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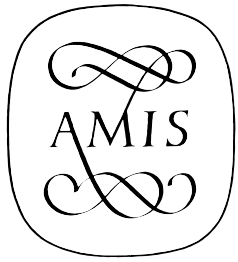

The Invention and Early Development of the Saxophone, 1840–55

Robert S. Howe

The saxophone, invented in the mid-nineteenth century by Adolphe Sax, has been the most popular of all woodwind instruments since the 1920s.The most common saxophones are the E-flat alto, B-flat tenor, E-flat baritone, and B-flat soprano, in approximately that order. The E-flat sopranino and B-flat bass are quite uncommon, while E-flat contrabass saxophones are extremely rare, with only twenty-two made before 1999 being known worldwide.[1]

Many twentieth-century writers presumed that this family of seven species[2] leaped fully-grown from the workbench of Adolphe Sax like Athena from Zeus's brow.[3] In fact, the modern saxophone family developed by trial and error from earlier forms. This article will use data from biographies,[4] early saxophone methods, patents, concert reviews, orchestration textbooks, advertisements, and extant instruments to demonstrate the form of the first saxophones, the changes Sax made to the

1. Paul Cohen, personal communication, February 2003. See also his articles "The Magnificent Contrabass Saxophone," *Saxophone Symposium* 9/2 (Spring 1984): 13–18, and "History of the Contrabass Saxophone," *Saxophone Journal* 11/4 (Winter 1987): 6–8.

2. Biologists classify organisms successively into domain, kingdom, phylum, class, order, family, genus, and species. I use part of this nomenclature in deference to the habit of describing the development of musical instruments as "evolution." In fact, it is not. *Evolution* proceeds by natural selection, in which overly numerous, randomly varying offspring are chosen for survival by their environment. In technological *development* a weakness is identified and addressed by a specific, targeted modification, which if successful is incorporated into later models. Technologic development is thus Lamarckian while evolution is Darwinian. However, the notion of development as evolution is part of our organological psyche. See Laurence Libin, "Progress, Adaptation, and the Evolution of Musical Instruments," this Journal 26 (2000): 187–213.

3. Adam Carse noted that "The whole family of saxophones was completed about 1846 . . ." (*Musical Wind Instruments* [London, 1938; reprint, New York: Da Capo Press, 1975], 176). Similarly, Phillip Bate stated ". . . young Sax continued his work and had virtually completed it by 1845 . . ." ("Saxophone," *The New Grove Dictionary of Music and Musicians* [London: Macmillan Publishers, 1980], 16:534–39, at p. 538).

4. The standard biographies of Sax are Malou Haine, *Adolphe Sax: Sa vie, son oeuvre, ses instruments de musique* (Brussels: Éditions de l'Université de Bruxelles, 1980) and Wally Horwood, *Adolphe Sax 1814–1894* (Baldock, Herts., England: Egon Publishers Ltd., 1983). Haine is rigorously academic and offers little interpretation; Horwood is

instrument during the first fifteen years of its existence, and the sequence of development of the individual species of saxophone.

Origins and Invention

The French wind band in 1840. Antoine-Joseph Sax, called Adolphe, was the eldest child of the Belgian wind instrument maker Charles-Joseph Sax. Born in 1814 in Dinant, Adolphe grew up in the atelier of his father, who was "Facteur du Roi à Bruxelles" ("Musical Instrument Maker of the King at Brussels") and was noted for his fine wind instruments. Adolphe was a prodigy as a wind instrument maker and player. In his twenties, he turned his attention to the vexing problems associated with bass woodwinds. Wind bands of the day had heterogenous, unstandardized instruments of variable quality, pitched in various keys. Brasses were found both with and without keys or valves, resulting in predictable difficulties of tone and intonation.[5]

The pianist and composer Oscar Comettant, Sax's first biographer, noted three major problems for these bands.[6] The limitations of natural and valved brasses of the day meant that most melodic writing was confined to the woodwinds, causing lower melody tones to be covered by brasses playing harmony. Gaps in the scale of natural trumpets caused incomplete harmony in the alto and tenor registers, leaving a hole in the middle of the ensemble. Most importantly, bands lacked a suitable bass. Among woodwinds, the basset horn and bassoon were too soft for effective outdoor use. Of the brasses, the tenor trombone did not play below E, the bass trombone lacked facility, and the valved tuba had barely been invented. The ophicleide was the most-used wind bass instrument of the day; however, it did not work well in its lowest range (notes from BB to B-flat were all pedal tones), blended poorly, and had questionable

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more journalistic but fails to reference his data. Two recent compilations offer no new information but have the advantage of being in print: Thomas Liley, "Invention and Development," in Richard Ingham, ed., *The Cambridge Companion to the Saxophone* (Cambridge: Cambridge University Press, 1998), 1–19; and Jean-Louis Delage, *Adolphe Sax et le Saxophone* (Paris: Éditions Josette Lyon, 1992).

5. Arthur Clappé, *The Wind Band and Its Instruments* (New York: Henry Holt and Co., 1911), 129–30, quoted in Rebekah Ellen Crouch, "The Contributions of Adolphe Sax to the Wind Band" (Ph.D. dissertation, Florida State University, 1968; University Microfilms, no. 69-587), 39.

6. Oscar Comettant, *Histoire d'un inventeur au dix-neuvième siécle, Adolphe Sax* (Paris: Paguerre, Librairie-Editeur, 1860), 83–84, quoted in Crouch, "The Contributions," 40.

tone and intonation. The serpent, Russian bassoon, serpent Forveille, and bass horn were even less useful than the ophicleide.

The critic Henri Blanchard confirmed Comettant's opinion, writing in 1843 that

> Mr. Sax has told us correctly enough what we know, that the sound of the bass wind instruments is either too loud or too soft. The ophicleide, which plays *forte* with the trombones, often has a raucous, uneven and above all disagreeable sound in the concert hall as well as in the open air; it is very difficult to modify these sounds. The bassoon in contrast is only good for accompaniments and certain effects which are peculiar to it; it is almost useless for *fortes*. With the exception of the bassoon, there are no instruments which work agreeably well with stringed instruments and the bassoon is worthless for outside performances where an instrument must overcome the strident voices of the brass instruments.[7]

By 1838 Adolphe Sax had created a functional bass clarinet, praised by the composer François-Antoine Habeneck and the musicologist François-Joseph Fétis.[8] However, its volume was limited. Seeking to create a bass woodwind with the power to be used outdoors and the ability to blend with strings and voices, Sax created his saxophone prototype in 1838–40 while working with his father.[9]

Metal body and single reed. Several writers have suggested that the saxophone's unique combination of woodwind sound generator and brass body was inspired by placing a bass clarinet mouthpiece on the lead pipe of an ophicleide.[10] Such an instrument gives a rich sound similar to the

7. Henri Blanchard, "Adolphe Sax," *Revue et gazette musicale de Paris* 10/37 (September 10, 1843): 315, translated in Fred L. Hemke, "The Early History of the Saxophone" (D.M.A. dissertation, University of Michigan, 1975; University Microfilms, no. 75-26,506), 28–29. Here and elsewhere, Hemke does not provide the original French text.

8. "Nouvelles clarinettes de M. Sax fils," *Revue et gazette musicale de Paris* 8/2 (January 3, 1841): 9–10 and 8/3 (January 10, 1841): 19–20 (courtesy of Albert Rice).

9. Bate, "Saxophone," 538; William Waterhouse, *The New Langwill Index: A Dictionary of Musical Wind-Instrument Makers and Inventors* (London: Tony Bingham, 1993), 347–49. Maurice Hamel, the son of Sax's friend Henry Hamel, gave the date 1838 in his *Notes complémentaires sur Adolphe Sax* (Paris: Archives de H. et A. Selmer, 1925), 38, translated in Hemke, "Early Saxophone," 10.

10. Carse, *Musical Wind Instruments*, 176; Anthony Baines, *Woodwind Instruments and their History* (rev. ed., New York: Norton, 1962), 142; Horwood, *Adolphe Sax*, 33–38; Paul Lindemeyer, *Celebrating the Saxophone* (New York: Hearst Books, 1996), 20; Malou Haine and Ignace de Keyser, *Instruments Sax* (Sprimont, Belgium: Mardaga, 2000), 7.

baritone or bass saxophones but is limited to the lower octave by the absence of a register key. Sax left no account of the saxophone's invention, but circumstances suggest that he did indeed make this experiment. Eight of the thirty-nine surviving brass instruments by Charles Sax are ophicleides[11] (a previously unknown specimen is shown in figure 1), and Adolphe was revising the bass clarinet in the same workshop where his father was building these instruments: really, how could he resist?

Regardless of whether Sax actually made the experiment, the saxophone's wide brass body with very large flat keys covering raised toneholes clearly derives from the ophicleide. The lowest note on each is written B, venting from the bell. The instruments differ in that on an ophicleide, all keys except the low B are closed at rest and are opened when pressed by the player. Thus, on the ophicleide the distal tube has an array of covered toneholes, which muffles notes vented higher on the tube. The best-sounding notes on an ophicleide are therefore those that vent near the bell. In contrast, ten of a saxophone's toneholes stand open at rest and are closed by the successive depression of keys. The existence of several open toneholes below the sounding tonehole allows production of a sound that remains open and relatively uniform regardless of the location of the tonehole on the saxophone's body.

Sax's knowledge of current wind instruments, technology, and acoustics led him to recognize that only an instrument with a wide, rapidly expanding bore and large toneholes could meet his needs. Sax designed a wind column in the shape of a parabola, which functions acoustically as a cone.[12] Thus the saxophone overblows at the octave like a (conical) oboe, rather than at the twelfth as does a (cylindrical) clarinet. The bores of early and modern saxophones expand at a rate of

11. Malou Haine and Ignace de Keyser, *Catalogue des Instruments Sax au Musée Instrumental de Bruxelles* (Brussels: Publications du Musée Instrumental de Bruxelles, 1980), 254–61.

12. Much has been made of Sax's statement that the saxophone bore is a "parabolic cone" (Hemke, "Early Saxophone," 59–70, summarizes much of the misunderstanding of this point). Rather than having perfectly straight sides, the bore of a Sax saxophone takes the shape of a nearly conical parabola. Its proximal bore is narrower than a cone, making the pitch of the high register easier to support. This is not necessarily a benefit; Nederveen shows that a soprano saxophone with a conical bore may be better tuned than one with a more parabolic bore. Cornelius J. Nederveen, *Acoustical Aspects of Woodwind Instruments* (rev. ed., De Kalb: Northern Illinois University Press, 1998), 82–88.

Figure 1. Left, Charles Sax ophicleide no. 5201 (c. 1830). Each key is on an individual mount. Right, ophicleide by Association Générale des Ouvriers, Paris (after 1905). Note the rows of keys on parallel axles, as on a saxophone. Both instruments from the author's collection.

about 7%, compared to about 1.7% for French oboes and about 1.2% for bassoons and contrabassoons. Similarly, the tone holes on a saxophone are larger than those of other conical woodwind instruments, both in absolute terms and relative to the bore diameter.

In the early part of the nineteenth century key mechanisms were added to all orchestral woodwinds. The new complex key systems required woods relatively impervious to changes in humidity and temperature; as a result, boxwood was soon replaced by dense tropical hardwoods.[13] Given the saxophone's large bore, the long span of its rods, and its enormous toneholes and pads, even dense woods such as palisander or grenadilla would be too unstable for a large saxophone. Indeed, it is unlikely that a sufficently large billet could be provided to construct a large wooden saxophone,[14] which in any case would be impossibly heavy, prone to cracking or warping, and difficult to repair when the wood inevitably split. A brass instrument, however, can be less than a millimeter thick; if damaged, it is relatively easy to hammer out the dent or solder on a patch. Sheet brass was cheaper than imported tropical hardwood and was easier to alter during the early experimental phases. Sax knew that the material of a woodwind's body has little effect on its tone or playing characteristics.[15] His extensive experience in making brasswinds thus made it inevitable that he chose brass as the material for his saxophone.

Early saxophones are surprisingly light; they respond quickly and burden the player less than do modern instruments.[16] This betrays the

13. Robert Howe, "The First Mechanized Oboes: Triébert's Systèmes 3 and 4," *The Double Reed* 24/2 (July 2001): 1–17.

14. The largest wooden segment of a modern contrabassoon has a finished diameter of three inches, and is cut from a log with a diameter of thirty inches. Using the same proportions, a wooden bass saxophone would require a log eight to ten feet in diameter. Personal communication, Chip Owen (Fox Corporation, South Bend, IN), January 21, 2002.

15. Arthur H. Benade, *Fundamentals of Musical Acoustics* (Oxford: Oxford University Press, 1976; reprint, New York: Dover, 1990), 499–501; Nederveen, *Acoustical Aspects*, 133–35; Neville H. Fletcher and Thomas D. Ross, *The Physics of Musical Instruments* (2nd ed., New York: Springer-Verlag, 1998), 717–30. By 1840, Halary and others had built successful metal clarinets. Flutes of ivory and glass also made this point. Sax suggested in his 1850 Belgian patent that (small) saxophones could be made of wood if desired, and in fact the tarogato is a single-reed woodwind of maple with dimensions similar to those of a soprano saxophone, with which its timbre can easily be confused.

16. Adolphe Sax soprano saxophone no. 32453 (made in 1869) weighs 0.91kg (2.0 lbs.); Selmer soprano saxophone no. 450984 (made in 1995) weighs 1.70 kg (3.75 lbs.). Similar ratios apply to other species of saxophone.

saxophone's ophicleide lineage, for ophicleides are very light and can generally be deformed with the bare hands. Although saxophones, with smaller radii of curvature and greater bracing by key work, are less susceptible to such bending, the wall thicknesses of French saxophones increased steadily from 1854 to the mid-twentieth century as manufacturers traded lightness for security.

The large conical bore had acoustical as well as mechanical consequences. A conical wind instrument works best when the mouthpiece-reed combination contains a volume of air equal to the volume missing from the apex of the cone.[17] The bore at the top of a parabolic saxophone is smaller than that of a truly conical instrument but still is too large to be fitted with a double reed, thus necessitating a clarinet-type mouthpiece. Sax's design included a mouthpiece with a large chamber that was carefully designed to complete the bore.

Key system. Before mechanization, woodwinds were built by drilling holes at the locations of fingers 1 through 6 to create a scale; semitones were normally obtained by cross-fingering. Tonehole size was often compromised in order to achieve a comfortable spacing (a smaller tonehole drilled higher on the instrument gives the same pitch as a larger tonehole lower down, but at the price of mismatched tone and response). Such an approach could not succeed on so large an instrument as a saxophone, however, since the toneholes would be far too large to close with fingers, even if placed higher and drilled smaller.

In inventing the saxophone, Sax first considered acoustical and musical needs rather than modifying an earlier simple-system instrument. In this he followed the example of Theobald Boehm, who had developed the first modern flute in 1832 by calculating the locations of large toneholes for each semitone,[18] recognizing that "Free and therefore powerful tones can be obtained only from large holes which are placed as nearly as possible in their acoustically correct positions."[19] The player

17. Benade, *Fundamentals*, 470.

18. The salient characteristic of a "Boehm system" woodwind is not a particular fingering pattern but rather this use of large toneholes, activated if need be from a distance. Theobald Boehm, *The Flute and Flute-Playing* (New York: Dover, 1964), 7 (this is a reprint of the 1922 translation by Dayton C. Miller of *Die Flote und das Flotenspiel* [Munich, 1871]). See also Arthur H. Benade, "Woodwinds: The Evolutionary Path since 1700," *Galpin Society Journal* 47 (1994): 63–110.

