltr. auf!" above the staff. The third staff (Tpt. 3) starts with *ff*. All three parts feature a series of eighth and sixteenth notes, with a final passage that includes a diminuendo to *pp* for the second trumpet and *mf* for the third. The score includes various articulation marks such as accents and slurs.

2

3

2

3

3

3

dim.

*p*

dim.

1 mit Dämpfer

*f*

*ff*

*p* *morendo*

*ppp*

Nicht zurückhalten.

Five-Valve Trumpet Version in C and D

Bedächtig. Nicht eilen.

Tpt. 1 in C

*ff*

in D

in D

1

in D

in D

*ff*

*ff*

Schalltr. auf!

in D

*ff*

2 in C

*ff*

3 in C

*ff*

in D

*p*

in D

*mf*

2 (in D)

3 (in D)

in D

2 (in D)  
dim. p dim.

1 in D mit Dämpfer f ff p morendo Nicht zurückhalten.

2 ppp

**Excerpt:** Gustav Mahler, *Symphony No. 4 in G Major*: Trumpet 1, Movement 1, beginning at the seventh measure before Rehearsal 21.

**Five-Valve Trumpet Advantages:** In the following excerpt, the D side of the five-valve trumpet may be used to aid response on the initial *piano* entrance. Then, the pitch concert F#5 may be played as E5 on the D side (fingered open), improving the quickness of response by using a shorter overall length of tubing. The utilization of a lower partial also increases accuracy. Finally, the leap up to the concert A5 tends to be more secure on the D side.

Original: Trumpet in F

Zeit lassen a tempo Rit. a tempo

in F p < f > p p < f > mf > p f

Five-Valve Trumpet Version in C and D

Zeit lassen in D a tempo Rit. a tempo

in C p < f > p p < f > mf > p f



**Excerpt:** Gustav Mahler, *Symphony No. 4 in G Major*: Trumpet 1, Movement 3, beginning at the tenth measure before Rehearsal 13.

**Five-Valve Trumpet Advantages:** In the following excerpt, the pitches concert A5 and concert G#5 are played on the D side to take advantage of the improved security and intonation on those pitches. The shorter length of tubing, utilization of lower partials, and superior intonation of these fingerings also tend to improve accuracy, sound quality, and articulation clarity.

Original: Trumpet in C

Shalltrichter auf! Poco più mosso Pesante

Five-Valve Trumpet Version in C and D

Shalltrichter auf! Poco più mosso Pesante

**Excerpt:** Gustav Mahler, *Symphony No. 5 in C# Minor*: Trumpet 1, Movement 1, beginning at measure 1.

**Five-Valve Trumpet Advantages:** By using the D<sup>b</sup> side of the five-valve trumpet, the intonation, response, resistance, and stability problems inherent in the 1-2-3 fingering may be eliminated. Fingered open, the pitch may be played in tune with no need to extend the valve sides. This results in improved response and enhanced articulation clarity. Additionally, the problematic pitches A5 and A<sup>b</sup>5 may be replaced with G5 and F#5. Both versions of this excerpt utilize the same advantages. However, Five-Valve Trumpet Version #1 uses the five-valve trumpet options only on the target notes, whereas Five-Valve Trumpet Version #2 includes longer passages on the D and D<sup>b</sup> sides, requiring less manipulation of the fourth and fifth valves.

Original: Trumpet in B<sup>b</sup>

In gemessenem Schritt. Streng. Wie ein Kondukt.

The musical score is written for a trumpet in B-flat. It consists of four staves of music. The first staff begins with a treble clef, a key signature of one flat (B-flat), and a common time signature. The tempo and performance instructions are 'In gemessenem Schritt. Streng. Wie ein Kondukt.' The music features several triplet markings (indicated by a '3' above the notes) and dynamic markings including *p*, *sf*, and *f*. The second staff continues the melodic line with a *molto* marking and a *f* dynamic. The third staff includes a triplet marked 'Triole: flüchtig' and dynamics of *sf*, *sf*, and *ff*. The fourth staff concludes with a *sempre ff* marking, a *cresc.* (crescendo) instruction, and a final *ff* dynamic. The key signature changes to two flats (B-flat and E-flat) in the final measure of the fourth staff.

Pesante

Musical notation for the first staff of the first section. It begins with a triplet of eighth notes marked *f*, followed by another triplet marked *f*. The piece concludes with a half note marked *ff* and a final half note marked *p*.

### Five-Valve Trumpet Version #1 in C, D, and D $\flat$

In gemessenem Schritt. Streng. Wie ein Kondukt.

in C

Musical notation for the second staff, starting in C and D $\flat$ . It features a triplet of eighth notes marked *p*, followed by a triplet marked *sf*, and another triplet marked *sf*. The piece concludes with a triplet marked *sf*.

Musical notation for the third staff. It begins with a triplet marked *sf*, followed by a triplet marked *molto f*, and another triplet marked *f*. The piece concludes with a triplet marked *f*.

Triole: flüchtig

Musical notation for the fourth staff. It features a triplet marked *sf*, followed by a triplet marked *sf*, and another triplet marked *ff*. The piece concludes with a triplet marked *ff*.

in D

Musical notation for the fifth staff, starting in D. It features a triplet marked *sf*, followed by a triplet marked *sf*, and another triplet marked *ff*. The piece concludes with a triplet marked *ff*.

Pesante

Musical notation for the sixth staff. It begins with a triplet marked *f*, followed by a triplet marked *f*, and another triplet marked *f*. The piece concludes with a triplet marked *ff* and a final triplet marked *p*.

### Five-Valve Trumpet Version #2 in C, D, and D $\flat$

In gemessenem Schritt. Streng. Wie ein Kondukt.

in C

Musical notation for the seventh staff, starting in C and D $\flat$ . It features a triplet of eighth notes marked *p*, followed by a triplet marked *sf*, and another triplet marked *sf*. The piece concludes with a triplet marked *sf*.

**Excerpt:** Gustav Mahler, *Symphony No. 5 in C# Minor*: Trumpet 1, Movement 1, beginning at the measure before Rehearsal 13.

**Five-Valve Trumpet Advantages:** Five-Valve Trumpet Version #1 of this excerpt replaces the less-stable concert A5 with the lower-partial G5 on the D side of the trumpet. Version #2 additionally uses the B<sup>b</sup> side to provide fingerings that tend to result in easier, smoother slurs. Additionally, the first note of the octave leap, marked with an asterisk (\*), may be played first valve on the B<sup>b</sup> side of the trumpet, making it a valve slur and also helping to preserve intonation and timbral consistency with the previous note. Another option would be to finger this pitch 1-2 or 3 on the C side.

Original: Trumpet in F

*molto portamento*

in F

*pp espr.*

*p*

This musical score is for a Trumpet in F. It consists of four staves of music in 3/4 time. The first staff begins with a dynamic marking of *pp espr.* and a tempo marking of *molto portamento*. The music features a series of notes with slurs and accents, including a triplet of eighth notes on the third staff. The piece concludes with a double bar line and a final note on the fourth staff.

Five-Valve Trumpet Version #1 in C and D

*molto portamento*

in C

*pp espr.*

*p*

in D

This musical score is for a Five-Valve Trumpet. It consists of four staves of music in 3/4 time. The first staff is in C major and begins with a dynamic marking of *pp espr.* and a tempo marking of *molto portamento*. The second and third staves continue the melody in C major, with a dynamic marking of *p* on the third staff. The fourth staff is in D major, indicated by a box labeled "in D" around the first few notes. The piece concludes with a double bar line and a final note on the fourth staff.

Five-Valve Trumpet Version #2 in C, D, and B

The musical score is written for a five-valve trumpet. It begins in C major and includes a section in B major. The first staff is marked 'in C' and 'in B' with 'molto portamento' and 'pp espr.' (pianissimo, expressive). The second staff continues the melody. The third staff has a 'p' (piano) marking. The fourth staff is marked 'in D' with an asterisk marking. The music features various articulations, slurs, and dynamic markings.