19. Boehm, *The Flute*, 26.

covered remote toneholes by pressing a conveniently-located ring which worked a key at a distance (see fig. 2). Sax devised a similar mechanism with keys grouped on pivoting rods as on a Boehm flute, rather than on individual levers as on an ophicleide (fig. 1).[20]

Sax's ultimate mechanism had eighteen touches acting on twenty keys. The fingerings for the left hand are identical to those of the simple-system and Triébert Système 3 oboes then current in France. The left-hand touches are 1, 2, and 3; G-sharp, low b and low c-sharp′ for the little finger; high d‴, d-sharp‴, and f‴ for the palm; and two (or more rarely three) octave keys for the thumb (fig. 3). The right hand of a saxophone fingers like a Boehm flute, F being 1234-- and F-sharp 123-5- or 123--6; most earlier woodwinds had used 1234-6 for F. The right hand touches are 4, 5, and 6; low c′ and E-flat for the little finger; and high e‴ and side B-flat for the palm (fig. 3).

Toneholes 1–6 and the keys for low c′ and low b stand open at rest, while the chromatic keys stand closed; this again resembles an oboe. The little-finger keys copy Iwan Müller's 1813 clarinet, including the need to depress two touchpieces to produce b and c-sharp′ (E and F-sharp, or b′ and c-sharp″ on the clarinet). This simplifes the mechanism and reduces the force necessary to close these toneholes, at the cost of complicating the fingerings.

That Sax did not slavishly copy Boehm is shown by the venting of low c′, c-sharp′, and d′. On a Boehm flute, to produce each successive semitone below d′ in a downwards chromatic scale, another tonehole is closed. On an oboe of Sax's time, however, d′ was vented by a large tonehole which was depressed for c′.[21] To produce c-sharp′, the large c′ tonehole was closed and an intermediate, tiny tonehole was opened (this was due to the location of the lower tenon of the oboe; placing the c-sharp′ key in its proper location would have required a key over the bell tenon). This venting gives c-sharp′ a thin and often unpleasant sound. Such an arrangement was not necessary on the saxophone, which did not derive from a simple-system instrument and has no tenon here, but

20. As figure 1 shows, late ophicleides may have keys on pivoting rods, suggesting that the design of the saxophone ultimately influenced its model, the ophicleide. Stephan Weston, "Improvements to the Nine-keyed Ophicleide," *Galpin Society Journal* 36 (1983): 109–14.

21. Robert Howe, "Development of the French Simple System Oboe 1800–1840," *The Double Reed* 24/1 (April 2001): 59–76.

Figure 2. Toneholes on early nineteenth-century flutes, showing the application of Boehm's ideas. Top, six-key flute by Milhouse, London (c. 1810). The toneholes lie well under the hand. Bottom, Louis-Auguste Buffet's modification of the Boehm 1832 system flute by Gautrot, Paris (1860s). Most of the holes are closed by keys activated at a distance by touches and axles. Both instruments from the author's collection.

Figure 3. Left, left-hand keywork, Adolphe Sax alto saxophone no. 21494 (1861). Right, right-hand keywork from the same saxophone. Author's collection.

Sax incorporated it nevertheless.[22] In doing so he maintained a pattern that holes venting notes of the C scale were open at rest, while those venting accidentals were closed.

Early saxophones descend only to written low b rather than the present b-flat or a. They lack the front F, side C, and side F-sharp keys, and the modern linkages between G-sharp, the right-hand keys, and the low B, B-flat, and C-sharp keys. They have two octave vents with separate touches rather than a single touch acting on two mechanically selected keys, and there are no pearls on the finger touches. The key linkages on Adolphe Sax saxophones are a simple design seen only on his instruments and on copies of them (fig. 4).

22. A number of workers have attempted to correct this (including Frédéric Triébert on the oboe and Charles Houvenaghel in Le Rationnel saxophone) but without lasting success. Howe, "First Mechanized Oboes," 13; James MacGillivray, "Recent Advances in Woodwind Fingering Systems," *Galpin Society Journal* 12 (1959): 68–71.

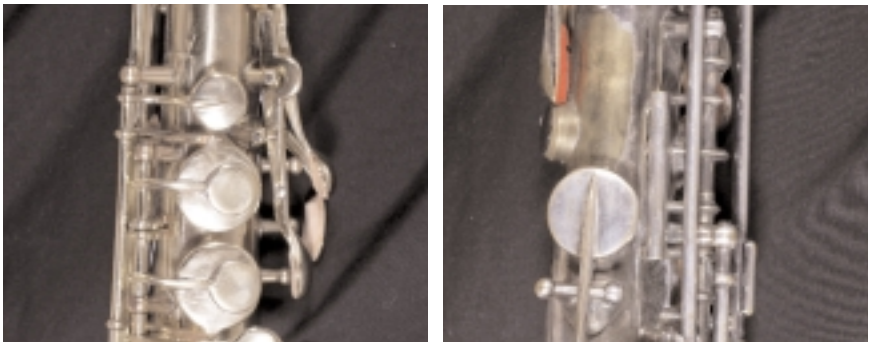

Figure 4. Left, key linkages, Adolphe Sax alto saxophone no. 21494 (1861). Right, the same key linkages on Adolphe Sax fils tenor saxophone (c. 1890), showing the modern form. Both instruments from the author's collection.

The First Saxophones

Sax in Paris. In 1839 Lieutenant-Général Comte Théodore de Rumigny met Sax in Brussels on behalf of King Louis Philippe of France. The aristocratic, music-loving general told Sax of the poor conditions of French military music and asked for his help; he would eventually give Sax valuable aid over many years.[23] Sax visited Paris later that year, meeting Hector Berlioz, Giacomo Meyerbeer, and Fromental Halévy, who complimented him on his instruments. Berlioz was impressed by and sympathetic to Sax, and they subsequently became close friends.[24] Both were enthusiastic, romantic, combatively protective of their own work, conceited, and suspicious of their rivals' intentions. Better known as a writer than as a musician, Berlioz made his living writing weekly essays (*feuilletons*) for the semi-official *Journal des débats politiques et littéraires*, and less often for *Le Correspondent* and the *Revue et gazette musicale de Paris*. He

23. Edward Neukomm, *Histoire de la musique militaire* (Paris: L. Baudoin, 1889), 58–59, quoted in Crouch, "The Contributions," 43–46.

24. Peter Bloom, *The Life of Berlioz* (Cambridge: Cambridge University Press, 1998), 133.

tells us much of Sax, his instruments, and the climate in which they were developed.[25]

Berlioz first mentioned Sax in a March 1842 article on the bombardon (a valved brass bass), apparently on the basis of comments from a musician who had seen Sax recently in Brussels.[26] The saxophone is not named, but the description is unmistakable:

> An invaluable invention, for the beauty of the sound which it gives to the ophicleide, is that which Mr. Sax recently made in Brussels. It is the replacement of the cup mouthpiece by a clarinet mouthpiece. Ophicleides thus become brass instruments with reeds. The difference of sonority and timbre which results from this system is so much to their advantage, according to all those who have been able to judge, that most likely the ophicleide with reed mouthpiece will be in general use in a few years.[27]

Sax had received a silver medal for his clarinet, bass clarinet, and brasses at the 1841 Brussels Exhibition; despite the judges' recommending the gold, the supervising committee considered him too young for this honor. A prototype saxophone brought to this Exhibition was not displayed since a rival had damaged it.[28]

Sax moved to Paris in June 1842; it is hard to imagine him not doing so. Political turmoil in Belgium threatened his father's business; he was indignant over his treatment in the 1841 Exhibition; and this was a time of great creativity in musical instrument design, which was centered in Paris—more than 4,000 French patents were issued for musical instruments in the nineteenth century.[29] No other city had so many makers of

25. Kenneth Norwood Deans, "A Comprehensive Performance Project in Saxophone Literature with an Essay Consisting of Translated Source Readings in the Life and Work of Adolphe Sax," (D.M.A. dissertation, University of Iowa, 1980; University Microfilms International, no. 8023465), 84–112.

26. Most likely this was Michele Carafa, director of the Gymnase Musicale.

27. Hector Berlioz, "De l'instrumentation," *Revue et gazette musicale de Paris* 9/11 (March 13, 1842): 99–100: "Une invention précieuse pour la beauté du son qu'elle donne aux ophicléides est celle que vient de faire à Bruxelles M. Sax. Il s'agit du remplacement de l'embouchure par un bec de clarinette. Les ophicléides deviennent ainsi des instruments de cuivre à anches; la différence de sonorité et de timbre qui résulte pour eux de ce système est tellement à leur avantage, au dire de tous ceux qui ont pu en juger, que, très probablement, l'ophicléide à bec deviendra d'un usage général dans quelques années" (courtesy of Peter Bloom; my translation).

28. Georges Kastner, *Manuel général de musique militaire* (Paris: Firmin-Didot Frères, 1848), 233 (courtesy of Bruno Kampmann).

29. Haine and de Keyser, *Instruments Sax,* 5.

instruments as did the French capital.[30] As the industrial revolution provided the technology to produce interchangeable pieces, artisans in such villages as La Couture, Ivry-la-Battaile, Château-Thierry, Mantes-la-Ville, Garennes, and Mirecourt provided parts to be assembled by Parisian wind instrument makers. Because this method limited innovation, the many important advances in woodwind design occurring here in the 1840s (such as Triébert's Système 3 and 4 oboes, Buffet and Klose's Boehm oboe and clarinet designs, the Boehm bassoon,[31] and the saxophone) were accomplished by smaller, younger firms. "The typical (nineteenth-century Parisian) instrument manufacturer was technically unable and philosophically opposed to the possibility of creating anything new and substantive."[32]

Sax opened his shop at 10 rue Neuve St. Georges[33] in 1843, manufacturing standard brasses while simultaneously developing two new families of brass instruments, the saxhorns and saxotrombas. Sax's reputation for excellence and innovation made other Parisian makers suspicious and hostile to him, and he met a cold reception in Paris. They were understandably frightened of his new ideas and methods; he threatened their military contracts and their livelihoods. Established makers lured away his workers, undercut his work, and tried to shut him down. Sax thus had to work hard to find allies. He showed his instruments privately, earning the support of Berlioz, Fétis, Halévy, Daniel Auber, Gaetano Donizetti, Jean-Georges Kastner, Meyerbeer, Gioacchino Rossini, Gasparo Spontini, and King Louis Philippe.

Two letters support the conclusion that the saxophone was still being developed when Sax moved to Paris. Only a few months earlier, in January 1842, Michele Carafa, director of the Gymnase Musical, wrote Sax, "I have examined with much care and interest the three instruments

30. Parisian wind instrument makers fill eight columns in Waterhouse, *New Langwill Index,* 474–76. Many made but one type of instrument, a specialization impossible in the smaller, widely-dispersed East European market.

31. The Boehm bassoon was a pet project of Frédéric Triébert and Sax that never succeeded. One wonders why Sax pursued this work, since he intended the saxophone to fill the bassoon's role in the band. His brass Boehm-system bassoon is displayed at the Musée de la Musique, Paris (E.1465). See *Guide du Musée de la Musique* (Paris: Éditions de la Réunion des musées nationaux, 1997), 231.

32. Hemke, "Early Saxophone," 126.

33. This was renumbered between 1847 and 1850 as 50 rue Saint Georges. Haine and de Keyser, *Catalogue des Instruments Sax,* 236.

which you have played for me . . . Your brass instrument which uses a clarinet mouthpiece will become a very good instrument; I regret not having seen it finished; in the state that I have heard it, I cannot express enough the advantages which it will offer."[34] On August 11, 1842, Fromental Halévy wrote, ". . . We have already had occasion to examine at the Conservatory your new instruments . . . They were in a state of testing at that time . . . Hasten, therefore, Monsieur, to complete your new family of instruments and come to the aid of poor composers who seek for new innovations and to the public which demands them . . ."[35]

The early bass saxophone. On arriving in Paris in June 1842, Sax performed on several of his new instruments for Auber, Berlioz, Halévy, and Kastner and professors at the Conservatoire. Berlioz described this meeting in an essay two days later:

ADOLPHE SAX'S MUSICAL INSTRUMENTS

> A revolution is in the making and Monsieur Adolphe Sax from Brussels . . . strongly contributes to it. . . . The Saxophone (*Le Saxophon*), named after its inventor, is a brass instrument with nineteen keys, whose shape is rather similar to that of the ophicleide. Its mouthpiece, unlike those of most brass instruments, is similar to the mouthpiece of the bass clarinet. Thus the Saxophone becomes the head of a new group, that of the brass instruments with reed. It has a compass of three octaves beginning from the lower B flat beneath the staff (bass clef); its fingering is akin to that of the flute or the second part of the clarinet. Its sound is of such rare quality that, to my knowledge, there is not a bass instrument in use nowadays that could be compared to the Saxophone. It is full, soft, vibrating, extremely powerful, and easy to lower in intensity. As far as I am concerned, I find it very superior to the lower tones of the ophicleide, in accuracy as well as in the solidity of the sound. But the character of such sound is absolutely new, and does not resemble any of the timbres heard up till now in our orchestras with the sole exception of the bass clarinet's lower E and F. Owing to its reed, it can increase or diminish the intensity of its sounds. The notes of the higher compass vibrate so intensively that they may be applied with success to melodic expression. Naturally, this instrument will never be suitable for rapid passages, for complicated arpeggios; but the bass instruments are not destined to execute light passages. Instead of complaining, we must rejoice

34. *Faits et documents relatifs au procés entre M. Sax et M. Gautrot* (Paris: Imprimerie Centrale de Napoléon Chaix et Cie., 1858), 98, translated in Hemke, "Early Saxophone," 25.

35. *Faits et documents*, 98, translated in Hemke, "Early Saxophone," 24.

that it is impossible to misuse the saxophone and thus to destroy its majestic nature by forcing it to render mere musical fripperies.

Composers will be very indebted to Mr. Sax when his new instruments are generally employed. If he perseveres, he will meet with the support of all friends of music.[36]

These meetings drew other public comments as well. The *Revue et gazette musicale de Paris* wrote that

Mister Sax . . . played his bass clarinet and a new ophicleide which he has created, at the Conservatory before the director M. Auber and several professors. Full justice has been rendered to the beauty of these instruments. They cannot be compared to any others by virtue of their range, quality and the infinite variety of nuances they are capable of providing.[37]

On the same day the journal *La France musicale* noted that

A distinguished artist from Brussels, M. Sax, performed on several instruments which he has invented. The first is a clarinet which allows the performer to play in every key. M. Sax, who is an excellent clarinettist, brought out the best from his instrument. The second is a bass clarinet in B♭, which descends to D of the fourth string of the 'cello and is remarkable for its intensity and quality of sound. His third invention is destined to replace the ophicleide. This brass instrument is played with a clarinet mouthpiece and has a range close to two and a half octaves beginning from the B♭ of the bassoon. You cannot imagine the beauty of sound and the quality of the notes in its lower octaves. These different instruments have been heard by a committee at the Conservatory and by the best composers, who highly approved of the improvements which M. Sax demonstrated in this performance. They have encouraged him to give the finishing touches to his inventions which they feel will be a great help to the orchestra.[38]

The size and nominal pitch of the saxophone is not given in any of these references, but because its range began with the B-flat below the

36. Hector Berlioz, "Nouvelles: Instruments de Adolphe Sax," *Journal des débats* (June 12, 1842), 3, translated by Léon Kochnitzky, *Sax and his Saxophone* (Chicago: North American Saxophone Alliance, 1985), 11–13. See Deans, "Translated Source Readings," 22–24 and 91–96, for Fétis' discussion and another translation; see Hemke, 20–23, for his translation. None of these sources gives the original text.

37. Anon., "Nouvelles (Conservatoire: Essai de la clarinette-basse et de l'ophicléide de Sax)," *Revue et gazette musicale de Paris* 9/24 (June 12, 1842): 245, translated in Hemke, "Early Saxophone," 19.

38. [Léon or Marie-Pierre-Yves] Escudier, *La France musicale* (June 12, 1842), 218, translated in Hemke, "Early Saxophone," 19–20. The brothers Escudier, publishers of *La France musicale*, did not generally sign first names to articles in their journal.

bass staff it must have been a bass. While it could have been an instrument pitched in C with a lowest keyed note of B-flat, a bass saxophone in B-flat with a lowest keyed note of (written) C is more likely, as this was a prototype, for which a smaller rather than a larger keyed range seems most reasonable. It is noteworthy that the descriptions are of a single, unfinished instrument, not of one member of a family.

During the next year, Sax worked to refine the saxophone. An article by Henri Blanchard gives the first evidence of extension of the lower range. In September 1843, after discussing the difficulties Sax faced in Paris, Blanchard noted:

> Adolphe Sax . . . has brought about the manufacture of an entirely new instrument which he, like a proud father, has already named the SAXOPHONE. This instrument which has been played for us has a low, noble and mellow voice; it is made of brass and is close to eight feet in length. By the proportions of its tube it forms a parabolic cone along its length and is equipped with nineteen keys, which close the holes, some of which are almost two inches in diameter. Its fingering is like the second register of the clarinet, something close to that of the new bass clarinet. Its range is three octaves, the lowest note being A.[39]

Blanchard's description of the saxophone and his argument (quoted earlier from this same article) regarding the weaknesses of bass instruments both ring true. That he described an instrument with range to AA rather than BB-flat shows that this saxophone was pitched in B-flat with range to written low B. Sax therefore must have added the additional semitone to his prototype some time between June 1842 and September 1843, probably by extending the bell.

When he met Sax, Berlioz was compiling his *Grand Traité d'instrumentation*. He added these paragraphs to the completed manuscript in December 1843:[40]

> THE SAXOPHONE is a large bass brass instrument, invented by Adolphe Sax, who has given it his name. It is played not with a cup mouthpiece, as are ophicleides (which it does not in any way resemble), but with a bass clarinet mouthpiece. We thus do not hesitate to classify it among the members of the family of the clarinets.
>
> The saxophone is a transposing instrument in B-flat; its range is this: [diatonic scale of BB–c″, transposed for an instrument in B-flat and thus sounding AA–b-flat′; written in the bass and tenor clefs].

39. Blanchard, "Adolphe Sax," 315, translated in Hemke, "Early Saxophone," 28–29.
40. Peter Bloom, personal communication, May 2001.

> Trills are possible over the entire extent of this range, but I believe that one should make only very reserved use of them.
>
> The timbre of the saxophone has something of pain and sadness in the upper register; the bass notes, on the contrary, are imposing and are, so to speak, pontifical. It has the clarinet's ability to swell and extend the sound, from which result, especially at the lower end of its scale, unheard-of effects which are completely unique to it. The saxophone, for pieces of a mysterious and solemn nature, is, in my opinion, the most beautiful bass voice known so far. It partakes of the sound of the bass clarinet and of the harmonium, which indicates sufficiently, I believe, that in general one should only employ it in slow movements. It would be equally admirable highlighted in a solo, as it would be [when] employed to support and color the harmony of an ensemble of voices and wind instruments.
>
> In spite of the extraordinary force of its sonority it is not very suited to the energetic and brilliant effects of military music.[41]

Clearly, this instrument made a deep impression on Berlioz, especially in the contrast of its uniform tone to the unsatisfactory timbres of the bassoon and ophicleide. This first working saxophone was unambiguously a B-flat bass with a keyed lowest note of BB, sounding the pitch AA. Sax's choice of AA as the instrument's lowest note was no accident, as this was a semitone below the bassoon's range and otherwise reachable among wind instruments only by the ophicleide in B-flat (on which this lowest pedal tone was unreliable and sharp) and the rarely-used quartbassoon and contrabassoon.[42]

Berlioz's counsel against rapid passages seems odd, as modern bass saxophones are as agile as their smaller counterparts. However, all early references note that the early saxophone was was not shaped like a modern saxophone but instead like an ophicleide. This form requires the player to support the full weight of the instrument in his arms, held above his waist, thus making the instrument clumsy (fig. 5). This may have spurred Sax to develop the smaller species of saxophone in what we now consider the saxophone form.[43]

41. Hector Berlioz, *Grand Traité d'instrumentation et d'orchestration modernes* (Paris, 1843), ed. Peter Bloom, New Berlioz Edition vol. 24 (Kassel: Bärenreiter, 2003), 576 (courtesy of Peter Bloom; my translation). See appendix 1 for the French text.

42. The latter two instruments were used extensively in Austrian *Harmoniemusik*, however. Werner Seltmann and Günter Angerhöfer, *Das Fagott* (Leipzig: VEB Deutscher Verlag für Musik, 1984), 6:12–16, "History of the Contrabassoon."

43. Hector Berlioz, "Idylle," *Revue et gazette musicale de Paris* 10/49 (December 3, 1843): 407–08 (courtesy of Peter Bloom).

Figure 5. Ophicleide player, from the *Méthode d'ophicléide* by Beer and Caussinus (after 1820). Berlioz considered Caussinus to be the finest ophicleide player in France. From *Larigot* 9 (December 1990), cover. Courtesy of Bruno Kampmann.

Georges Kastner's 1848 *Manuel général de musique militaire* quoted laudatory letters to Sax from Berlioz, Halévy, Kastner himself, Federico Ricci, Meyerbeer, Adolphe Adam, Ambroise Thomas, and Carafa, all written in 1843. Two of these specifically mention the saxophone as a single instrument. Meyerbeer wrote, "among the newly invented instruments of M. Sax, I am only acquainted with the instrument he calls

'saxophone'. This instrument appeared to me to have a beautiful and powerful effect, and to be capable of being employed advantageously in orchestras and military bands." Thomas wrote, "The bass woodwind called the saxophone and the bass clarinet could not be any more remarkable for the power of their low notes."[44]

These references agree on the state of the saxophone family in 1843. Only a single species of saxophone was available at the beginning of 1844, namely the B-flat bass in ophicleide form.

First public use. In 1843 Berlioz scored his *Chant Sacré* for an ensemble of Sax's instruments: B-flat piccolo trumpet, E-flat bugle, B-flat bass bugle, soprano clarinet, bass clarinet, and saxophone.[45] This was performed as *Hymne pour les instruments de Sax* at the Salle Herz on February 3, 1844, with the inventor himself playing the saxophone at this first public performance using the new instrument. Comettant's comment that the saxophone used at this performance was held together in a patchwork suggest that Sax used a prototype which he continued to modify.[46] His comments (and those of Blanchard and Berlioz quoted above) suggest that a B-flat bass saxophone was used at this performance, which

44. Kastner, *Manuel général,* 243–44: "Je ne connais, des noveaux instruments qu'a inventés M. Sax, que l'instrument qu'il appelle saxophone. Cet instrument m'a paru d'un bel et puissant effet, et pouvant être avantageusement employé dans les orchestres et les musiques militaires" (Meyerbeer); "La basse d'harmonie, appelée saxophone, et la clarinette-basse sont on ne peut plus remarquables par la puissance de leurs notes graves" (Thomas) (my translations).

45. Maurice Bourges, "Concert de M. Berlioz," *Revue et gazette musicale de Paris* 11/6 (February 11, 1844): 43, quoted in Horwood, *Adolphe Sax;* 51–52; Haine, *Adolphe Sax,* 93; and Deans, "Translated Source Readings," 88. Taken from *Neuf Mélodies* of 1829, the arrangement is now lost. Curiously, although Berlioz championed Adolphe Sax in his newspaper column, the *Chant Sacré* transcription is the composer's only work calling for saxophone. This is because, the Parisian musical public being deaf to his works, Berlioz spent much time travelling; between December 1842 and May 1843, for example, he conducted in thirteen German cities. As finding saxophones outside of Paris was unlikely (Berlioz even had difficulty finding players of ophicleide, harp, and English horn in Germany and had to import them at his own expense or rearrange their parts), it is understandable that he did not write for them. The difficult politics of the Paris Opéra, many of whose players were spokesmen for other makers, also played a role in keeping Berlioz and other composers from embracing the saxophone. See Peter Bloom, ed., *The Cambridge Companion to Berlioz* (Cambridge: Cambridge University Press, 2000), 137, 237–38, and 258; also Hector Berlioz, *The Memoirs of Hector Berlioz,* trans. Ernest Newman (New York: Alfred Knopf, 1932; reprint, New York: Dover, 1966), 269, 274, 281, 293, 298, 303; and Jacques Barzun, *Berlioz and His Century* (Chicago: University of Chicago Press, 1956; 3rd ed., 1969), 214.

46. Comettant, *Histoire,* 53, quoted in Horwood, *Adolphe Sax,* 52.

Georges Kastner (hardly an impartial writer), spoke of as "a victory gained by Mr. Sax."[47]

At the 1844 Paris Industrial Exhibition, Sax played for the judges a saxophone which he had not registered and had kept hidden from other exhibitors. Commetant wrote that

> . . . Sax continued the audition of his instruments with the Saxophone in low B-flat. For lack of proper details that Sax could not give because he had not patented the instrument, the jury had designated the Saxophone as a contrabass clarinet in its report. Only the mouthpiece could have given rise to this wrong designation, for neither the Saxophone's sound, its proportions, nor its form resembles the sound, proportions or form of a clarinet.[48]

This confirms the species of the saxophone and is consistent with ophicleide form.

Kastner boasted that "The first saxophone constructed belonged to the bass compass. I was the first to make use of it in the orchestra in the score of my grand Biblical opera, *The Last King of Juda,* performed at the Conservatoire on December 1, 1844."[49] Hemke found the score to this work and notes that the saxophone was a bass in C ("saxophone en ut").[50] It was placed in the score below the trombones and voices, like an

47. "une victoire remportée par M. Sax": Georges Kastner, *Le Ménestrel* (February 11, 1844), 1 (courtesy of Peter Bloom).

48. Comettant, *Histoire,* quoted in Deans, "Translated Source Readings," 63–67. Sax was not paranoid to keep this unpatented instrument away from his competitors; a cartel led by Roux, Halary, Gautrot, Buffet, and Gambaro later tried to use this display to annul his saxophone patent application.

49. Kastner, *Manuel général,* 235: "Le premier saxophone créé appartenait au registre grave; nous l'avons le premier employé à l'orchestre, dans la partition de notre grand opéra biblique, *Le dernier roi de Juda,* exécuté au Conservatoire le 1er décembre 1844 . . ." (my translation).

50. Hemke, "Early Saxophone," 58, and personal communication of February 5, 2002. Sigurd Rascher implied that the part was played on a B-flat bass saxophone (it fits either instrument) when he noted ". . . in the score to his opera *Le Dernier Roi de Juda,* George Kastner wrote an F sharp for the Bass saxophone, although the instrument had no key for it. And he got it because the first saxophonist played the part himself. Nor was that astonishing—Adolphe Sax had played three full octaves on the same instrument for Hector Berlioz more than two years earlier." Sigurd M. Rascher, *Top-Tones for the Saxophone,* 3rd ed. (New York: Carl Fischer, 1977), 3, 5. The highest written note, e′, if transposed for the B-flat bass saxophone, would indeed give f-sharp‴ in modern notation. Rascher gives no reference for his claim but he is known to have communicated with Sax's daughter, then more than 80 years old, in 1938. Did Rascher assume the bass saxophone was pitched in B-flat because of twentieth-century usage, or is this legitimate oral history?

ophicleide. The requested range was C–e′ and Kastner used it in brass rather than woodwind groupings.

The next public performance of the saxophone might have been on April 22, 1845. When Lt.-Général de Rumigny called for proposals from instrument makers to improve French military bands, Sax alone submitted a plan. This emphasized his saxhorns and saxotrombas, which had better tone and pitch than brasses then in use. De Rumigny's commission, which included at least six men partial to Sax,[51] arranged a true "battle of the bands" at Paris's Champ de Mars between two forty-five-piece bands, one using standard instruments under Carafa and another playing Sax's instruments, conducted by M. Fessy. Intrigues reduced Sax to thirty-eight musicians, yet his band was the clear winner of this competition, as judged by the commission and by the enthusiastic citizens who witnessed it.

Kastner gives the instrumentations intended and actually used by Sax's band.[52] The first list has two saxophones, without mention of pitch or species; other instruments are noted as being of specific voice range and pitch. The B-flat bass was undoubtably intended, the only likely alternative being the E-flat baritone. The saxophone does not appear on the list of instruments actually used, as the players did not appear; Sax covered their parts with ophicleides and a bass clarinet.[53]

First evidence of other sizes. By the summer of 1843 the bass saxophone was in good working order. We now begin to find the first evidence of Sax's intention to expand from a single species to a family of saxophones. On August 27, 1843, the writer Castil-Blaze[54] noted:

51. The commission included musicians Spontini, Auber, Halévy, Adam, Georges Onslow, and Carafa, with Kastner as secretary-reporter; Count Gudin and Colonel Riban represented the Army, and Colonel Savart and Baron de Séguier served as experts on acoustics (Kastner, *Manuel général,* 260). Colonel Savart should not be confused with Félix Savart (1791–1841), the eminent French acoustician who had died before Sax came to Paris.

52. Kastner, *Manuel général,* 264–66.

53. This contrasts to the interpretation given earlier in these pages (Gunther Joppig, "Sarrusophone, Rothophone (Saxorusophone) and Reed Contrabass," this Journal 12 [1986]: 68–106), which takes Kastner's term "ophicléides à clefs" as meaning saxophones. Given that Kastner uses the word "saxophone" freely, such assumption is unwarranted. It is more likely that Kastner used the redundant term "ophicléide à clef" (ophicleide is Greek for "keyed serpent") to distinguish the ophicleide from the military serpent.

54. François-Henri-Joseph Blaze, using this pen name, was Berlioz's predecessor at the *Journal des débats.* Bloom, *Life of Berlioz,* 75.

> In their form, these instruments resemble the ophicleide, they have nineteen keys and are played with a metallic mouthpiece similar to that of the bass clarinet. Mr. Sax has given a metal mouthpiece to all his clarinets in order to prevent the variations in intonation produced by dryness and humidity. The range of the bass saxophone is that of the bassoon, three octaves between the low B♭ and the fourth B♭. The sonority and the timbre are admirable, it will be the "bull" of the orchestra, and yet the huge vibrant full rich gratifying sounds of the saxophone can be softened almost to the final degree of pianissimo without effort, without constraint. The saxophone can sing and play a melody with the charm and polish that can be obtained on the English horn. The sound, the timbre of this instrument are completely unheard of until now, and I cannot give you anything to compare it with. It is a beautiful acquisition for the orchestra. The saxophone is made in a complete family, with an alto and two sopranos. The effect of three or four saxophones introduced into a symphonic orchestra would be charming. Their clinging and connected sounds and those sounds struck with vigor will be doubly valuable in supporting the mass of harmony.[55]

In addition to supporting the ophicleide connection, this passage reverts to the lowest tone first described by Berlioz, BB-flat, and confirms the three-octave range given by him (in contrast to the two octaves and a fifth that soon became standard). Even more importantly, it is the first suggestion of smaller species of saxophones, although only the merest information is given, and "alto" may refer to the modern baritone, as will be discussed below. What the "two sopranos" were we cannot know; later evidence suggests sopranos in C and B-flat. Perhaps Castil-Blaze was describing Sax's plans or instruments in preparation, rather than what was actually finished; this suspicion recurs in reviewing the writings of Georges Kastner.

The Escudier brothers noted early in 1844 that "The saxophone is still in a state of construction; it could be completed in the space of a few days, but in order to do this, it would be necessary to stop other more necessary and more immediate work . . . The saxophone we heard is a large brass instrument of colossal form but nevertheless very light in weight . . . There could actually be a quartet of saxophones; soprano, tenor, bass and contrabass."[56] This confirms the current imperfection of

55. *La France musicale* (August 27, 1843), 278, translated in Hemke, "Early Saxophone," 26–27.

56. Escudier, *La France musicale* (January 7, 1844), 4, translated in Hemke, "Early Saxophone," 34.

the instrument, while suggesting a different saxophone family than Castil-Blaze's report.