**Excerpt:** Gustav Mahler, *Symphony No. 5 in C# Minor*: Trumpet 1, Movement 1, beginning on the tenth-to-last measure.

**Five-Valve Trumpet Advantages:** The improved response and security of the D side of the five-valve trumpet may also enhance articulation clarity and consistency on the A-major arpeggio. Additionally, in Version #2 of the excerpt, the same concept may be applied to the concert F#-minor arpeggio. Reserving the advantages of the five-valve trumpet for the most difficult arpeggios may be advantageous, as in Five-Valve Trumpet Version #1. However, Five-Valve Trumpet Version #2 may prove to provide better accuracy and consistency on the entire passage.

Original: Trumpet in F

Five-Valve Trumpet Version #1 in C and D

Five-Valve Trumpet Version #2 in D

**Excerpt:** Gustav Mahler, *Symphony No. 5 in C# Minor*: Trumpet 1, Movement 5, beginning at the measure before Rehearsal 22.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet offers a more stable fingering for an octave leap ending on the relatively unstable pitch A5. Five-Valve Trumpet Version #1 uses the D side of the five-valve trumpet for pitches A4 and A5 only. Five-Valve Trumpet Version #2 uses the D side for the entire phrase.

Original: Trumpet in F



Five-Valve Trumpet Version #1 in C and D

Five-Valve Trumpet Version #2 in D

**Excerpt:** Modest Mussorgsky/Maurice Ravel, *Pictures at an Exhibition*: Trumpet 1, opening “Promenade,” beginning at measure 1.

**Five-Valve Trumpet Advantages:** In Five-Valve Trumpet Version #1, the relatively unstable pitch  $A\flat_5$  may be played more reliably as  $G_5$  on the  $D\flat$  side of the five-valve trumpet, utilizing a lower partial and shorter overall length of tubing. The most important advantage that this provides is an increase in accuracy and security on that pitch. The



result is greater consistency and clarity of articulation. In Five-Valve Trumpet Version #2, the D side may be used only on the two pitches that follow each octave leap. This version stays closest to the original and provides the greatest accuracy advantages.

Original: Trumpet in C

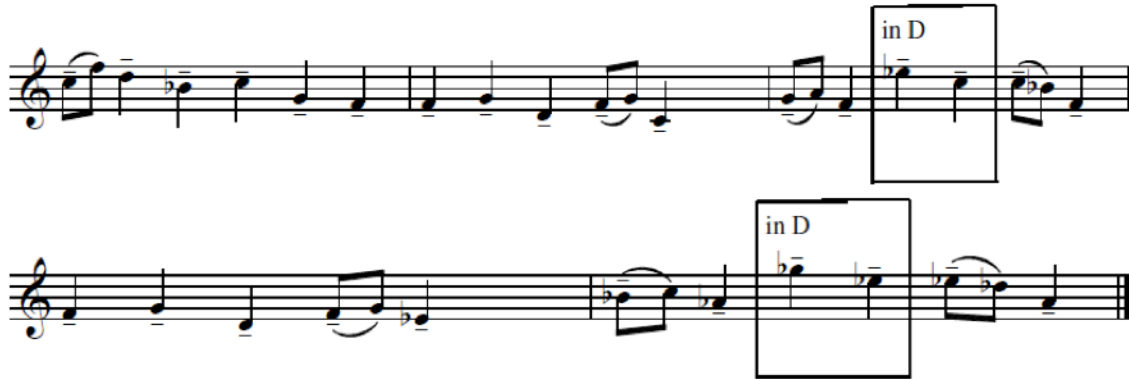
in C

Five-Valve Trumpet Version #1 in C and Db

in C

Five-Valve Trumpet Version #2 in C and D

in C



**Excerpt:** Modest Mussorgsky/Maurice Ravel, *Pictures at an Exhibition*: Trumpet 1, Movement 1 “Gnomus,” beginning at the second measure before Rehearsal 14.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet provides alternate fingerings to improve technical facility and ease of execution in this difficult figure. Five-Valve Trumpet Version #1 illustrates this passage in B $\flat$  and Five-Valve Trumpet Version #2 illustrates the passage in D.

Original: Trumpet in C

Vivo

in C

Five-Valve Trumpet Version #1 in B $\flat$

in B $\flat$   
Vivo

### Five-Valve Trumpet Version #2 in D



**Excerpt:** Modest Mussorgsky/Maurice Ravel, *Pictures at an Exhibition*: Trumpet 1, Movement 1, second “Promenade,” beginning at the fourth measure before Rehearsal 33.

**Five-Valve Trumpet Advantages:** In Five-Valve Trumpet Version #1 of this excerpt, the pitch concert C#4 may be played second valve as B3 on the D side of the five-valve trumpet. This fingering has superior intonation without the need to extend the third slide, allowing the note to be played easily in the center of the pitch and without the change in tone color that can occur when using the 1-2-3 fingering. The second-valve fingering also uses less tubing and has fewer disturbances in the air column, potentially improving resistance, response, sound quality, and clarity of articulation. Alternatively, as shown in Five-Valve Trumpet Version #2, the entire excerpt may be played on the D<sup>b</sup> side of the five-valve trumpet, utilizing the same fingerings as the opening promenade when played on the C side. In this version, the pitch C#4 becomes C4, which also has good intonation.

### Original: Trumpet in C

Moderato non tanto, pesante



Five-Valve Trumpet Version #1 in C and D

Moderato non tanto, pesante

in C

Five-Valve Trumpet Version #2 in D $\flat$

in D $\flat$   
Moderato non tanto, pesante

**Excerpt:** Maurice Ravel, *Alborada del Gracioso*: Trumpets 1 and 2, beginning at Rehearsal [27](#).

**Five-Valve Trumpet Advantages:** The D side of the five-valve trumpet may be used in this excerpt to facilitate the quick leap up a perfect fifth. Accuracy and response may be a problem on the top concert G $\sharp$ 5, especially while triple tonguing at a quick tempo and *pianissimo* dynamic. By using the D side on the top concert G $\sharp$ 5, the trumpeter uses the shortest overall length of tubing possible on this pitch on the five-valve trumpet, providing response and accuracy advantages. In Five-Valve Trumpet Version #1, the D side is used for most of the excerpt. In Five-Valve Trumpet Version #2, the D side is used

only on the highest pitches. In both versions, the shorter overall tubing length and utilization of a lower partial on this pitch help to improve the ease of execution of this excerpt. The same concept is then applied to the second trumpet reiteration of the phrase one whole-step lower, fingering the top note open, as an E5 on the D side.

Original: Trumpet in C

**sourdine**  
Tpt. 2 (in C)

**(sourdine)**  
Tpt. 1 (in C)

2

1

2 (sourdine)

Five-Valve Trumpet Version #1 in C and D

**sourdine**

in D  
Tpt. 2

in C

**pp**

(sourdine)  
in D  
Tpt. 1

3 3 3 3 3 3 3 3 3 3 3 3

2

*pp*

1

2 (sourdine)

in D

3 3 3 3 3 3 3 3 3 3 3 3

*pp*

Five-Valve Trumpet Version #2 in C and D

sourdine  
Tpt. 2 (in C)

in C

*pp* 3 3 3 3 3 3 3 3 3 3 3 3

in D

(sourdine)  
Tpt. 1 (in C)

3 3 3 3 3 3 3 3 3 3 3 3

2

*pp*

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 1: Trumpet 1, beginning at the fourth measure before Rehearsal 75.

**Five-Valve Trumpet Advantages:** In the following excerpt, the B $\natural$  side of the five-valve trumpet may be used to extend the low register. Many modern C trumpets feature a third valve slide that may be extended far enough to play the pitch F3. On the five-valve trumpet, however, this pitch may be fingered 1-2-3 on the B $\natural$  side, which necessitates only a modest extension of the third slide.

Original: Trumpet in C

Five-Valve Trumpet Version in B $\natural$

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 1: Trumpet 1, beginning at Rehearsal 151.

**Five-Valve Trumpet Advantages:** The D side of the five-valve trumpet may be used in this excerpt to improve the playability of the G5 to A5 trill. Because the A5 is in a higher partial and the G5 may be played with the same fingering, this is an especially difficult trill. In Five-Valve Trumpet Version #1, the entire passage is played in D and the trill becomes F5 to G5. This trill is comparatively easy because both pitches are in the same partial and neither pitch may be played with the other pitch's alternate fingering. In Five-Valve Trumpet Version #2, the first four measures of the passage are played in C, and the D side is used only for the trill. Alternatively, the last sixteenth note before the trill may be fingered open on the D side, as in Five-Valve Trumpet Version #3.

Original: Trumpet in C

Five-Valve Trumpet Version #1 in C and D



### Five-Valve Trumpet Version #2 in C and D

The musical score for Five-Valve Trumpet Version #2 consists of two staves. The first staff is in C major and is marked 'Plus animé' with a dynamic of *f*. The second staff is in D major and is marked 'Animez' with a dynamic of *ff*. A box highlights the transition from C to D in the second staff, showing a melodic line that begins in C and then shifts to D.

### Five-Valve Trumpet Version #3 in C and D

The musical score for Five-Valve Trumpet Version #3 consists of two staves. The first staff is in C major and is marked 'Plus animé' with a dynamic of *f*. The second staff is in D major and is marked 'Animez' with a dynamic of *ff*. A box highlights the transition from C to D in the second staff, showing a melodic line that begins in C and then shifts to D.

**Excerpt:** Maurice Ravel, *Daphnis et Chloé, Suite No. 2*: Trumpet 1, beginning at the measure before Rehearsal 197.

**Five-Valve Trumpet Advantages:** The B $\flat$  side of the five-valve trumpet may be used to improve the ease of execution for this excerpt that is at an extremely fast tempo. Not only does the B $\flat$  side enable the use of easier fingerings, but also the pitch C $\sharp$ 4 becomes a D4, lessening the extent to which the third valve slide must be manipulated. Moving the third valve slide to the correct location for C $\sharp$ 4, D4, and D $\sharp$ 4 on successive eighth-note triplets at a tempo of *quarter note equals 176* is a rather difficult, if not impossible, task.

Therefore, the five-valve trumpet allows this passage to be played with better intonation

and the added benefit of easier fingerings. The result is easier execution, improved intonation, enhanced precision, and faster attainable tempos.

Original: Trumpet in C

Five-Valve Trumpet Version in B $\flat$

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 2: Trumpet 1, beginning at Rehearsal 201.

**Five-Valve Trumpet Advantages:** The five-valve trumpet provides two fingering options to improve technical facility for the following very quick passage. Five-Valve Trumpet Version #1 utilizes the D $\flat$  side, and Five-Valve Trumpet Version #2 utilizes the B $\natural$  side.

Original: Trumpet in C

Five-Valve Trumpet Version #1 in D $\flat$

sourdine  
in D $\flat$

*mf*

Five-Valve Trumpet Version #2 in B $\natural$

sourdine  
in B

*mf*

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 2: Trumpet 1, beginning at the third measure before Rehearsal 212.

**Five-Valve Trumpet Advantages:** The five-valve trumpet provides two fingering options to improve technical facility for the following very quick passage. Five-Valve Trumpet Version #1 utilizes the D side, and Five-Valve Trumpet Version #2 utilizes the B $\natural$  side. Both options are feasible, but the fingerings in Five-Valve Trumpet Version #1 tend to be the easiest of the three options below.

Original: Trumpet in C

in C

sourdine

*p*

Five-Valve Trumpet Version #1 in D

Five-Valve Trumpet Version #2 in B

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 2: Trumpet 3, beginning at Rehearsal 212.

**Five-Valve Trumpet Advantages:** The D side may be utilized in this excerpt to improve technical facility and intonation. When the passage is played in C, it contains the pitches C#4 and D4 in succession. These pitches notes may be played with good intonation as B3 and C4 on the D side of the five-valve trumpet, which may be an advantage at the quick tempo. The Five-Valve Trumpet Version of this excerpt requires no use of the third valve slide.

Original: Trumpet in C

### Five-Valve Trumpet Version in D

Musical score for Five-Valve Trumpet Version in D. The score is written on a single staff in treble clef. It begins with the instruction "sans sourd." and "in D". The music consists of a series of eighth notes, many of which are grouped into triplets. The dynamic marking starts at *p* (piano) and ends at *mf* (mezzo-forte). The piece concludes with a double bar line.

**Excerpt:** Maurice Ravel, *Daphnis et Chloé, Suite No. 2*: Trumpet 1, beginning at the third measure of Rehearsal 212.

**Five-Valve Trumpet Advantages:** The  $D\flat$  side provides alternate fingerings to improve technical facility in this passage.

### Original: Trumpet in C

Musical score for Original: Trumpet in C. The score is written on two staves in treble clef. It begins with the instruction "(sourd.)" and "in C". The music consists of eighth notes, many of which are grouped into triplets. The dynamic marking starts at *pp* (pianissimo) and ends at *p* (piano). The piece concludes with a double bar line.

### Five-Valve Trumpet Version in $D\flat$

Musical score for Five-Valve Trumpet Version in  $D\flat$ . The score is written on two staves in treble clef. It begins with the instruction "in  $D\flat$ " and "(sourd.)". The music consists of eighth notes, many of which are grouped into triplets. The dynamic marking starts at *pp* (pianissimo) and ends at *p* (piano). The piece concludes with a double bar line.

**Excerpt:** Maurice Ravel, *Daphnis et Chloé*, Suite No. 2: Trumpet 1, beginning at Rehearsal 220.

**Five-Valve Trumpet Advantages:** The D and D $\flat$  sides provide alternate fingerings to improve technical facility. The trill at the end of the passage is also improved because, on the D $\flat$  side, both pitches remain in the same partial. Alternatively, if the player chooses to play this passage on the C side, the E5 may be fingered 1-2, also allowing both pitches of the trill to be played in the same partial.

Original: Trumpet in C

Five-Valve Trumpet Version in D and D $\flat$



**Excerpt:** Maurice Ravel, *La Valse*: Trumpet 1, beginning at Rehearsal 53.

**Five-Valve Trumpet Advantages:** The D side of the five-valve trumpet may be utilized in the following excerpt to improve ease of execution and precision. The extremely quick tempo combined with the *Pressez un peu* instruction makes this excerpt challenging. The awkward fingerings throughout the continuous eighth notes at the end of the excerpt are especially difficult. However, on the D side of the horn, the fingerings are comparably less difficult.

Original: Trumpet in C



Five-Valve Trumpet Version in D



**Excerpt:** Maurice Ravel, *Rhapsodie Espagnole*: IV. “Feria,” Trumpet 1, beginning at Rehearsal 4.

**Five-Valve Trumpet Advantages:** This Trumpet 1 excerpt is a fingering challenge, but the five-valve trumpet provides two additional fingering options, both of which are preferable to the original. The player should choose the most comfortable option. Five-Valve Trumpet Version #1 provides easy, natural fingering options. Five-Valve Trumpet Version #2 may provide an advantage to articulation response by utilizing the shorter D $\flat$  side of the five-valve trumpet. This may aid the trumpeter in achieving the light, clean articulation characteristic of the French style.

Original: Trumpet in C

Assez animé  
Sourdine

in C

*p*

3 3 3 3

Five-Valve Trumpet Version #1 in B

Assez animé  
in B  
Sourdine

*p*

3 3 3 3

Five-Valve Trumpet Version #2 in D $\flat$

Assez animé  
in D $\flat$   
Sourdine

*p*

3 3 3 3




**Excerpt:** Maurice Ravel, *Rhapsodie Espagnole*: IV. “Feria,” Trumpet 2, beginning at Rehearsal 4.

**Five-Valve Trumpet Advantages:** This is the Trumpet 2 complement to Maurice Ravel, *Rhapsodie Espagnole*: Trumpet 1, beginning at Rehearsal 4. It is also somewhat of a fingering challenge, but the D $\flat$  side of the five-valve trumpet provides an additional fingering option.