Georges Kastner's 1844 *Cours de instrumentation* likewise mentions a family of soprano, alto or tenor (signifying the modern alto), bass and contrabass saxophones.[57] That same year the prolific Kastner published a supplement to his 1837 *Traité d'instrumentation*, listing soprano saxophone in C or B-flat, alto or tenor in F or E-flat, bass in C or B-flat, and contrabass in F or E-flat. His musical examples gave the soprano saxophone's range as written b to a-flat‴. The alto and bass were given three octaves and a semitone (for the alto, written b to c‴ in the treble clef, sounding d to e-flat″; for the bass, BB in bass clef to c″ in treble, sounding a step lower), the contrabass saxophones three octaves exactly (lacking the low B).[58] Kastner warned that the highest notes were difficult: "These three octaves can only barely be used by virtuosos and you are therefore advised to limit yourself to using two octaves and a half for orchestral writing."[59] These ranges agree with early descriptions of the bass by Berlioz and other writers. Sax had likely applied to all species the key system used in the ophicleide-shaped bass saxophone, which his 1846 patent shows had three octave vents.

This document is the only unequivocal demonstration of the existence of soprano, alto, or contrabass saxophones before the saxophone was patented in 1846, at which time none of them was finished. We shall see that Sax was probably engaged in redesigning these species on

57. Georges Kastner, *Cours d'instrumentation considérée sous les rapports poétiques et philosophiques de l'art* (Paris: Meissonier, 1844), 38, quoted in Gail Beth Levinsky, "An Analysis and Comparison of Early Saxophone Methods Published Between 1846–1946" (D.M.A. dissertation, Northwestern University, 1997; University Microfilms Incorporated, no. 9826739), 8–9.

58. This supports my earlier contention that the low B was added as an afterthought to the original prototype B-flat bass saxophone.

59. Georges Kastner, *Supplément au traité général d'instrumentation* (Paris: Prilipp, 1844), 38–40: "Ces trois octaves ne peuvent guère être employées par des virtuoses, on [fe]ra donc bien de s'en tenir pour l'orchestre à deux octaves et demie, par exem:" (the example shows written b–f‴) (courtesy of Ignace de Keyser). However, Adolphe Adam's note to Sax of 1845, "I have busied myself by dashing off a little piece for E-flat and B-flat clarinets, bass clarinet and the saxophone," implies the existence of a single species of saxophone. Henri Radiguer, "La Vie et l'oeuvre d'Adolphe Sax," *Encyclopédie de la musique et dictionnaire du Conservatoire* 6:3742, translated in Hemke, "Early Saxophone," 257.

simpler lines; they next appear in 1848 (alto) and 1849 (soprano and contrabass).

An 1844 letter to Sax from the Strasbourg instrument maker Charles Finck provides the first mention of the baritone saxophone. Finck praises new instruments that he had seen at Sax's house, mentioning bass and tenor saxophones (i.e., the B-flat bass and E-flat baritone in modern parlance).[60]

Berlioz contemplated using saxophones in the *Épilogue (Dans le ciel)*, the last scenes of *La Damnation de Faust* (1845–46).[61] In the autograph, two saxophone staves appear below one for flutes, one for English horns, and one for clarinets. They are marked in pencil, which is crossed out: "Saxophone ténor en Es Mi♭," with a treble clef, and "Saxophone basse en B♭," with a bass clef; these are the very instruments which would be shown in finished form in Sax's 1846 patent. The final score has no saxophones, but the manuscript to *Dans le ciel* proves the existence of the E-flat baritone saxophone in 1845. Had Berlioz used saxophones here, *La Damnation de Faust* would be the earliest orchestral work with saxophones, and the B-flat bass saxophone might be common today rather than an oddity.

Further Development of the Large Saxophones

The 1846 patent. The Champs de Mars competition led to Sax's brass instrument designs being adopted by the French military in 1845.[62] French infantry bands now were expected to include two saxophones, but the pitch of these saxophones is not given in the document; like an oboe or bassoon, the instrument was presumed to be in one pitch, which we shall see was the E-flat baritone. After a delay caused by legal maneuvers by a

60. Horwood, *Adolphe Sax,* 197.

61. Julian Rushton, ed., New Berlioz Edition vol. 8b (Kassel: Bärenreiter, 1986), 496. The finished score is in volume 8a. The editor gives the modern equivalents of "Saxophone ténor en Mi♭" and "Saxophone basse en B♭" as the alto and tenor saxophones; clearly, however, Berlioz meant the modern E-flat baritone ("baryton-ténor") and B-flat bass.

62. *Moniteur de l'Armée* 50 (September 10, 1845): 2, quoted in Haine, *Adolphe Sax,* 104. Established makers were justifiably upset that de Rumigny's committee had awarded contracts exclusively to Sax. In 1845, thirty-four makers colluded in a series of lawsuits that would bankrupt Sax three times and wreak havoc on many of the plaintiffs. Sax did not license his designs to other makers until 1860 (Waterhouse, *New Langwill Index,* 229 and 348).

coalition of rival makers, a fifteen-year French patent for the saxophone was filed on March 21, 1846, and granted on June 22 (fig. 6).[63]

This patent is often misinterpreted to show that Sax had invented a compete family of saxophones. Rather, it suggests eight *potential* species of saxophones having similar bore dimensions, fingerings, and tonal characteristics. Two of these, drawings 1 and 2, are illustrated with great fidelity, with distinct identification and enumeration of the various keys. The other six are seen in outline only and in forms which did not ultimately come to be. This contrasts with Sax's 1845 patent drawing for saxhorns, in which each of fourteen species of saxhorn is shown in great detail, with clear representations of the valve mechanisms, bracing, and minutiae of the valve slides; the artist obviously drew these from life.[64]

Sax labelled saxophone no. 1 as "E-flat tenor"; it is our E-flat baritone, in modern form, written range b–f‴. Number 2 is the bass saxophone in ophicleide form, described as being in C or B-flat. Its lowest note was written BB-flat; the highest note for which a key was provided was d-sharp′ but it was playable to c″. Numbers 3 and 4 are contrabass (in G or A-flat) and sub-contrabass (in C or B-flat) saxophones, both in ophicleide form.[65] For these and the smaller saxophones, the bodies are barely sketched, without keywork or mouthpieces.

The text makes no specific mention of what has and has not been manufactured. Regarding the smaller species, it merely states "the saxophones no. 5, 6, 7 and 8 are at the same pitch as the preceeding [i.e., instruments 1–4] at the octave above" ("Les saxophones No. 5, 6, 7 et 8

63. The French text given in translation in the caption to fig. 6 reads: "No. 1. Saxophone en mi bémol ténor tout fermé: Si en mi bémol fait ré bécarre en ut. No. 2. Saxophone en ut, descendant au si bémol dans son ton. Le même instrument se fait aussi en si bémol et descend par conséquent au la bémol qui fait si bémol dans le même ton. No. 3. Saxophone en sol contrebasse. On peut aussi le faire en la bémol. No. 4. Saxophone en ut Bourdon. On peut aussi le faire en si bémol (un ton plus bas). Les saxophones No. 5, 6, 7 et 8 sont dans les mêmes tons que les précédents à l'octave supérieure." The complete French text of this patent is given in Günter Dullat, *Internationale Patentschriften im Holz- und Metallblasinstrumentenbau, Band 1. SAXOPHONE (1) 1846–1973 (Belgien, Deutschland, Frankreich, Gr.-Britannien, Tschechoslowakei)* (Nauheim, Germany: Günter Dullat, 1995), 192–95; a complete English translation is in Horwood, *Adolphe Sax,* 203–04.

64. Horwood, *Adolphe Sax,* 30.

65. The contrabasses in G or A-flat are illogical as they break the progression of instruments pitched in B-flat or C, E-flat or F. Ignace de Keyser, of the Musical Instrument Museum, Brussels, suggests that the G contrabass was intended to replace the quartbassoon. Personal communication, January 21, 2002.

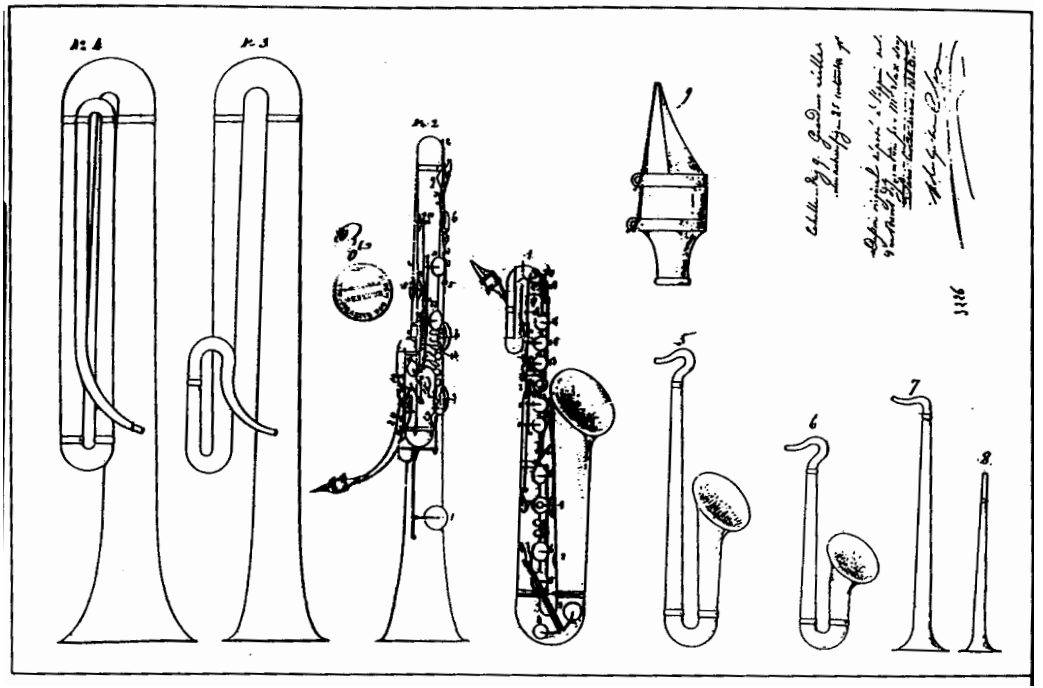

Figure 6. Illustrations from Sax's patent for the saxophones, July 1846. Courtesy of Ignace de Keyser. As described in the accompanying text, the drawings show "No. 1. Saxophone in E-flat tenor. All closed, written B, sounding as D natural. No. 2. Saxophone in C descending to B-flat in sounded pitch. The same instrument is made also in B-flat and thus descends to sounded A-flat. . . . No. 3. Saxophone in G contrabass, which may also be made in A-flat. No. 4. Saxophone in C Bourdon, which may also be made in B-flat (a tone lower). Saxophones Nos. 5, 6, 7 and 8 are at the same pitch as the preceding, an octave higher."

sont dans les mêmes tons que les précédents à l'octave supérieure"). This is confusing, since saxophones an octave higher than nos. 1–4 would be pitched in E-flat (alto), B-flat or C (tenor), G or A-flat (barely sub-tenor) and C or B-flat (identical to the bass, thus redundant). This interpretation, although literally correct, is untenable. Extrapolating from the sketches and from modern practice, it is usual to conclude that the intended species were the modern B-flat tenor (no. 5, an octave higher than no. 2), E-flat alto (no. 6, an octave higher than no. 1), B-flat soprano (no. 7, an octave higher than no. 5), and E-flat sopranino (no. 8, an octave higher than no. 6). However, the diagrammed instruments vary from their modern forms in ways that make this interpretation suspect. Numbers 5 and 6 have triply curved necks like that of Sax's bass clarinet.[66] Number 7, a putative soprano saxophone, has a doubly curved neck like that of a modern tenor saxophone attached at 90 degrees to a straight body. It is unlikely that Sax built a soprano saxophone with a curved neck; none is extant, described, or noted in iconography. No larger than a clarinet or oboe, the soprano saxophone neither warrants nor requires this elaborate neck. Number 8 is straight, as one would expect for the smallest member of the family.

Sax carefully illustrates the E-flat *baryton-ténor* mouthpiece and notes that other mouthpieces "may be made a little larger or smaller as the need arises." This does not square with his methodical, exact design of the mouthpiece, which he knew to be an integral continuation of the bore. In fact, mouthpieces for small saxophones have different proportions than those of the larger species. That Sax glossed over this important detail again suggests that the smaller species were still hypothetical or unpresentable.

Although earlier writings show that smaller species were in development,[67] the illustrations, the issue of the mouthpiece, and the vague text compel one to conclude that instruments 3–8 were unfinished when the

66. For further discussion see William McBride, "The Early Saxophone in Patents 1838–50 Compared," *Galpin Society Journal* 35 (1982): 112–21.

67. A specimen thought to be by Sax bearing the number 341 may illustrate this process. It has a straight body intended for an F (or G?) alto saxophone; the neck is missing, as are the low B and C keys. See Leo van Oostrom, *Saxofoons* (Eindhoven, Netherlands: Museum Kemperland, 1994), 10. Perhaps this is the saxophone listed as item 54 in the 1887 auction catalog of the Adolphe Sax musical instrument collection: "Experimental saxophone, working on placement of keys, taper and length of the bell" ("Type expérimental de Saxophone, théorie sur le placement des clefs, l'évasement et la longueur du pavillon"). Günter Dullat, *Saxophone* (Nauheim: Günter Dullat, 1999), 26.

patent was drawn. Most likely, the design with three octave vents that Kastner implied in 1844 had been found impractical and was being revised as the patent was executed. One must conclude that in 1846, only the bass and E-flat baritone saxophones were presentable and the bass was in ophicleide form.[68] Perhaps Sax felt that a vague patent would minimize further legal difficulties; he simply could not forsee exactly what he would eventually build, and by describing what he hoped to make soon, Sax's patent protected his later developments from commercial infringement.[69]

Further evidence of the baritone's ascendancy comes from Kastner's *Méthode*, writtten in 1846 at the direction of the French Minister of War, after the saxophone had been adopted by French army bands.[70] Kastner's association with Sax implies that this *Méthode* reflects Sax's thinking in 1846.[71] It has a fingering chart showing an E-flat baritone saxophone similar to no. 1 in the patent (fig. 7), revealing that Kastner and Sax considered the E-flat baritone to be the "standard" saxophone in 1846. Kastner also illustrated and described the saxophone family by reprinting the patent diagrams, rearranged on the page and labelled with the pitch of each instrument.[72] The pictures are marked "bourdon" (patent no. 4), "contre basse" (patent no. 3), "basse" (in ophicleide form with keys drawn in, patent no. 2), "soprano" (in tenor form, patent no. 5), "saxophone aigu en fa ou en mi b" (with curved neck, patent no. 7), "saxophone sur aigu" (i.e., piccolo, in straight form, patent no. 8). Missing from this group are the modern E-flat alto and B-flat tenor

68. A clue to the appearance of saxophones in ophicleide form comes from a putative F baritone saxophone by Pélisson Frères (Lyon and Paris, 1875–1931), shown in Dullat, *Saxophone*, 34. This appears to be both the only ophicleide-shaped saxophone and the only F baritone saxophone in existence. Although it resembles the contrabass clarinet that Kastner illustrated in his *Manuel général* of 1848, the body appears to be conical and the bell is marked "Système George Breveté S.G.D.G." The George system inscription (referring to a saxophone mechanism patented in 1867 for fifteen years) dates this instrument to 1875–82. Dullat, *Internationale Patentschriften*, 151–63. The specimen is owned by an anonymous Swiss collector who states that it is pitched in F; as another observer notes that it is not in playable condition, this claim cannot be verified.

69. Hemke, "Early Saxophone," 53–54.

70. Georges Kastner, *Méthode complète et raisonnée de saxophone* (Paris: E. Troupenas et Cie, 1846).

71. Deans, "Translated Source Readings," 117; Levinsky, "Early Saxophone Methods," 9, 12.

72. Kastner's use of Sax's illustrations here and in the *Manuel général* demonstrates his intimate association with Sax and should caution us that he was biased in Sax's favor.