Original: Trumpet in C

Assez animé  
Sourdine


in C



Five-Valve Trumpet Version in D $\flat$

Assez animé

in D $\flat$   
Sourdine



**Excerpt:** Maurice Ravel, *Rhapsodie Espagnole*: IV. “Feria,” Trumpet 1, beginning at the fourth measure before Rehearsal 25.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet may be used to increase accuracy and ease of execution. The shorter overall length of tubing also provides quicker response that may aid the trumpeter in achieving the rapid, clean articulation necessary in the French style. In the Five-Valve Trumpet Version, the concert B $\flat$ ’s may optionally be fingered third valve instead of the usual 1-2 fingering.

Original: Trumpet in C

Five-Valve Trumpet Version in D

**Excerpt:** Maurice Ravel, *Rhapsodie Espagnole: IV*. “Feria,” Trumpet 3, beginning at the fourth measure before Rehearsal 25.

**Five-Valve Trumpet Advantages:** This is the Trumpet 3 complement to Maurice Ravel, *Rhapsodie Espagnole: IV*. “Feria,” Trumpet 1, beginning at the fourth measure before Rehearsal 15. The execution of the first two measures is especially awkward, but technical facility and accuracy are improved when played on the D side of the five-valve trumpet. Additionally, the five-valve trumpet option corrects intonation on the concert C#4. This very sharp pitch on the C side becomes in tune when played as a B3 on the D side.

Original: Trumpet in C

Five-Valve Trumpet Version in C and D

in C

*mf* < *ff*      *mf* < *ff*      *f*

**Excerpt:** Nikolai Rimsky-Korsakov, *Grand Russian Easter*: Trumpets 1 and 2, beginning at the twenty-third measure of Rehearsal U.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet provides alternate fingerings that may improve intonation, ease of execution, and accuracy. The pitch concert A5 is more reliable when played on the D side as G5.

Original: Trumpet in A

*Allegro agitato*

in A

*f marcato*

Five-Valve Trumpet Version in D

in D

*Allegro agitato*

*f marcato*



**Excerpt:** Gioacchino Rossini, *Guillaume Tell Overture*: Trumpet 1, beginning at the eighteenth measure before Rehearsal H.

**Five-Valve Trumpet Advantages:** In this excerpt, the B $\flat$  side of the five-valve trumpet provides alternate fingerings that may improve intonation, ease of execution, and accuracy.

Original: Trumpet in E



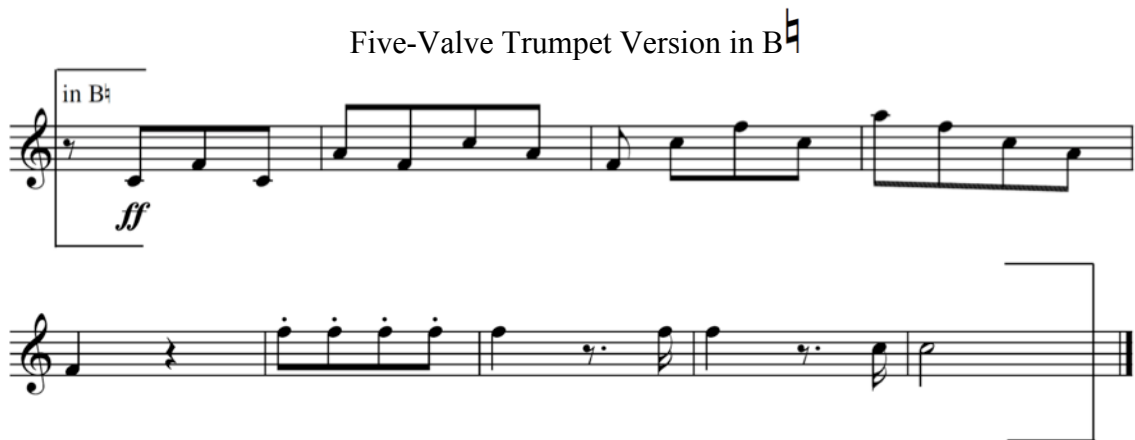
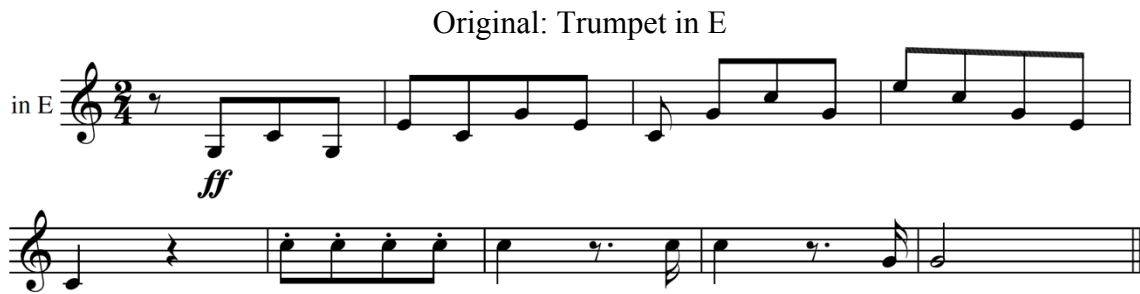
Five-Valve Trumpet Version in B $\flat$





**Excerpt:** Gioacchino Rossini, *Guillaume Tell Overture*: Trumpet 1, beginning at the ninth measure from the end.

**Five-Valve Trumpet Advantages:** In this excerpt, the B $\flat$  side of the five-valve trumpet provides alternate fingerings that may improve intonation, ease of execution, and accuracy.



**Excerpt:** Alexander Scriabin, *Le Poème de l'Extase*: Trumpet 1, beginning at measure 13.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet may be used to improve response, accuracy, security, and intonation on the opening concert A5. The shorter overall length of tubing of the D side, utilization of a lower partial, and fewer air column disturbances all help to make this soft entrance more reliable. Articulation clarity and sound quality are also likely to improve.

Original: Trumpet in B $\flat$

in B $\flat$

Andante. Languido

*p* cresc. *f* imperioso dim. *p* *pp*

Five-Valve Trumpet Version in C and D

in C

in D  
Andante. Languido

*p* cresc. *f* imperioso dim. *p* *pp*

**Excerpt:** Alexander Scriabin, *Le Poème de l'Extase*: Trumpet 1, beginning at the sixth measure before Rehearsal 38.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side may be used to increase security on this solo marked “*imperioso con sonorita*” (with commanding sonority). The shorter overall length of tubing and the utilization of lower partials help to improve accuracy, security, articulation clarity, and projection. These improvements help the

player to achieve the “commanding sonority” at this special moment in the music and project over the orchestra with a brilliant, powerful sound.

Original: Trumpet in B $\flat$

Five-Valve Trumpet Version in C and D

**Excerpt:** Jean Sibelius, *Finlandia*: Trumpet 1, beginning at the fifth measure of Rehearsal G.

**Five-Valve Trumpet Advantages:** The first note of this excerpt is normally played on the C trumpet as A $\flat$ 5. In Five-Valve Trumpet Version #1, to improve accuracy and response on this soft entrance, the D $\flat$  side of the five-valve trumpet may be used to make the pitch G5, a lower-partial pitch with improved stability and response. The rest of the passage may be played normally on the C side of the trumpet. Alternatively, as in Five-Valve Trumpet Version #2, the entire passage may be played on the D $\flat$  side.

Original: Trumpet in F

Five-Valve Trumpet Version #1 in C and D $\flat$

in C

in D $\flat$

*p* *cresc.* *ff*

Five-Valve Trumpet Version #2 in D $\flat$

in D $\flat$

*p* *cresc.* *ff*

**Excerpt:** Jean Sibelius, *Symphony No. 2 in D Major, Op. 43*: Trumpet 1, Movement 4, beginning at measure 5.

**Five-Valve Trumpet Advantages:** On the D side of the five-valve trumpet, the beginning pitch concert A5 may be played G5. The utilization of a lower partial and shorter length of tubing improves accuracy, security, response, and clarity of articulation. These advantages are particularly true for this pitch, especially as a first note. Five-Valve Trumpet Version #1 uses the D side for the pitch concert A5 only. Five-Valve Trumpet Version #2, although the notation for the first concert E5 and F#5 may look strange, allows the player to switch back to the C side of the five-valve trumpet without any accompanying valve changes.

Original: Trumpet in F

**Allegro Moderato**

in F

*f*



Five-Valve Trumpet Version #1 in C and D

in C

in D  
Allegro Moderato

Five-Valve Trumpet Version #2 in C and D

in C

in D  
Allegro Moderato

**Excerpt:** Richard Strauss, *Also Sprach Zarathustra*: Trumpet 1, beginning at measure 9.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet offers options for improving security, intonation, and confidence in the upper register. By playing the first concert A5 as a G5 on the D side, this pitch becomes more stable and in tune. The improved stability and intonation, along with shorter overall tubing and fewer air-column disturbances, result in better accuracy and projection, as well as added confidence. Also, using the D side on the last three notes of the excerpt allows the player to adjust intonation on the concert C6, now a B $\flat$ 5 fingered first valve, by using the first slide.

Original: Trumpet in C

in C

*f*

*f*

*immer breiter*

*f* *cresc.* *ff* *ff*

### Five-Valve Trumpet Version in C and D

**Excerpt:** Richard Strauss, *Also Sprach Zarathustra*: Trumpet 1, beginning at Rehearsal 19.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet may be used to increase accuracy, security, and intonation on the concert A5. The concert A5 tends to be sharp, but the five-valve trumpet options may correct this intonation tendency while simultaneously increasing accuracy and security. These improvements, along with a shorter overall length of tubing and fewer air-column disturbances, also tend to make the diminuendo to *pianissimo* easier.

**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at the measure before Rehearsal 68.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides improved stability, accuracy, and response in the high register. In Five-Valve Trumpet Version #2 of the excerpt, waiting to switch to the D side until the concert D6 may maximize this effect on that note. In Five-Valve Trumpet Version #3 and Five-Valve Trumpet Version #4 of the excerpt, using the alternate, first-valve fingering for concert B $\flat$ 5 may improve accuracy, and this allows the change to the D side to be made without any accompanying valve changes.

Original: Trumpet in B $\flat$

The original score for Trumpet in B $\flat$  consists of two staves. The top staff is in B $\flat$  and begins with a dynamic marking of *f*. The bottom staff is in D and begins with a dynamic marking of *fp*. The music features a melodic line with various articulations and a triplet of eighth notes.

Five-Valve Trumpet Version #1 in D

The Five-Valve Trumpet Version #1 in D consists of two staves. The top staff is in D and begins with a dynamic marking of *f*. The bottom staff is in D and begins with a dynamic marking of *fp*. The music features a melodic line with various articulations and a triplet of eighth notes.

Five-Valve Trumpet Version #2 in C and D

in C

*f*

*fp*

in D

The musical score for Five-Valve Trumpet Version #2 consists of two staves. The top staff is in C major and begins with a dynamic marking of *f*. It features a series of eighth notes with accents, followed by a half note. A bracket labeled "in D" indicates a change in key signature for the final two measures. The bottom staff continues the melody with a triplet of eighth notes and a dynamic marking of *fp*. A slur covers the final two measures, which correspond to the "in D" section of the top staff.

Five-Valve Trumpet Version #3 in C and D

in C

*f*

*fp*

in D

1

The musical score for Five-Valve Trumpet Version #3 consists of two staves. The top staff is in C major and begins with a dynamic marking of *f*. It features a series of eighth notes with accents, followed by a half note. A bracket labeled "in D" indicates a change in key signature for the final two measures. The bottom staff continues the melody with a triplet of eighth notes and a dynamic marking of *fp*. A slur covers the final two measures, which correspond to the "in D" section of the top staff. A finger number "1" is written above the first note of the "in D" section.

Five-Valve Trumpet Version #4 in C and D

in C

*f*

*fp*

in D

1

in D

The musical score for Five-Valve Trumpet Version #4 consists of two staves. The top staff is in C major and begins with a dynamic marking of *f*. It features a series of eighth notes with accents, followed by a half note. A bracket labeled "in D" indicates a change in key signature for the final two measures. The bottom staff continues the melody with a triplet of eighth notes and a dynamic marking of *fp*. A slur covers the final two measures, which correspond to the "in D" section of the top staff. A finger number "1" is written above the first note of the "in D" section. A second bracket labeled "in D" is placed above the final two notes of the top staff.

**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at the second measure of Rehearsal 70.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides improved stability, accuracy, and response in the high register. In Five-Valve

Trumpet Version #2 of the excerpt, waiting to switch to the D side until the concert D6 may maximize this effect on that note. In Five-Valve Trumpet Version #3 of the excerpt, using the alternate, first-valve fingering for concert B $\flat$ 5 may improve accuracy, and this allows the change to the D side to be made without any accompanying valve changes.

Original: Trumpet in B $\flat$

The first staff of music is in B $\flat$  and features a melodic line starting with a fortissimo (*ff*) dynamic. It includes a triplet of eighth notes. The second staff shows a sustained note with dynamics *f*, *dim.*, and *p*.

Five-Valve Trumpet Version #1 in D

The first staff of music is in D and features a melodic line starting with a fortissimo (*ff*) dynamic. It includes a triplet of eighth notes. The second staff shows a sustained note with dynamics *f*, *dim.*, and *p*.

Five-Valve Trumpet Version #2 in C and D

The first staff of music is in C and features a melodic line starting with a fortissimo (*ff*) dynamic. It includes a triplet of eighth notes. The second staff shows a sustained note with dynamics *f*, *dim.*, and *p*.

Five-Valve Trumpet Version #3 in C and D

**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at the third measure of Rehearsal 91.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides alternate fingerings that may improve the ease of execution, accuracy, and clarity of articulation.

Original: Trumpet in C

Five-Valve Trumpet Version #1 in D

Five-Valve Trumpet Version #2 in C and D

**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at Rehearsal 94.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides fingerings that may improve accuracy, security, and response in the high register. As depicted in Five-Valve Trumpet Version #1 and Version #2, the pitches concert C#6, A5, and G#5 may be more reliable when executed on the D side as B5, G5, and F#5, respectively. In Five-Valve Trumpet Version #3, the pitch concert C#6 is played as the pitch C6 on the D $\flat$  side. In addition, the pitch concert B4 is played on the C side, which may help to improve intonation.

Original: Trumpet in C

in C

Five-Valve Trumpet Version #1 in D

in D

Five-Valve Trumpet Version #2 in C and D

in C

Five-Valve Trumpet Version #3 in C, D, and D $\flat$


in C




**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at the fourth measure of Rehearsal 110.

**Five-Valve Trumpet Advantages:** Provides alternate fingerings that may promote accuracy, response, and the smoothness of slurs. The entrance on concert  $D\flat_5$  may be more reliable when played on the  $D\flat$  side as  $C_5$ .

Original: Trumpet in C



Five-Valve Trumpet Version in  $D\flat$



**Excerpt:** Richard Strauss, *An Alpine Symphony*: Trumpet 1, beginning at Rehearsal 113a.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides alternate fingerings that may improve security, accuracy, response, and intonation. In Five-Valve Trumpet Version #2, waiting to switch to the D side until the concert  $D_6$  may maximize the effect for that note. Security and accuracy on the concert  $G\sharp_5$  and  $A_5$  may be improved by playing them on the D side as  $F\sharp_5$  and  $G_5$ , respectively. In Five-Valve Trumpet Version #3 of the excerpt, using the alternate, first-

valve fingering for concert B $\flat$ 5 may further increase accuracy. This also allows the change to the D side to be made without any accompanying valve changes.

Original: Trumpet in C

in C

*ff*

3

Five-Valve Trumpet Version #1 in C and D

in C

*ff*

3

in D

Five-Valve Trumpet Version #2 in C and D

in C

*ff*

3

in D

Five-Valve Trumpet Version #3 in C and D

in C

*ff*

3

in D

1



**Excerpt:** Richard Strauss, *Der Rosenkavalier*: Trumpet 1, beginning at the fifth measure before Rehearsal 61.

**Five-Valve Trumpet Advantages:** Provides alternate fingerings that promote good intonation, response, smoothness of slurs, and security in the high register.