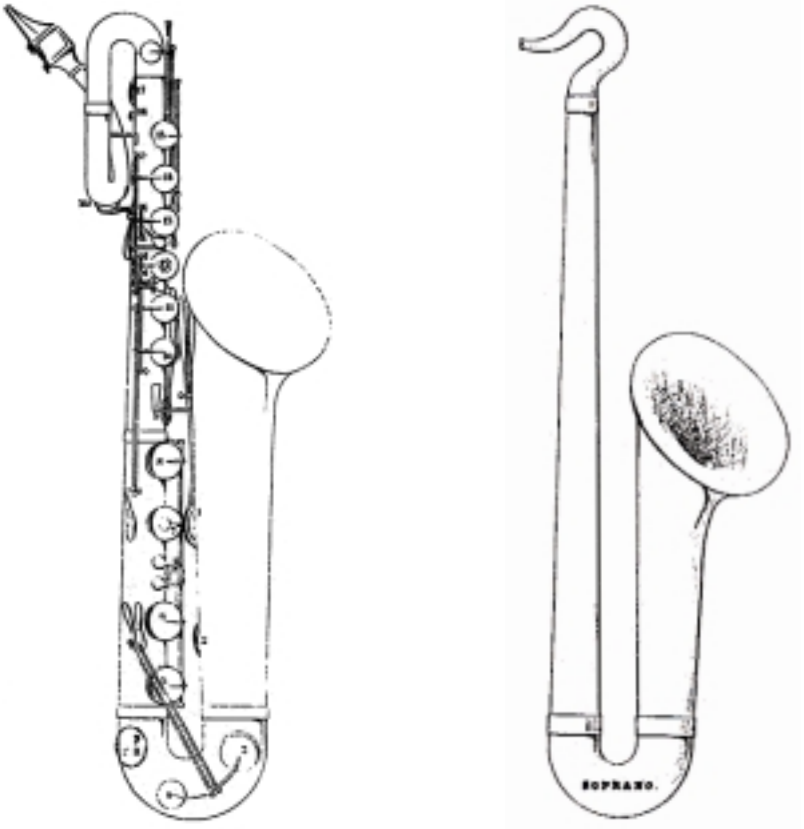

Figure 7. Left, saxophone from the "Tablature" of Kastner's *Méthode* (Paris, 1846, reprinted after 1850). Cokken's and Hartmann's methods have virtually identical illustrations. Right, soprano saxophone from the same source. Note the unusual shape of the neck. Courtesy of Guy Laurent and Susan Boiron.

saxophones.[73] Assigning the soprano to the shape of no. 5 and the *aigu* ("acute"; the modern sopranino) to no. 7 is absurd and shows that the instruments were not yet built.

Kastner also included a table of saxophone pitches and ranges (fig. 8a). Discussion of this table is complicated by the fact that the *Méthode*, originally published by Eugène-Théodore Troupenas in 1846, was modified and reprinted by his successor Louis Brandus (fig. 8b), after

73. Kastner, *Méthode complète*, 25.

Troupenas died in 1850.[74] Troupenas' 1846 edition described seven nominal sizes of saxophones, each in two possible keys, thus comprising fourteen species. These were the high-pitched sizes *sur aigu*, *aigu*, *soprano*, and *contr'alto ou ténor;* and the low-pitched *basse*, *contrebasse*, and *bourdon*. The *sur aigu* saxophones described here are virtually unknown.[75] Contrabass saxophones in F and E-flat have replaced the puzzling A-flat or G contrabasses of the patent. Tenor and baritone saxophones are absent, leaving a gap in the sequence.

This *Méthode* is the first description of saxophones existing in parallel species a tone apart; two families of saxophones, one composed of species in F and C and the other composed of species in B-flat and E-flat, are implied but not actually stated. At the end of the *Méthode* is a *Sextour* for two C soprano, F alto, two C bass, and F contrabass saxophones; "alto" in this context means the modern alto.[76] Kastner's caption to the drawings of saxophones stated that the mechanism was the same for all, disregarding the keywork of the bass[77] and thus confirming that many of these instruments were yet unfinished.

If we apply the information from Kastner's 1846 *Méthode* to the patent, we conclude that Sax's 1846 conception of the saxophone family included a soprano genus comprised of instruments sounding in or above the treble staff and a bass genus comprised of instruments with ranges extending below the bass staff.[78] The absence of a true tenor, and Kastner's ambiguity regarding the baritone, which is illustrated in the "Tablature" but not shown in the range chart, are otherwise inexplicable.

74. Richard Macnutt, "Troupenas," *The New Grove Dictionary of Music and Musicians* (London: Macmillan Publishers, 1980), 19:208. Troupenas died on April 11, 1850; Brandus bought the firm that October, thus acquiring Troupenas' plates. Thus, while the Troupenas edition of the *Méthode* shows Sax's intentions in 1846, the Brandus edition is clearly from after 1850, and can reasonably be taken to represent Kastner's (and therefore Sax's) views at that later time.

75. No historical specimens are known, although the 1910 Besson catalog lists these in B-flat and C. Besson, *Catalogue* (Paris, 1910), reproduced in *Larigot* 5 (May 1989): 20–28. The German craftsman Benedikt Eppelsheim makes a B-flat piccolo saxophone but this is a very recent development; see note 161 below.

76. Kastner refers to an "alto en mi♭" in the introduction to this *Méthode* (1). This unhyphenated nomenclature further suggests the existence of a working (modern) alto; why was it not illustrated? The drawing in the "Tablature" of a saxophone identical to the patent's E-flat "tenor" (fig. 7) cannot be ignored; was this the alto, or was a *baryton-ténor* left off of the range chart?

77. Three octave keys are clearly visible. Kastner, *Méthode*, 25.

78. Regarding the term "genus," see note 2 above.

This conception of the saxophone family would change in the five or more years between the Troupenas and Brandus editions of Kastner's *Méthode.* The range chart in the Brandus edition shows a different set of saxophones (fig. 8b). Nine sizes are now listed, compared to eight in the patent and seven in the 1846 *Méthode.* Sax has filled the gap in the middle of the family with *alto, ténor,* and *baryton* saxophones,[79] and standardized the use of treble clef notation for all species. Instead of listing F and C saxophones as individual species, Kastner now notes that all species in E-flat exist also in F, and all species in B-flat exist also in C, sounding a tone higher than their counterparts in E-flat and B-flat.[80] These tables of saxophone pitches show that after his 1844 experiments, Sax did not initially intend the manufacture of a (modern) B-flat tenor saxophone but that this species was later developed, no doubt in response to a need; and that the saxophones pitched in F and C quickly became afterthoughts to the E-flat and B-flat species.

The E-flat baritone saxophone. Much information on the early saxophone comes from Sax's advertising. Haine shows pages 1–4 of a Sax "Prix-Courant" (current price list), which lacks date and illustrations.[81] The 10 rue Neuve St Georges address, a listing of the 1845 instrumentation for infantry bands, and the fact that a saxophone is listed points to a date between June 1846 and February 1848. No key is specified for the saxophone, unlike the clarinet and bass clarinet. Page 2 gives the official infantry band instrumentation and a cost analysis for outfitting such a band. The instruments are arranged in score order with the saxophone under the bass clarinet and before the cornet, so this was a bass or baritone saxophone. Early saxophone methods show that it was in fact the E-flat baritone, which Kastner had illustrated as his typical saxophone.

79. This implies a date of after February 1850, when Sax referred to the *baryton-ténor* in a prospectus. Sax also used the term "baryton" in his December 1850 Belgian patent.

80. "Tous les Saxophones en Si♭ se font aussi en Ut et tous les Saxophones en Mi♭ se font aussi en Fa. Dans ce cas l'effet réel est d'un ton plus haut pour les Saxophones en Si♭ et en Mi♭."

81. Haine, *Adolphe Sax,* 58, 60. Prices include saxophone, 200 francs; ophicleide, 115; slide trombone, 80; Sax's B-flat bass clarinet, 200; and Sax's B-flat clarinet in ebony with nickel silver mounts, 150. These instruments were not cheap, being proportionate in price to first-quality modern instruments. "(One hundred francs) . . . equaled the monthly salary of a low-level government employee in the eighteen-twenties and thirties." Bloom, *Life of Berlioz,* 80.

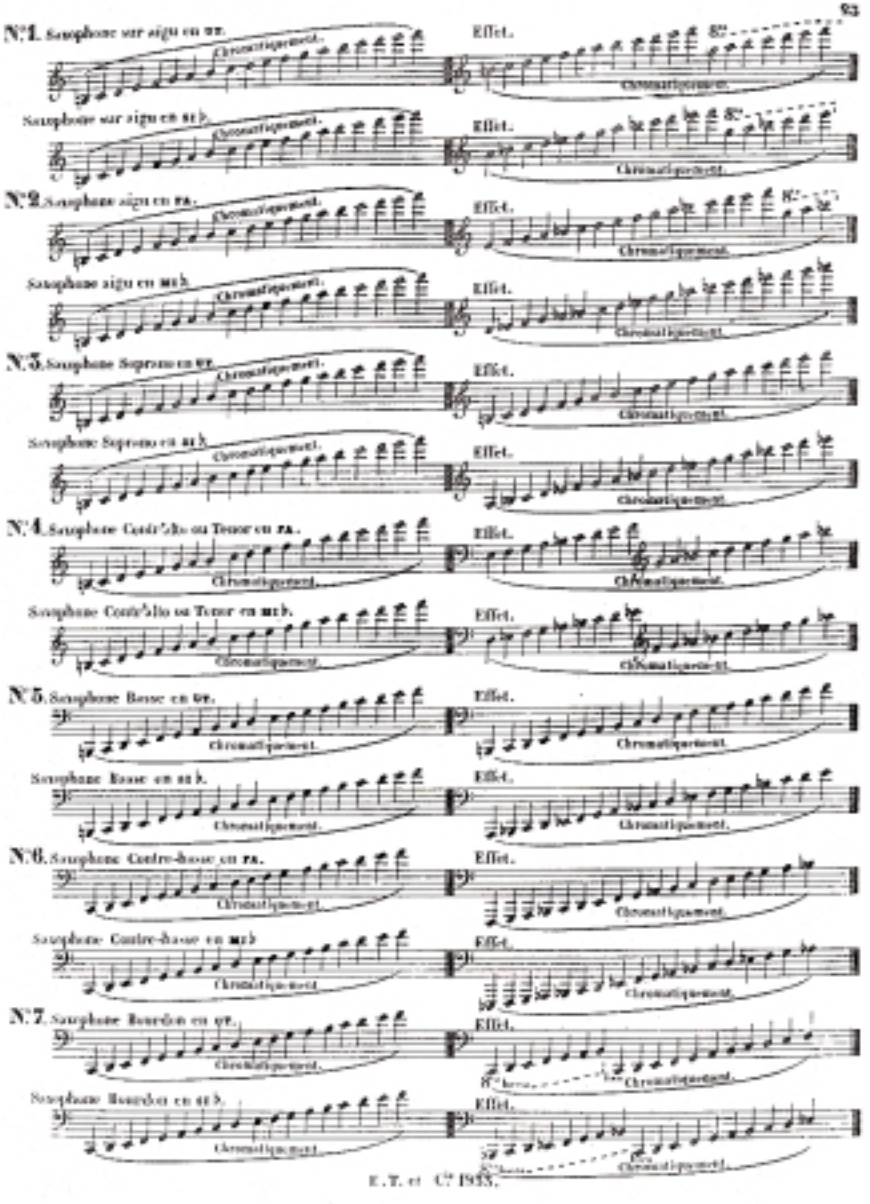

Figure 8a. Saxophones listed in Kastner's *Méthode*, as printed by Troupenas (1846). Courtesy of the Bibliothèque Nationale, Paris.

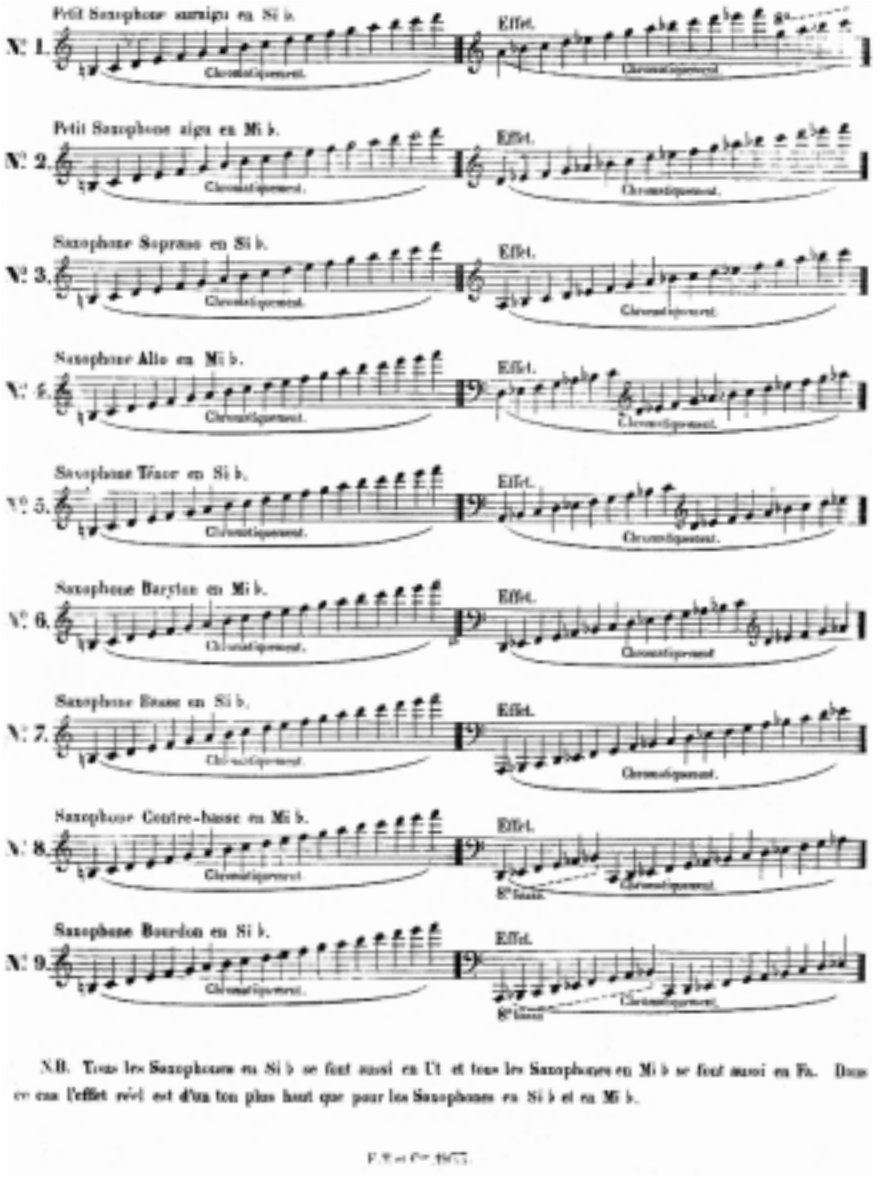

Figure 8b. Saxophones listed in Kastner's *Méthode*, as printed by Brandus (after 1850). Courtesy of the British Library and Tony Bingham.

The next published saxophone text after Kastner was the 1845 *Méthode complète* by François Barthémy Cokken,[82] who taught bassoon at the Gymnase Musicale Militaire.[83] It was commissioned for use at that school, where he also taught the saxophone to regimental band directors between 1845 and 1850. Cokken is not known to have been a crony of Sax, so his views may be more accurate than Kastner's. His foreword notes that

> The saxophone is an instrument newly invented by Mr. Adolphe Sax. The purpose of this maker is to establish a family of this sort of instrument that will encompass a large range from the lowest to highest tones; the only one that has been put to use so far is the one in E-flat, called contralto or tenor, which will hold a middle [position] between all the others; it is this last model that we show in the tablature, because it satisifes all the exigencies of the entire family; the mechanism being the same for all, the exercises and lessons contained in this work will be suitable in the same way to all the other saxophones low or high.[84]

The fingering chart shows an E-flat baritone saxophone, which thus was used in the military by February 1847, when Berlioz wrote about (Cokken's) saxophone class at the Gymnase.[85] Cokken's "contr'alto et ténor" proves that various early descriptions of the "alto" or "tenor" saxophone often refer to the species that we now call the baritone. Cokken alludes to a family of instruments but notes that there is only one species in E-flat. This suggests that other saxophones then extant were in other keys; B-flat bass and B-flat soprano would, with the E-flat baritone, constitute such a family, confirming Castil-Blaze. His comment that "the mech-

82. Jean François Barthéthemy Cokken, *Méthode complète de Saxophone* (Paris: J. Meissonnier et Fils, 1845), discussed in Levinsky, "Early Saxophone Methods," 26–37.

83. Michael Burns, "Music written by Bassoonists for Bassoon—an Overview," *The Double Reed* 24/2 (July 2001): 51–65.

84. Cokken, *Méthode complète de Saxophone*, quoted in Levinsky, "Early Saxophone Methods," 28: "Le Saxophone est un instrument nouvellement inventé par Mr. Adolphe Sax fils. Le projet de ce facteur est d'establir une famille de cette sorte d'instrument, qui embrassera une grande étendue depuis les tons les plus graves jusqu'aux plus aigus; le seul qui soit mis en pratique jusqu'à présent est celui en mi♭, dit contr'alto ou ténor qui tiendra le milieu entre tous autres; c'est le modèle de ce dernier que nous representons dans la tablature, parcequ'il satisfait à toutes les exigences de la famille entière; le mécanisme étant le même pour tous, les exercises et leçons contenus dans cet ouvrage conviendront pareillement à tous les autres Saxophones graves ou aigus" (my translation.)

85. Hector Berlioz, "Nouvelle salle des concerts d'Adolphe Sax," *Journal des débats* (February 14, 1847), 2, quoted in Deans, "Translated Source Readings,"118; Levinsky, "Early Saxophone Methods," 26–27.

anism is the same for all" shows that the ophicleide-shaped basses with a third octave key and low B-flat were no longer in use. His "Tablature" of saxophone species' ranges differs from that in Kastner's 1846 *Méthode* only by identifying the *contr'alto et ténor* as the modern baritone.

A third saxophone tutor from 1846 is the *Méthode élémentaire de saxophone* bearing the name of Hartmann.[86] Its author noted that "The saxophone, whose invention is due to Mr. Sax, is an instrument in brass, with reed, with twenty keys or holes covered by pallets, six for the right hand, nine for the left. It has a bocal for the mouthpiece, which is similar to that of the bass clarinet. The saxophone is in E-flat, it is written in the G clef."[87] An E-flat baritone is illustrated in the tablature and confirmed by a comparative table of written and sounded pitches showing a C major chord in the treble clef and an E-flat major chord in the bass, notes that occupy identical written positions on their respective staffs. Hartmann continued, "The lower voices particularly agree with this instrument. . . . There are several kinds of saxophones. This method will only deal with those mentioned up to now."

Thus, three textbooks and the 1846 patent demonstrate that although Sax intended to manufacture a broad family of saxophones, by early 1847 only the bass and baritone were finished, and the baritone was the standard instrument for band use, having supplanted the bass by virtue of being lighter and more easily played while standing or marching.[88] Although it had received high praise, the bass saxophone in ophicleide form was clumsier than the baritone and more prone to damage. The baritone covered the same useful range (roughly E-flat–g′) as the ophicleide, whose bottom octave consisted of difficult pedal tones.

86. Hartmann, *Méthode élémentaire de saxophone* (Paris: Georges Schoenberger, 1846), translated in its entirety in Levinsky, "Early Saxophone Methods," 192–227. Hartmann has neither first name nor biographical information, and his text closely mimics Kastner. Although Levinsky (38–40) has sought the identity of this author, no compelling candidate has emerged. I believe "Hartmann" is a pseudonym; this text could easily have been produced by adding a saxophone fingering chart to an oboe method, as the instruments had identical ranges in 1846. The existence of this *Méthode* shows an interest in the saxophone outside the Gymnase Musicale Militaire and hence outside of the military.

87. Hartmann, 2, quoted in Levinsky, "Early Saxophone Methods," 41: "Le Saxophone, dont l'Invention est due à Mr Sax, est un Instrument en cuivre, à anche, à vingt Clefs, ou trous recouverts par des palettes, six pour la main droite, neuf pour la gauche. Il a un bocal auquel s'adapte le Bec qui est semblable à celui de la Clarinette Basse. Le Saxophone est en Mi b, il s'écrit à la clef de sol" (my translation).

88. Sax baritone saxophone no. 22201 (made in 1862) weighs 5.5 kg (12 lbs); Sax bass saxophone no. 34287 (1870) weighs 9.1 kg (20 lbs).

The deepest tones of the bass saxophone had never existed in the wind band and thus were not missed. The baritone had the further advantage that its player could read bass clef parts directly by merely imagining treble clef and adding three sharps.

Another reason for the bass saxophone's demise is that Sax's quest to invent a satisfactory wind bass had been fulfilled by other instruments. Even as the saxophones were developed, the bass voice was taken by new brasses, including the contrabass saxhorns, which were also mandated for French bands in 1845.[89] Deep saxhorns (which are functionally tubas) are easier to play while marching than are ophicleides or saxophones, and have fewer moving parts to break. Military ophicleidists could not simply be put out to pasture; it would be easier to transfer these musicians to tubas than to saxophones. These three brass basses thus coexisted into the twentieth century (fig. 9).

The modern bass saxophone. Many sources confirm that the early bass saxophone was in ophicleide form. Kastner wrote in his *Méthode* that

> The low saxophones such as the tenor, bass, and contrabass, are held very much like the ophicleide, the bassoon, the Russian bassoon, and other instruments of that type, that is positioned slightly angled from left to right [with] the mouthpiece at the height of the lips. The saxophone rests mainly on the left hand, which occupies the upper part of the instrument, the right hand is placed a little below. . . . The high Saxophones are held like the clarinet or English horn, i.e., straight forward, forming about a 45 degree angle to the body. The left hand is always on the upper half (of the saxophone), but here the right hand principally supports the instrument.[90]

A contemporary illustration of an ophicleide player (fig. 5) demonstrates this position. The position described for the high saxophones works only for an instrument in straight form (patent no. 8); those with a curved neck cannot be played at 45 degrees in front of the body, suggesting they did not yet exist.

89. *Moniteur de l'Armée* 50 (September 10, 1845): 2, quoted in Haine, *Adolphe Sax,* 104.

90. Kastner, *Méthode,* 23: "Les Saxophones graves tels que le S. Tenor, le S. Basse le S. Contrebasse, se tiennent à peu de chose près comme l'Ophicléide, le Basson, le Basson russe et autres instruments de même nature, c'est-à-dire dans une position légèrement inclinée de gauche à droite; le bec à la hauteur des lèvres. Le Saxophone répose surtout sur la main gauche qui occupe la partie supérieure du corps de l'instrument, la main droite est placée un peu en dessous" (my translation).

Figure 9. Left to right, B-flat baritone saxhorn by Théophile Wahlen (Payerne, c. 1870); ophicleide by Association Générale (c. 1905); E-flat baritone saxophone by Sax, no. 22126 (1862). All instruments from the author's collection.

In 1846 Hartmann wrote, "The saxophone is held like the bassoon. One fastens it to a cord which attaches to a button of the coat. The length of the cord must be adjusted so that the mouthpiece is at the level of the lips. One must hold the body and head upright without affectation or stiffness."[91] There is no mention of a playing position for smaller

91. Hartmann, 2, quoted in Levinsky, "Early Saxophone Methods," 42: "Le Saxophone se tient comme le Basson. On le fixe par un cordon qui s'attache à l'un des boutons de l'habit, la longueur de ce cordon doit être réglée de manière à ce que le bec se trouve à la hauteur des lèvres. Il faut avoir le corps et la tête droite sans affectation n'y raideur" (my translation).

forms. Thus, two of the earliest saxophone methods describe the instrument as being held like a bassoon or ophicleide.

The humorous journal *La Charivari* caricatured Sax repeatedly. Several cartoons show men playing what appear to be ophicleides, although the captions suggest that these may be saxophones with the mouthpieces improperly drawn.[92] One of these (fig. 10) seems to illustrate the use of B-flat bass saxophones in ophicleide form by military music students.

Berlioz, Kastner's *Cours*, Kastner and Hartmann's methods, and the 1846 patent show that in 1844 the B-flat bass saxophone was in ophicleide form. Yet Kastner and others later minimized the similiarities between saxophone and ophicleide. This inconsistency is easily explained. Parisian wind instrument makers were united in their opposition to Sax. One legal tactic that they used was to claim that the saxophone was not a new invention but merely an ophicleide with a reed mouthpiece. As silly as this claim seems today, we may recall that Berlioz first described the bass saxophone as an "ophicléide à bec." To refute this argument it behooved Sax to make his saxophone seem as unlike the ophicleide as possible. Redesigning the bass saxophone in its modern form, creating the smaller members of the family, and denying that the saxophone derived any inspiration from the ophicleide were all steps towards this end.

Between 1846 and 1850 we see nothing of the bass saxophone. Sax likely withdrew the bass from production in 1847 while recasting it in saxophone form, during which time the baritone achieved permanent ascendancy as the standard large saxophone.[93] Evidence that Sax temporarily stopped making basses includes Cokken's *Méthode*, which mentions only the baritone as being in use, and a c. 1848 Sax prospectus showing alto and baritone only (fig. 11a). We next see the instrument in

92. Shown in Horwood, *Adolphe Sax*, 67–68; and Léon Kochnitzky, *Adolphe Sax and his Saxophone* (New York: Belgian Government Information Center, 1949, 1964; reprint by North American Saxophone Alliance, 1985), 25, 38.

93. French military pitch was standardized as a′=435 Hz in 1859, making most older instruments obsolete (Horwood, *Adolphe Sax*, 129). An 1864 Adolphe Sax advertisement in the *Revue et gazette musicale de Paris* (reproduced in Deans, "Translated Source Readings," 187) shows "Saxophone alto Mi bémol, Saxophone tenor Si bémol" and notes that Sax can provide soprano, alto, tenor, or baritone saxophones in old pitch at reduced prices. The lack of old-pitch bass saxophones suggests that few of this species were made prior to 1859. The instrumentation of Oscar Comettant's *Septour* for saxophones (B-flat soprano, 2 E-flat altos, 2 B-flat tenors, 2 B-flat basses), written c. 1869, suggests that the bass saxophone, although not shown in an 1867 prospectus, remained available (Deans, "Translated Source Readings," 55).

Figure 10. Cartoon entitled "Les Bonnes têtes musicales" ("Good Heads for Music"; or, less literally, "Great Musical Minds"). The caption reads "Études consciencieuses sur de nouveaux instruments de M. Sax" (Conscientious study of Mr. Sax's new instruments). This drawing is the last known contemporary reference to ophicleide-shaped saxophones. Lithograph by Frédéric Bouchot, in *Le Charivari*, Paris, 1847. Reprinted from this Journal 12 (1986): 74.

Figure 11a. Saxophones from illustrated price list of Sax instruments, c. 1848. From Horwood, *Adolphe Sax*, 160.

Figure 11b. Alto, baritone, and tenor saxophones from Kastner, *Manuel générale de musique militaire,* plate 25. The alto and baritone are identical to those in Sax's c. 1848 prospectus (fig. 11a) except for the word "Sax." By permission of Musical Instrument Museum, Brussels.

a *Prospectus de vente* dated February 2, 1850, where it appears on a page of text, separately from the B-flat soprano, E-flat alto, and E-flat baritone saxophones that are shown together on a page of illustrations (fig. 12). This is the first depiction of a bass saxophone in saxophone, rather than ophicleide, form. Each instrument in this prospectus is given with its written and sounded range, so that there is no uncertainty as to the exact species. Here the bass has not only a different body form but also a different range (written b–f‴, sounding AA–e-flat′) and mechanism than it had in 1846.

Sax patented the saxophone in Belgium in December 1850 (fig. 13). That patent shows a C bass saxophone in modern form, with a range of written b–f‴ (sounding BB–f′). (It also shows B-flat soprano, E-flat alto, E-flat baritone saxophones and lists the E-flat sopranino and B-flat tenor species.[94]) The C bass had advantages over the B-flat bass: like the E-flat

94. The full text of the patent is given in Dullat, *Internationale Patentschriften,* 1:27–31.

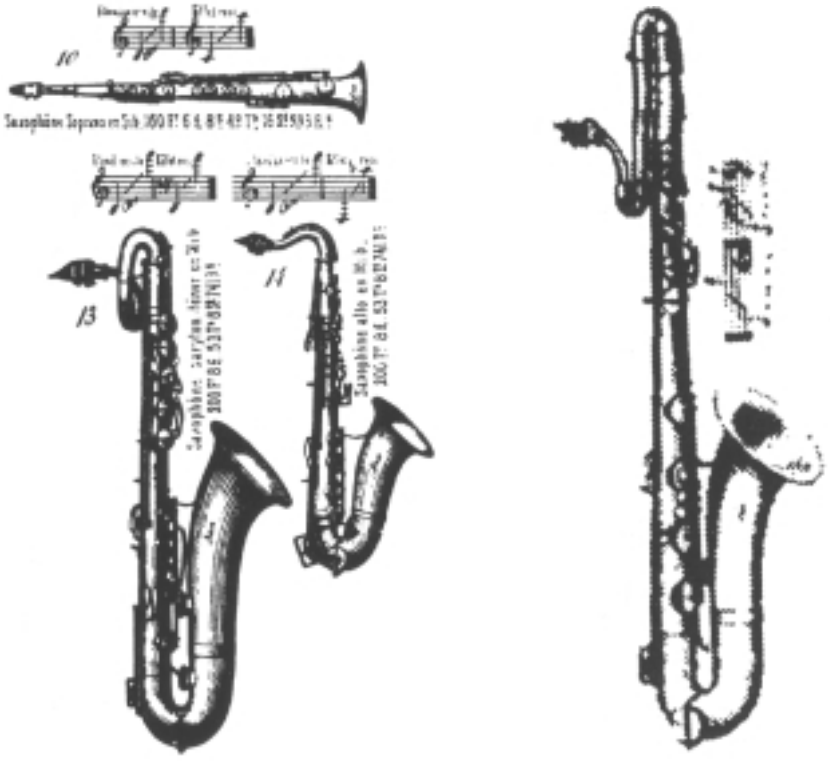

Figure 12. Left, B-flat soprano, E-flat alto and E-flat "baritone-tenor" saxophones from from Sax's *Prospectus de vente*, February 2, 1850. Right, B-flat bass saxophone from the same source. By permission of Musical Instrument Museum, Brussels.

baritone, it was lighter than the B-flat bass, and the player could read bass clef parts directly without transposing.

The implications of changes in the playing range of the bass saxophone between 1846 and 1850 have been largely ignored. A three-octave range was quoted for the bass saxophone in 1842–43 by Berlioz, Castil-Blaze, and Blanchard, and for alto, bass, and contrabass as well by Kastner in 1844. In contrast, Kastner, Cokken, and Hartmann's 1846 methods give the baritone—and Sax's 1850 Belgian patent gives the alto, tenor, baritone, and bass—a range of only two octaves and a fifth, a compass that remained standard until the mid-twentieth century.