Original: Trumpet in C

Five-Valve Trumpet Version in D $\flat$

**Excerpt:** Richard Strauss, *Sinfonia Domestica*: Trumpets 2, 3, and 4, beginning at Rehearsal 104.

**Five-Valve Trumpet Advantages:** The B $\natural$  side of the five-valve trumpet may be used in the following excerpt to utilize fingerings that promote clean execution. When performed on C trumpet, the number of fingerings that use the third valve is quite large. Since

fingerings like these have a tendency to be more difficult to execute, the ability to choose between different sets of fingerings without switching trumpets may be a valuable tool, and it may help a section achieve greater precision in *tutti* passages.

Original: Trumpet in E

Mit Dämpfer

in E

*ff*

Five-Valve Trumpet Version in C and B

in B

Mit Dämpfer

in C

*ff*

**Excerpt:** Richard Strauss, *Till Eulenspiegel Lustige Streiche*: Trumpet 1, beginning at Rehearsal 14.

**Five-Valve Trumpet Advantages:** The D side of the five-valve trumpet may be used in the following excerpt to ensure a smooth slur to the concert A5. By playing this pitch as a G5 on the D side, it stays in the same sixth partial as concert G5, increasing security. The shorter overall length of tubing also helps the trumpeter achieve a centered, brilliant sound on the climax of this phrase. Intonation is also improved.

Original: Trumpet in F

Gemächlich mit Dämpfer      Doppelt so schnell

in F

Five-Valve Trumpet Version in C and D

Gemächlich mit Dämpfer      Doppelt so schnell

in C

**Excerpt:** Richard Strauss, *Till Eulenspiegel Lustige Streiche*: Trumpet 1, beginning at the fourth measure before Rehearsal 19.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet may be used to improve the multiple instances of the pitch concert A5. The utilization of a lower partial with a shorter length of tubing in this instance tends to improve security, projection, intonation, and confidence. As shown in Five-Valve Trumpet Version #2, the D side may be used continuously beginning at measure 6 of the excerpt.

Original: Trumpet in F

in F

Five-Valve Trumpet Version #1 in C and D

in C *mf* *mf* in D

in D *ff marcato*

in D *ff* → Etc.

Five-Valve Trumpet Version #2 in C and D

in C *mf* *mf* in D

in D *ff marcato*

in D *ff* → Etc.

**Excerpt:** Richard Strauss, *Till Eulenspiegel Lustige Streiche*: Trumpet 1, beginning at the second measure of Rehearsal 24.

**Five-Valve Trumpet Advantages:** In this excerpt, the D side of the five-valve trumpet may be used to increase technical facility and accuracy. On C trumpet, beginning on the

concert A5 may be an accuracy hazard, but this difficulty is greatly improved when the excerpt is played on the D side of the five-valve trumpet. The relatively unstable concert A5 becomes the very reliable G5. Additionally, the shorter overall length of tubing and use of a fingering with fewer air-column disturbances improves response. Intonation is also improved.

Original: Trumpet in F

Five-Valve Trumpet Version in D

**Excerpt:** Richard Strauss, *Till Eulenspiegel Lustige Streiche*: Trumpet 1, beginning at fifth measure before Rehearsal 37.

**Five-Valve Trumpet Advantages:** Many different ways of playing the following excerpt on the five-valve trumpet are possible. In the following Five-Valve Trumpet Version, the primary advantage is in accuracy and security on the many instances of the pitch concert A5. Added advantages are at the end of the excerpt, where the D side of the five-valve trumpet allows the trumpeter to utilize lower partials and fingerings that are more in tune.

Original: Trumpet in F

immer ausgelassener und lebhafter

in F

*ff* *ff*

*ff* *fff*

This musical score is for a Trumpet in F. It consists of four staves of music. The first staff begins with a treble clef, a key signature of one sharp (F#), and a common time signature. The music starts with a half note followed by eighth notes, then quarter notes, and ends with a half note. The dynamic marking *ff* is placed below the first and last notes of the first staff. The second staff contains eighth notes with accents. The third staff contains eighth notes with a key signature change to two sharps (D#) and a common time signature. The fourth staff contains quarter notes with accents and a dynamic marking of *fff* at the end.

Five-Valve Trumpet Version in C and D

immer ausgelassener und lebhafter

in C

in D

*ff* *ff*

in D

*ff* *fff*

This musical score is for a Five-Valve Trumpet. It consists of four staves of music. The first staff begins with a treble clef, a key signature of one sharp (F#), and a common time signature. The music starts with a half note followed by eighth notes, then quarter notes, and ends with a half note. The dynamic marking *ff* is placed below the first and last notes of the first staff. The second staff contains eighth notes with accents. The third staff contains eighth notes with a key signature change to two sharps (D#) and a common time signature. The fourth staff contains quarter notes with accents and a dynamic marking of *fff* at the end. There are five boxes labeled "in D" above the first staff, indicating key changes for the five-valve version.



**Excerpt:** Richard Strauss, *Tod und Verklärung*: Trumpet 1, beginning at the twelfth measure of Rehearsal Y.

**Five-Valve Trumpet Advantages:** In the following excerpt, the D side of the trumpet may be used to improve response and intonation. The D side of the five-valve trumpet allows the top pitch (concert A5) to be played with a minimum length of tubing and in a lower partial. The result is quicker response and improved security. In the following measures, the pitch concert G5 is held for over four measures. Since this is a slightly sharp note at a dynamic of *pianissimo*, intonation may be improved by playing this pitch as F5 on the D side and using the first valve slide to correct pitch. Response on the re-articulation of this pitch also improves because the pitch may be played directly in the center, without any “lipping.”

Original: Trumpet in C

tranquillo

in C

*pp*

Five-Valve Trumpet Version in C and D

tranquillo

in C

*pp*

in D

**Excerpt:** Igor Stravinsky, *Feuerwerke*: Trumpets 1 and 2, beginning at the second measure of Rehearsal 5.

**Five-Valve Trumpet Advantages:** This passage works well on the C side of the trumpet, but the D side may provide some fingering and security advantages, especially in the third measure. The last measure is played on the C side, since the pitch A5 on the D side tends to be comparably less stable.

Original: Trumpet in A

The original musical notation is in 3/4 time, starting with a treble clef and a key signature of one sharp (F#). The first measure is marked with a forte *f* dynamic. The melody consists of quarter notes: F#4, G4, A4, B4. The second measure contains a triplet of eighth notes: B4, C5, D5. The third measure contains a triplet of eighth notes: D5, E5, F#5. The fourth measure contains a triplet of eighth notes: F#5, G5, A5. The fifth measure contains a quarter note G5, followed by a quarter note A5, and a quarter note G5. The sixth measure contains a quarter note F#5, followed by a quarter note G5, and a quarter note F#5. The piece ends with a double bar line.

Five-Valve Trumpet Version in C and D

The five-valve trumpet version is also in 3/4 time, starting with a treble clef and a key signature of one sharp (F#). The first measure is marked with a forte *f* dynamic. The melody consists of quarter notes: F#4, G4, A4, B4. The second measure contains a triplet of eighth notes: B4, C5, D5. The third measure contains a triplet of eighth notes: D5, E5, F#5. The fourth measure contains a triplet of eighth notes: F#5, G5, A5. The fifth measure contains a quarter note G5, followed by a quarter note A5, and a quarter note G5. The sixth measure contains a quarter note F#5, followed by a quarter note G5, and a quarter note F#5. The piece ends with a double bar line. Brackets above the staff indicate that the first two measures are in D (C5, D5, E5) and the last three measures are in C (F#5, G5, A5).

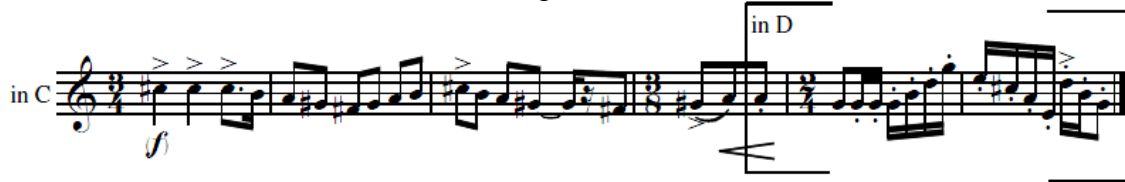
**Excerpt:** Igor Stravinsky, *Histoire du Soldat*: “March du Soldat,” beginning at the fourth measure of Rehearsal 8.