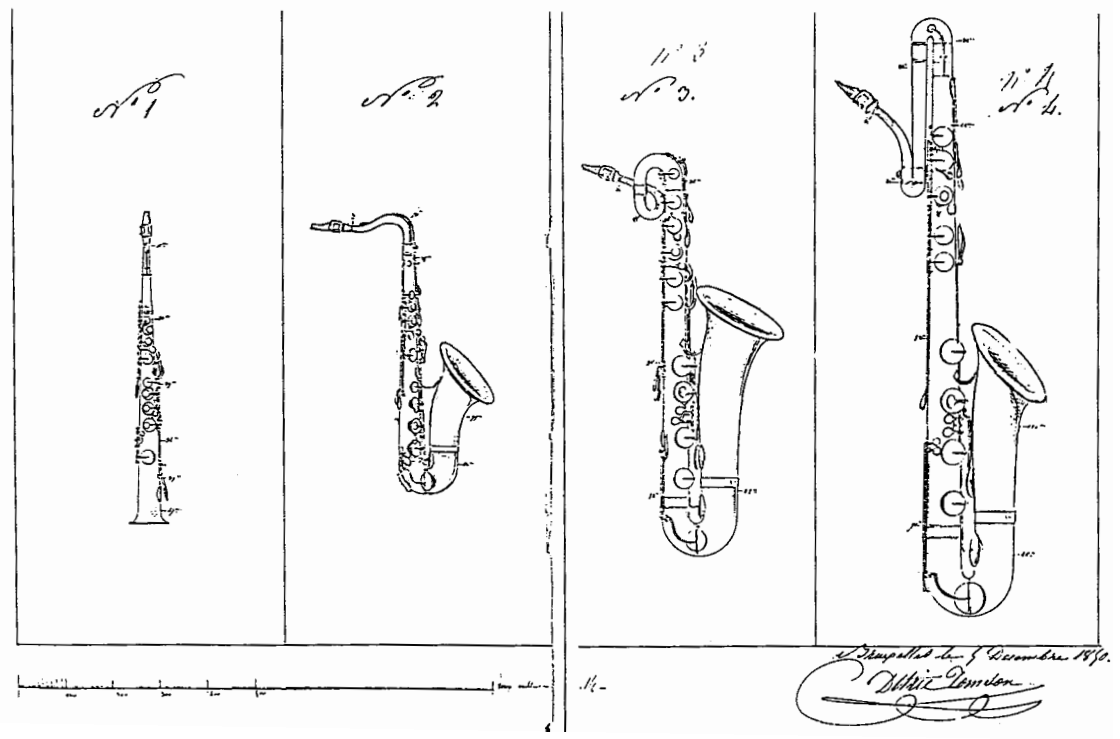

Figure 13. Saxophones from Adolphe Sax's Belgian patent, 1850. The text and scale at the bottom show that these are B-flat soprano, E-flat alto, E-flat baritone, and C bass saxophones. The E-flat sopranino and B-flat tenor are described in the text and fingering chart but not illustrated. From Dullat, *Internationale Patentschriften*, 31, by permission.

Comparison of the 1846 and 1850 saxophone patents provides the likely explanation for the differences, namely the different key systems for the E-flat *baryton-ténor* (1846 patent, no. 1) and C/B-flat bass (no. 2). On the *baryton-ténor,* the lowest note is written b and the highest note for which a specific key is provided is f‴. The two octave keys are described in 1846 as "Octave key for the first part of the instrument . . . Octave key for the second part of the instrument."[95] Sax noted in 1846 that this system was intended for all the other saxophones except no. 2, the bass.

The bass saxophone in ophicleide form was keyed from b-flat to d-sharp‴ (sounding two octaves, or two octaves and a tone, lower). This lowest note is a half tone below that mentioned by Berlioz in both editions of his *Grand Traité.*[96] Sax likely extended the instrument so that the C bass might play the lowest notes of the bassoon. The bass in ophicleide form had three octave keys, described as "octave key for the first fifth of the instrument, chromatically [presumably for overblowing written d′–a′ to d″–a″] . . . octave key for a part of the following notes . . . octave key for the rest of the following notes, that is to say for producing the highest notes of the instrument."[97] The third octave key is visible on the neck of the saxophone, only a few centimeters from the mouthpiece.

Using the third vent, Sax developed an "altissimo" register (written e‴–c⁗) as part of the fundamental technique of the first saxophones.[98] Altissimo tones are easiest on a large saxophone, so it was reasonable to explore these capabilites on the bass. This would not surprise musicians of the period as it does modern players; simple system oboes and clarinets, which used long cross-fingerings for the upper registers, were still

95. "clef pour octavier la première partie de l'instrument . . . clef pour octavier la seconde partie de l'instrument." This anticipates the modern use of the octave keys, in which an automatic mechanism opens the lower octave vent for d′ to g-sharp′, and the upper octave vent for all higher notes. Sax's instruments had two touches; the player chose the octave vent. The single touch became popular after 1900.

96. It makes sense for the lowest member of the family to have an extended lower register, thus extending the family's range. The modern bass clarinet typically extends down to written C instead of E as on a soprano clarinet; the modern baritone saxophone extends down to A instead of B-flat.

97. "18. clef pour octavier chromatiquement la première quinte de l'instrument. 19. clef pour octavier une partie des notes suivantes. 20. clef pour octavier le reste des notes suivantes, autrement dit pour produire les sons les plus élevés de l'instrument."

98. The altissimo ("highest") register begins with the first semitone above the keyed range of the instrument. Sax's ophicleide-shaped bass, keyed to d-sharp‴, thus began this range at e‴. A modern saxophone, keyed to f-sharp‴ or g‴, begins the altissimo at g‴ or a-flat‴. Sax saxophones nos. 21494, 32453, 39116, and 40582 play the altissimo register easily without a third register vent.

common in 1843.[99] Although this register is now routine, for many decades few saxophonists attempted it. Given Kastner's 1844 mention of a three-octave (or nearly three-octave) range for soprano, alto, bass, and contrabass saxophones, this system must have been initally used on all prototype saxophones.[100]

After the 1846 patent Sax deleted the highest seven semitones (and the lowest one) from the bass saxophone's "official" compass.[101] In fact this is not a deletion of notes, but is rather the description of the range of a different instrument. After 1844, the extended range was attributed only to the bass saxophone in ophicleide form shown in the 1846 patent. As smaller saxophones were developed these higher notes became redundant on the bass saxophone, which was recast in saxophone form with two octave vents by 1850.

Turning the bass saxophone into a larger form of baritone (fig. 12) had advantages for both the maker and the player. The ophicleide form has keywork on four parallel tubes; in the saxophone form all the keys except low B and C-sharp are on a single tube, easing construction. The saxophone form removes two of the three bows (180-degree curves) from the keyed portion of the instrument, creating a more regular bore profile and improving the pitch. The saxophone form has a lower center of gravity; a seated player can rest a modern bass saxophone on the floor, whereas the ophicleide form instrument is always held with all of its weight above the player's waist and tends to fall forward if not carefully gripped (fig. 9), hindering the player's facility.

It is unfortunate that few saxophones exist from before 1850. About 400 numbered instruments (including about 170 saxophones) are known from Adolphe Sax's working years, some of which are poorly documented; their serial numbers go up to 41,000.[102] Thus only one

99. Howe, "French Simple System Oboe," 60, 64; Benade, *Fundamentals of Musical Acoustics*, 455–62; Benade, "Woodwinds: The Evolutionary Path," 73–80.

100. Kastner, *Supplément au traité générale*, 39, translated in Hemke, "Early Saxophone," 55–56.

101. Horwood (*Adolphe Sax*, 39) alleges that these notes were deleted "on account of their poor quality." Since no such saxophone is extant, this comment is unwarranted. None of the several contemporary writers who heard the early bass saxophone registered any objection to the tone of its upper register. Sax baritone and bass saxophones after 1858 are keyed only to d‴, rather than to f‴ (baritones nos. 16722, 20449, 22412, 26063, and 39730; basses nos. 34285 and 34287), thus further reducing the upper ranges of the deep instruments.

102. Haine and de Keyser, *Catalogue des instruments Sax*, 236–53.

percent of Sax's production is known to organologists; saxophones make up a surprisingly large percentage of surviving instruments. The earliest known saxophone is an E-flat baritone with serial no. 5140 (1848), the next extant E-flat baritone saxophone is serial no. 16062 (1857), and the earliest known bass saxophone is serial no. 34285 (1870) (see appendix 2). The dearth of surviving early bass and baritone saxophones illustrates the danger of drawing conclusions from small data samples, as the surviving instruments do not accurately reflect the development of the saxophone before 1850.[103]

Changes to the baritone saxophone. Sax's 1846 and 1850 patent drawings of E-flat baritone saxophones are sufficiently detailed to allow comparisons; a scale on the 1850 patent allows approximate measurements.[104] Several changes are apparent, each simplifying manufacture or easing the player's lot in some way. The 1846 E-flat baritone saxophone's body was made of six soldered pieces, the 1850's of five. The bows were relocated to simplify keywork. The neck was redesigned to bring the mouthpiece more readily to the player and to bring the second octave vent off the bottom of the bow of the neck, so that opening the upper vent would not wet the player's left hand. The bows on the neck became less acute, reducing turbulence in the air column and thus improving the playing characteristics. By 1850 the bell was reshaped, with a more graceful development of the rim. In early baritone and bass saxophones, the saxophones in the c. 1848 Sax prospectus (fig. 11a), and the saxophones shown in Kastner's *Manuel général de musique militaire* (fig. 11b), the key for low B pivots behind the bell. This key was moved to the left side of the bell in the saxophone shown in an 1849 London drawing, in the alto shown in an 1850 prospectus, and in the 1850 patent's alto; the baritones and basses in these documents still show this key behind the bells. It was moved in the baritone and bass by the late 1860s,[105] simplifying the mechanism and improving the player's leverage for closing this large pad.

103. It is logical that baritone and bass saxophones would be the least likely to survive into our era given the grim realities of the Franco-Prussian war, two world wars fought on French soil, and the size of the instruments. Large old saxophones would be tempting sources of scrap metal, and it would be no small task to preserve such specimens outside of a museum.

104. McBride, *Early Saxophone,* 117–19.

105. As shown by bass saxophone no. 34287, c. 1870 (courtesy of Marlowe Sigal).

Development of the Smaller Saxophones

The E-flat alto saxophone. After the E-flat baritone, Sax began production of the E-flat alto. It is first mentioned by Castil-Blaze in 1843, then by Escudier in 1844, and by Kastner in 1844 and in the 1846 *Méthode*.

An undated, illustrated price list of Sax brasswinds (figure 11a) shows the modern E-flat baritone and E-flat alto saxophones, labelled "Saxophone baryton ténor en mi b" and "Saxophone alto en mi b" respectively. Both are priced at 200 francs. The paucity of instruments shown and the style of the illustrations reveal this to be an earlier document than the list of February 1850. On the other hand, the presence of an E-flat alto saxophone called an alto shows that this price list must postdate the 1846 patent and the Troupenas edition of Kastner's *Méthode.* A date of 1848 is most likely, as the saxophones and saxhorns in this prospectus are identical to those in Kastner's 1848 *Manuel général de musique militaire,* differing only in that the instruments in the prospectus are marked "Sax" and those in the *Manuel général* are not. (The printers used the same woodcuts for both publications, filing off the word "Sax" from each pictured instrument before using the blocks for Kastner's book.)

Kastner wrote in the caption to this illustration (fig. 11b):

> The saxophone is an entirely new instrument in its proportions, form and sound: the body is of brass and the mouthpiece is a [single-]reed mouthpiece. There exists an entire family: the high saxophone in F or E-flat, the soprano in C or B-flat, the alto in E-flat (shown above as no. 3), the alto-tenor in B-flat (shown above as no. 5), the tenor-baritone in E-flat (shown above as no. 4), the bass in C or B-flat, the contrabass in F or E-flat.[106]

This is a different set of seven saxophones than in his 1846 *Méthode;* here he mentions neither F baritone, F alto, C tenor, nor *suraigu* saxophones in B-flat or C. That Kastner does, however, list sopranino saxophones in F and contrabasses in F suggests once again that this is in part a wish list, not a list of instruments that existed in final form at the time.

106. Kastner, *Manuel général,* plate XXV: "Le saxophone est un instrument entièrement noveau par ses proportions, sa forme et son timbre: le corps de l'instrument est en cuivre et l'embouchure est un bec à anche. Il en existe une famille entière: le Saxophone suraigu en fa ou mi bémol, le s. soprano en ut ou si bémol. le s. alto en mi bémol (indiqué ci-dessus no 3). Le Saxophone alto-ténor en si bémol (indiqué ci-dessus no 5). Le S. ténor-baryton en mi bémol (indiqué ci-dessus no 4). Le S. basse en ut ou si bémol, le s. contre basse en fa ou mi bémol" (my translation).

The E-flat baritone saxophone is correctly drawn, but the E-flat alto is a mirror image of reality and lacks the keys for d‴–f‴. It has a doubly-curved neck, as do the earliest extant E-flat altos. The low B opens behind the bell, as does that of the baritone. In an illustration of a saxophone from the 1849 Paris Exhibition (fig. 14),[107] the February 1850 prospectus, and on modern instruments, it opens on the side of the bell. Thus the E-flat alto was put into production after the B-flat bass and E-flat baritone, with a body design derived from that of the baritone, between 1846 and 1848.

The E-flat alto in the *Prospectus de vente* of February 2, 1850 (fig. 12), has a doubly-curved neck and the large bell characteristic of all saxophones before the 1860s. The low B key of the alto is no longer behind the bell as it was in the c. 1848 prospectus, but that of the *baryton-ténor* shown next to it remains in this location. Thus the B key was moved from behind to the left side of the alto's bell between 1848 and 1849. This helps us date the earliest known alto saxophone, serial no. 5828, now in the collection of the Museum of Fine Arts, Boston: since the B key is beside the bell, the instrument must date from 1848 or later, not 1844–46, as other writers have proposed.[108]

Why was the E-flat alto saxophone the next species produced? Although not proven by the 1846 patent or Kastner's 1846 *Méthode*, an instrument of this size made perfect sense. It would be easier to manufacture than the bulky bourdon or contrabass models. It could be used by the same player as the E-flat baritone without any need to adjust to a new transposition. It was small enough to be eminently portable, but not so small as to be comically disparate from the E-flat baritone in range and timbre. The niche that a soprano or sopranino saxophone might fill in a military band was already occupied by clarinets and the newly-developed Boehm system oboes, which were more sonorous than earlier French oboes.[109] Furthermore, Sax was producing E-flat and B-flat soprano saxhorns, which extended the melodic range of the brass section to the upper treble staff; a soprano saxophone would have competed with these

107. *Illustrated London News* (London, July 7, 1849) (courtesy of Dr. Paul Cohen). The proportions of the neck show this to be an alto saxophone.

108. Phillip T. Young, *4900 Historical Woodwind Instruments* (London: Tony Bingham, 1993), 203; Haine and de Keyser, *Catalogue des instruments Sax*, 237. Nicholas Bessabaroff, *Ancient European Musical Instruments* (Cambridge, Mass.: Harvard University Press, 1941), 105, prudently gives a date of c. 1850.

109. Robert Howe, "The Boehm Oboe and its Role in the Development of the Modern Oboe," *Galpin Society Journal* 56 (2003), 27–60.

SAXOPHONE.

Figure 14. "Our third illustration represents a new Musical Instrument, the invention of M. Saxe [sic], whose fame is already known in this branch of art; it is appropriately named after the inventor—the *Saxophone*." The proportions suggest that this is an E-flat alto saxophone. From *The Illustrated London News,* July 7, 1849. Courtesy of Dr. Paul Cohen.

saxhorns. And whereas a tenor saxophone would have been too close to the E-flat baritone in range and timbre to present any important difference to a composer—Sax's repeated references to the E-flat baritone as a *baryton-ténor* suggest that he intended this instrument to work in both ranges—an alto saxophone filled the middle range of the band yet extended the family's range to the top of the treble staff.

Further development of the E-flat alto can be noted after 1850. E-flat altos seen in the c. 1848 Sax handbill, in the July 1849 *Illustrated London News*, in the February 1850 prospectus, in the Belgian patent (fig. 13), and in Kastner's *Manuel général* all have doubly-curved necks, as do the two earliest extant altos, nos. 5828 and 5918 (1848). The next surviving alto, no. 9935 (1854), has a singly-curved neck, which simplified production and placed the mouthpiece at an easier angle for the player. An 1860 drawing of the instruments mandated by Napoleon III for French military bands shows the alto saxophone with a singly-curved neck (fig. 15), as does a Sax handbill from 1867 (fig. 16). Thus the evidence of specimens and of iconography agree.