**Five-Valve Trumpet Advantages:** The D side of the five-valve trumpet may be used in the following excerpt to promote lightness and ease of execution of the sixteenth-note arpeggios. The shorter overall length of tubing of the D side combined with fingerings that use fewer valve slides result in increased quickness of response. This helps achieve the light, clear articulation necessary in these arpeggios. The utilization of lower partials and fingerings improves accuracy and ease of execution.

Original: Trumpet in A



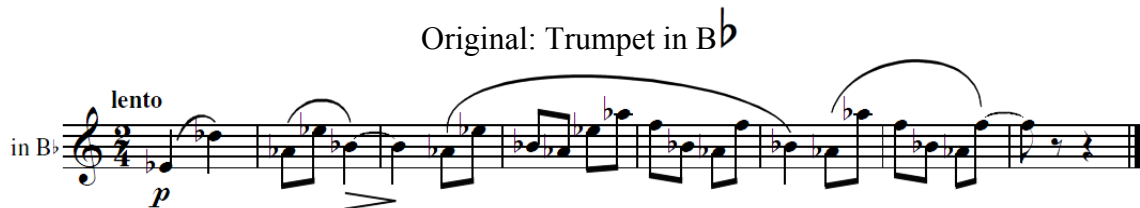
Five-Valve Trumpet Version in C and D



**Excerpt:** Igor Stravinsky, *Histoire du Soldat*: “Musique de la 2ème Scène,” beginning at the fifth measure of Rehearsal 2.

**Five-Valve Trumpet Advantages:** The following excerpt may pose intonation and response challenges because of the key, especially at the *piano* dynamic. When played on C trumpet, the fingerings 1-2-3 and 2-3 tend to have sluggish response. However, when played on the D $\flat$  side of the five-valve trumpet, the shorter overall tubing length and use of fingerings with fewer valve slides and better intonation help improve response and the smoothness of slurs. The notes marked with an asterisk (\*) may be fingered open on the D side to take advantage of an available lower partial.

Original: Trumpet in B $\flat$



Five-Valve Trumpet Version in D $\flat$

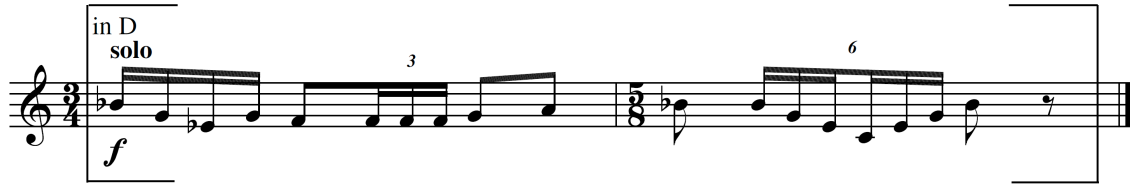
**Excerpt:** Igor Stravinsky, *Histoire du Soldat*: “March Triomphale du Diable,” beginning at the third measure of Rehearsal 7.

**Five-Valve Trumpet Advantages:** The following excerpt contains a fingering challenge when performed on C trumpet. The D-major, minor-seventh arpeggio contains a “forked fingering” (concert F $\sharp$ 4, fingered second valve, to concert D4, fingered 1-3) that can be difficult to execute cleanly at the requisite speed. By using the D side of the five-valve trumpet, the execution is relatively easy. In Five-Valve Trumpet Version #1, the change to the D side is made halfway through the passage. Alternatively, the entire passage can be played entirely on the D side, as in Five-Valve Trumpet Version #2.

Original: Trumpet in B $\flat$

Five-Valve Trumpet Version #1 in D

Five-Valve Trumpet Version #2 in D



**Excerpt:** Igor Stravinsky, *Petrushka*, (1911): “Ballerina’s Dance,” Cornet 1, beginning at the measure before Rehearsal 69.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides alternate fingerings that may increase security, accuracy, response, clarity of articulation, and technical facility. Additionally, if the second group of slurred sixteenths is problematic, the pitches denoted by an asterisk (\*) may be fingered with the first and fourth valves in combination to allow the use of a valve slur in place of the downward lip slur.

Original: Trumpet in B $\flat$



Five-Valve Trumpet Version in C and D

**Excerpt:** Igor Stravinsky, *Petrushka*, (1911): “Waltz,” Cornet 1, beginning at Rehearsal 75.

**Five-Valve Trumpet Advantages:** In the following excerpt, the five-valve trumpet provides alternate fingerings that may improve accuracy, response, clarity of articulation, ease of execution, and smoothness of slurs. As depicted in Five-Valve Trumpet Version #1, the pitch concert  $A\flat_5$  tends to be more stable and reliable when played on the D side as  $G\flat_5$ . In Five-Valve Trumpet Version #2, the entire excerpt is played on the  $D\flat$  side.

Original: Trumpet in  $B\flat$

Tempo di Valse. (lento.)

Five-Valve Trumpet Version #1 in C and D

Tempo di Valse. (lento.)

in C

(*p*) Come sopra

in D

stacc.

leggiere

in D

Five-Valve Trumpet Version #2 in D $\flat$

in D $\flat$

Tempo di Valse. (lento.)

(*p*) Come sopra

stacc.

leggiere

**Excerpt:** Peter Tchaikovsky, *Capriccio Italien*, Op. 45: Cornet 1, beginning at the eighth measure before Rehearsal D.

**Five-Valve Trumpet Advantages:** In the following excerpt, the  $D\flat$  side of the five-valve trumpet allows the trumpeter to play this solo in the key of C major. This simplifies execution and allows more attention to be put into the musical details and stylistic elements. When performed on C trumpet, some of the fingerings may be tricky, but the five-valve trumpet helps to alleviate this difficulty.

Original: Trumpet in A

Allegro moderato  
solo

in A

*f* *mf*

Five-Valve Trumpet Version in  $D\flat$

Allegro moderato  
solo

in  $D\flat$

*f* *mf*



**Excerpt:** Peter Tchaikovsky, *Symphony No. 4 in F Minor*: Trumpet 1, Movement 1, beginning at measure 7.

**Five-Valve Trumpet Advantages:** In this excerpt, the five-valve trumpet may be used to increase the accuracy, security, response, and articulation clarity of the pitch concert  $A\flat_5$ . This pitch, when fingered 2-3 on the C trumpet, tends to be unstable and be prone to cracks and accuracy problems. Five-Valve Trumpet Version #1 shows the option of playing the entire passage on the D side of the trumpet. In Five-Valve Trumpet Version #2, each concert  $A\flat_5$  may be played open as a G5 on the  $D\flat$  side of the horn, utilizing a lower partial and shorter length of tubing with fewer disturbances in the air column. If switching between the C side to the  $D\flat$  side is too difficult, Version #1 is preferable.

Original: Trumpet in F

Andante sostenuto

in F

Five-Valve Trumpet Version #1 in D

Andante sostenuto

in D

Five-Valve Trumpet Version #2 in C and D $\flat$

**Excerpt:** Peter Ilyich Tchaikovsky, *Symphony No. 5 in E Minor*: Trumpet 1, Movement 4 beginning at the *molto meno mosso*, 8 measures before Rehearsal Ee.

**Five-Valve Trumpet Advantages:** The following excerpt is the finale of the symphony. Performing it on the D side of the five-valve trumpet helps to achieve a brilliant and powerful ending. Since the sound tends to be a little more brilliant on the D side, using the D side on this excerpt may help to achieve an easy, centered, and brilliant sound that projects without sounding forced. In addition, the utilization of lower partials improves security and ease of execution.

Original: Trumpet in A

*Molto meno mosso*

Five-Valve Trumpet Version in D

in D  
Molto meno mosso

*fff*

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<sup>61</sup> Mahler's fifth symphony has been reprinted with the key signature of C# minor.

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APPENDIX A  
DIFFICULT TRILLS CATALOG



in C = [ in B ] = [ in D $\flat$  ]

in C = [ in B ] = [ in D ]

in C = [ in B ] = [ in D $\flat$  ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in D $\flat$  ] = [ in B ]

in C = [ in D ] = [ in D ]

in C = [ in D $\flat$  ] = [ in B <sup>3</sup> ]

in C = [ in B ] = [ in D ]

in C = [ in D $\flat$  ] = [ in B ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in B ] = [ in D $\flat$  ]

in C = [ in D ] = [ in D ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in B ] = [ in D $\flat$  ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in D $\flat$  ] = [ in B ]

in C = [ in D ] = [ in B ]

in C = [ in B ] = [ in D $\flat$  ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in D $\flat$  ]

in C = [ in D ] = [ in D ]

in C = [ in D ] = [ in B ]

in C = [ in D ]

in C = [ in D $\flat$  ] = [ in D ]

in C = [ in D $\flat$  ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note F#. This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D $\flat$ ', containing a whole note F#.

in C = [ in D ] = [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note F. This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D', containing a whole note F. This is followed by another equals sign. The third measure is also enclosed in square brackets and labeled 'in D', containing a whole note F.

in C = [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note B $\flat$ . This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D', containing a whole note B.

in C = [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note F. This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D', containing a whole note F.

in C = [ in D $\flat$  ] = [ in B ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note B $\flat$ . This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D $\flat$ ', containing a whole note B. This is followed by another equals sign. The third measure is enclosed in square brackets and labeled 'in B', containing a whole note B.

in C = [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note B. This is followed by an equals sign. The second measure is enclosed in square brackets and labeled 'in D', containing a whole note B.

in C      #e      =      [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with a sharp sign and the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D' above it; it contains a whole note with the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

in C      #e      =      [ in D $\flat$  ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with a sharp sign and the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D $\flat$ ' above it; it contains a whole note with a flat sign and the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

in C      e      =      [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D' above it; it contains a whole note with the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

in C      b e      =      [ in D $\flat$  ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with a flat sign and the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D $\flat$ ' above it; it contains a whole note with a sharp sign and the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

in C      e      =      [ in D $\flat$  ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D $\flat$ ' above it; it contains a whole note with a sharp sign and the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

in C      #e      =      [ in D ]

Detailed description: A single staff of music in treble clef. The first measure is labeled 'in C' and contains a whole note with a sharp sign and the letter 'e'. The second measure contains an equals sign. The third measure is enclosed in square brackets and labeled 'in D' above it; it contains a whole note with a sharp sign and the letter 'e'. The staff continues with a double bar line and a final measure containing a whole rest.

APPENDIX B

LIST OF TOOLS AND MATERIALS USED IN THE BUILDING OF THE AUTHOR'S

FIVE-VALVE TRUMPET

Soldering:

- Propane Torch
- Welding Gloves
- Silver Solder
- Soldering Paste
- Solder Wick

Hand Tools:

- Pipe Cutters
- Tube Expanding Pliers
- Tapered Reamer
- Various Taps and Dies
- Burnishing Tool
- Copper Tube Brush
- Nylon Tube Brush

Power Tools:

- Hand Drill
- High-speed Adjustable Reamers
- Micro Mill
- Carbide End Mill Bits
- Bench Grinder
- Buffing Wheel (for removing lacquer and polishing the exteriors of instruments)

Miscellaneous Chemical Supplies:

- Buffing Rouge
- Silver Polish
- Brass Polish
- Muriatic Acid (for cleaning tubing and removing lacquer)
- Cutting Lubricant (for high-speed cutting using power tools)
- Penetrating Oil
- Silver Plating Solution

Dimensional Measuring:

- Digital Calipers



APPENDIX C  
LIST OF DONOR INSTRUMENTS, SPECIFICATIONS,  
AND HARVESTED PARTS

Make	Description	Model	Key	Bore Size	Parts Harvested
Vincent Bach	Trumpet	25	B $\flat$	.462 in.	<ul style="list-style-type: none"> <li>Leadpipe (reversed by author)</li> <li>Mouthpiece Receiver<sup>62</sup></li> <li>3rd Valve Slide</li> <li>Right-hand Pinky Hook</li> <li>1st Valve Slide Trigger (Saddle)</li> <li>3rd Valve Slide Trigger (Ring)</li> </ul>
Berkeley <sup>63</sup>	C Trumpet with extra slides for the key of B $\flat$	B $\flat$ /C	B $\flat$ /C	11.7 mm. (.4606 in.)	<ul style="list-style-type: none"> <li>Valve Block Assembly (3 Piston Valves)</li> <li>1st Valve Slide</li> <li>2nd Valve Slide</li> <li>3rd Valve Slide<sup>64</sup></li> <li>1st Valve Slide Trigger (Ring)<sup>65</sup></li> <li>3rd Valve Slide Trigger (Ring)<sup>66</sup></li> </ul>
Cervený	German Rotary Trumpet	N/A	E $\flat$	N/A	<ul style="list-style-type: none"> <li>Clock Spring Triggers and Mounting Hardware</li> </ul>
Clifford Blackburn <sup>67</sup>	Leadpipe	19	C	.462 in.	<ul style="list-style-type: none"> <li>Leadpipe (non-reversed) and Mouthpiece Receiver</li> </ul>
	Tuning Slide	Square	C	.462 in.	<ul style="list-style-type: none"> <li>Tuning Slide (non-reversed)</li> </ul>

<sup>62</sup> The author used the Bach leadpipe only in the intermediate phase of assembly (see figure 19). The author subsequently replaced this leadpipe with the Blackburn leadpipe (see figure 20).

<sup>63</sup> For information on Berkeley instruments, refer to the Berkeley Wind Website: <http://berkeleywind.com>.

<sup>64</sup> The author used the Berkely third valve slide only in the intermediate phase of assembly (see figure 19). The author subsequently replaced this third valve slide with the Bach third valve slide (see figure 20).

<sup>65</sup> The author used the Berkely first-valve slide trigger (ring) only in the intermediate phase of assembly (see figure 19). The author subsequently replaced this first-valve slide trigger (ring) with the Bach first-valve slide trigger (saddle). See figure 20.

<sup>66</sup> The author used the Berkely third valve slide trigger (ring) only in the intermediate phase of assembly (see figure 19). The author subsequently replaced this third valve slide trigger (ring) with the Bach third valve slide trigger (ring). See figure 20.

<sup>67</sup> For information about Blackburn Trumpets, refer to the Blackburn Trumpet Website: <http://www.blackburntrumpets.com>. For information about Clifford Blackburn, refer to: David R. Hickman, *Trumpet Greats: A Biographical Dictionary* (Chandler, AZ: Hickman Music Editions, 2013).

Make	Description	Model	Key	Bore Size	Parts Harvested
Josef Lidl <sup>68</sup>	Posthorn	LGB 280	B♭	11.7 mm. (.4606 in.)	<ul style="list-style-type: none"> <li>• 2 Rotor Valves</li> <li>• 1st Valve Slide (for use as the 4th valve slide/main tuning slide)</li> <li>• Mini-ball Linkages</li> </ul>
F.A. Reynolds Co.	Cornet <sup>69</sup>	310 <sup>70</sup>	B♭	.458 in.	• Bell
	Trumpet <sup>71</sup>	Contempora	B♭	.488 in.	• Tuning Slide (reversed by present author) <sup>72</sup>

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<sup>68</sup> For information about Josef Lidl and his instruments, refer to the Josef Lidl Website: <http://www.josef-lidl.com>.

<sup>69</sup> For information about the F.A. Reynolds Company's "Roth" cornets, refer to the "Roth Cornets" page on the Contempora Corner Website: <http://contemporacorner.com/cornets/roth-cornets>.

<sup>70</sup> Known as the "Roth" Cornet (Made by Roth-Reynolds).

<sup>71</sup> For information about the F.A. Reynolds Company's "Contempora" Trumpets, refer to the "Contempora Trumpets" page on the Contempora Corner Website: <http://contemporacorner.com/trumpets/contempora-trumpets>.

<sup>72</sup> The author used the Reynolds tuning slide only in the intermediate phase of assembly (see figure 19). The author subsequently replaced this tuning slide with the Blackburn tuning slide (see figure 20).