The saxophones in all the documents in this paper have oversized bells when compared to later Sax specimens and to modern saxophones. This is most apparent in the altos and tenors, which can look comical with their large bells gaping like fish mouths (figs. 15–16). Specimens show that the bell diameter of all Sax saxophones was reduced intermittently after 1855 and consistently after 1865, although this trend is not perfectly linear with time (see table 1). Smaller bells require less material and are less likely to be damaged, while the flare of the bell may affect the pitch and response throughout the instrument's range. However, the rule of thumb that large bells imply a date before 1865 does not apply to saxophones made by other makers in violation of Sax's patents, or to those made after Sax licensed his designs to other makers in 1865.[110]

The B-flat soprano saxophone. It is unclear how often saxophones were actually used in military bands between 1845–48. In 1848 King Louis Philippe was deposed, removing from power Lt.-Général de Rumigny and others who had promoted Sax. To have been a friend of the king

110. For examples, see *Catalogue des Instruments de Musique de la Manufacture Générale de Gautrot Ainé et Cie.* (Paris, 1867), reprinted in *Larigot Spécial* 10 (April 1999): 10–11; Maison David, *Catalogue des Instruments de Musique* (Paris, 1883), reprinted in *Larigot* 17 (August 1995): 15–31; and Van Oostrom, *Saxofoons* 35, figs. 46–47.

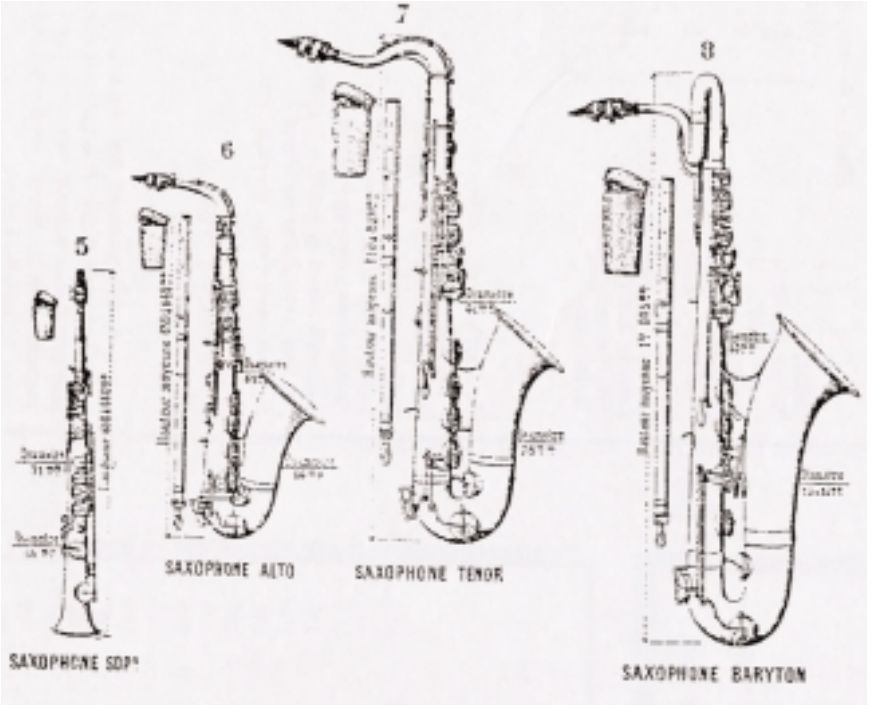

Figure 15. Illustration showing instruments used in French infantry bands by decree of Napoleon III, March 26, 1860. From Jacques Cools, "Adolphe Sax, la réorganisation des Musiques militaires sous Napoléon III," *Larigot* 25 (March 2000): 31–35. Courtesy of Bruno Kampmann.

and his cronies became a sudden liability for Sax. At the behest of Sax's competitors the decree of 1845 which mandated the use of saxophones was rescinded and a new military instrumentation was instituted on March 21, 1848. This had neither saxhorns, saxotrombas, nor saxophones. Sax's instruments were dropped from military use and he suffered a sudden, significant loss of income.[111]

The lean years that followed gave Sax the time to work on saxophone development, filling the gaps between species and completing the family.

111. Sax was not the only instrument maker to suffer; the unstable political climate of these years led to large losses in sales by many of his colleagues. Malou Haine, *Les facteurs d'instruments de musique à Paris au 19e siècle* (Brussels: Éditions de l'Université de Bruxelles, 1985), 65–99.

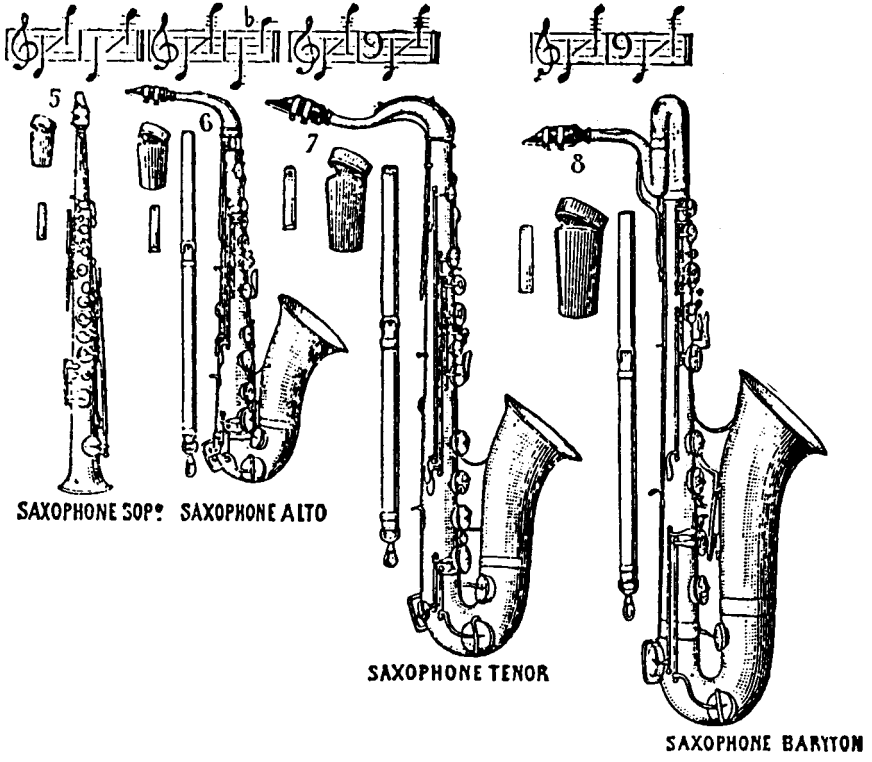

Figure 16. Sax prospectus from 1867, showing soprano, alto, tenor, and baritone saxophones. Note that the range of the tenor erroneously duplicates that of the baritone. From Haine and de Keyser, *Sax Instruments,* 20, by permission.

At the Paris Exhibition of 1849 he exhibited a family of saxophones described by the jury as ranging from E-flat sopranino to contrabass ("depuis le plus petit en mi bémol aigu jusqu'à la contre-basse").[112] An extract from the 1877 auction catalog of the Adolphe Sax musical instrument collection shows four relevant items:

59—Early soprano saxophone, silver and gilt, shown at the 1849 Exposition
60—Early alto saxophone, silver and gilt, shown at the 1849 Exposition

112. *Rapport du Jury Central sur les produits de l'Agriculture et de l'Industrie exposés en 1849* (Paris, 1850), 559, quoted in Haine, *Adolphe Sax,* 143.

Table 1. Bell diameters of selected Adolphe Sax saxophones, 1849–79, in millimeters. (For locations and published references, see appendix 2; for estimated dates, see appendix 3.)

Serial No.	Date	Bell	Serial No.	Date	Bell
B-flat sopranos			*B-flat tenors*		
6497	1849	78	13097	1855	146
Belgian Patent	1850	85	15353	1857	147
15830	1857	90	16142	1857	148
16497	1857	79	16676	1858	149
17849	1858	85	17059	1858	148
18672	1859	79	19555	1860	130
22627	1862	80	23049	1862	147
27996	1866	79	27340	1865	135
29829	1867	86	28623	1866	140
31699	1868	68	31648	1868	138
32131	1869	67	31651	1868	138
32457	1869	67	33215	1870	135
40316	1878	79	33886	1870	139
			36458	1872	136
E-flat altos			39116	1877	134
5828	1848	143	40990	1879	134
5918	1848	140			
Belgian Patent	1850	165	*E-flat baritones*		
12966	1855	140	5040	1847	202
15117	1856	121	Belgian Patent	1850	200
16149	1857	140	16722	1858	200
16531	1858	114	17146	1858	204
20139	1860	140	17609	1858	205
20572	1860	139	20149	1860	204
21494	1861	110	20674	1860	213
24125	1863	141	21307	1861	204
25620	1864	140	22126	1862	203
27403	1865	117	22201	1862	187
33304	1870	120	26063	1864	203
33451	1870	116	31204	1868	160
34132	1870	116	34463	1870	160
35557	1871	118	38896	1875	140
37478	1873	118	40415	1878	153
39778	1877	116			

61—Early tenor saxophone, silver and gilt, shown at the 1849 Exposition
62—Early bass saxophone, silver and gilt, shown at the 1849 Exposition.[113]

The earliest extant soprano bears serial no. 6497, placing it in this same year, 1849. Its unique configuration of low-register keys suggests it was indeed the experimental model of 1849: it is keyed only to c-sharp‴, and there are no keys for the left palm, which usually opens d‴, d-sharp‴, and f‴.[114] The February 1850 prospectus clearly shows a soprano with no side key for d‴; the range shown extends only to this note. Similarly, the 1850 Belgian patent shows that d‴ was obtained on the sopranino and soprano saxophones by a cross fingering; no specific key was provided.[115]

The next sopranos for which the number of keys is known are keyed to d-sharp‴ (serial nos. 19575, 20432); these date to 1860, showing that Sax added the extra semitones after Berlioz's 1855 *Grand Traité*. Why keys for e‴ and f‴ were not also placed is a mystery. Since the value of a high-pitched instrument lies in its upper register, one expects the maker to emphasize that register in constructing the instrument. The highest and lowest notes of a saxophone, like those of an oboe, are the hardest to produce in tune with good tone; however the soprano saxophone no. 32453 plays very well to its highest note, d-sharp‴. Extension to e‴ and f‴ seems entirely feasable.

Kastner had alluded to a range for the soprano saxophone of b to a-flat‴ in 1844; this was probably played on a mechanism with three octave vents.[116] He and Cokken gave the soprano, now presumably with two octave vents, a range of b to f‴ in 1846. Hartmann's 1846 *Méthode*, Sax's

113. Dullat, *Saxophone*, 26: "59–Saxophone-Soprano primitif, argenté et doré, mis à l'Exposition de 1849; 60–Saxophone-Alto primitif, argenté et doré, mis à l'Exposition de 1849; 61–Saxophone-Ténor primitif, argenté, mis à l'Exposition de 1849; 62–Saxophone-Baryton primitif, argenté, mis à l'Exposition de 1849." The soprano is believed to be in the collection of the Musée de la musique, Paris (E.714, serial no. 6497); this instrument is indeed "primitive" in comparison to the soprano shown on the 1850 prospectus. The alto, tenor, and baritone are also claimed by the Musée (E.715–17), but this claim is spurious; the serial numbers of these saxophones are all after 1849, and their morphologies are not primitive. Their serial numbers and the dates assigned by the museum are, respectively, 35557 ("milieu 19e"), 15353 (1854), and 17609 (1856). These data and photographs of the specimens are available on the museum's excellent website (*http://servsim.cite-musique.fr/museedelamusique/instrooeuvres.asp*) by searching simultaneously under "saxophones" and "Sax."

114. Musée de la musique, Paris, E.714.

115. Dullat, *Internationale Patentschriften*, 31.

116. See note 59 above.

1850 Belgian patent and prospectus, Kastner's revised *Méthode*, and the 1855 edition of Berlioz's *Grand Traité* describe a top note for soprano (and sopranino) saxophones of d‴. Hartmann showed the full range of the soprano (b–d‴) but endorsed a playing range (b–a″) which excluded the highest five semitones—where the instrument is most characteristic and unique—suggesting that in 1847 the soprano saxophone was imperfect.[117] No such limitations were proposed for other saxophones. Likely problems were a malposition of the second octave vent, which is used for notes above a″; a poorly-designed mouthpiece; or difficulties with the bore of the upper part of the instrument.

The Sax *Prospectus de vente* of February 2, 1850 (fig. 12), shows a B-flat soprano saxophone in straight form; this is the first unambiguous picture of a soprano saxophone. Although such an instrument had been in development as early as 1844, it was commercially manufactured only after the E-flat alto, although still before the B-flat tenor. Thus by January 1850 four species of saxophone were commercially available: B-flat soprano, E-flat alto, E-flat baritone-tenor, and B-flat bass in modern form.

Why was the B-flat soprano produced next? Undoubtedly to expand the overall range of the family. Drawing on the example of Renaissance consorts, the musicologist Fétis called for families of like instruments extending from bass to piccolo range, which began a vogue in the 1830s.[118] As the E-flat alto became accepted, this attitude made it logical for Sax to introduce another saxophone pitched higher than those already in existence. Together the B-flat bass, E-flat baritone, and E-flat alto covered the range AA to a-flat″. A B-flat tenor instrument would overlap the E-flat baritone and E-flat alto, adding nothing to the family's compass, while the B-flat soprano added four notes to the saxophone family's range.[119] In addition, a B-flat soprano used less material and was easier and cheaper to make than a B-flat tenor would be.[120]

117. "Overall range of the soprano (b–d‴); limits within which it is best to remain (b–a″)" ["Étendue générale du soprano (b–d‴); Limites dans lesquelles il est bon de se refermer (b–a″)"]. Levinsky, "Early Saxophone Methods," 198, and personal communication, June 5, 2001.

118. Frédéric Triébert, *Nouveau Prix-Courant* (Paris: Caillet, c. 1860), reprinted in *Larigot* 4 (January 1989): 4–7, at p. 6. The saxhorns were the first successful modern family of instruments organized on such lines. Of instruments now in use in orchestras and bands, only the saxophones and clarinets constitute such families.

119. Not seven notes, as early soprano saxophones lacked keys for d-sharp‴, e‴, and f‴.

120. In the February 2, 1850, prospectus the B-flat soprano cost 160 francs, the E-flat alto and E-flat baritone-tenor 200, the B-flat bass 250.

The B-flat tenor saxophone. Early use of the term "tenor" saxophone is interesting and confusing. Kastner refers to the modern E-flat alto as an *alto-ténor* in 1844 and 1846. The 1846 patent shows a "Saxophone in E-flat tenor. All closed, written B, sounding as D natural." This is the modern E-flat baritone. The prospectuses of c. 1848 and 1850 also list the E-flat baritone as a *baryton-ténor;* clearly, as late as early 1850 Sax sold the E-flat baritone to cover the baritone-tenor range. Kastner's 1848 *Manuel général* provides the first evidence of the B-flat tenor (fig. 11b). Besides the realistic E-flat baritone ("Saxophone en mi bémol ténor-baryton") and the mirror-image drawing of an E-flat alto ("Saxophone en mi bémol alto") already mentioned, there is also a fantastic-appearing "Saxophone en si bémol alto-ténor." This saxophone is bizarre: the bow brace is unwieldy, the bell is too small and curves too far anteriorly, the keys are on the wrong side of the instrument, there are no keys for d‴–f‴, and the neck curves down upon itself in a most improbable fashion, as if damaged. Most of the *Manuel général*'s twenty-six plates are scrupulously drawn, including all of the then-modern instruments *except* the alto and tenor saxophones, which are taken from Sax's c. 1848 prospectus. Clearly, the artist was capable and had seen an E-flat baritone saxophone and possibly an E-flat alto. Just as clearly, however, he had not seen a B-flat tenor saxophone but was relying on description and analogy to create his image—here of a species of saxophone as yet unbuilt.

Although shown in the 1849 Paris Exhibition, the tenor saxophone was not available for sale in February 1850; it is likely that Sax had created a prototype for the exhibition. His Belgian patent for the saxophone, dated December 4, 1850, lists six species (E-flat sopranino, B-flat soprano, E-flat alto, B-flat tenor, E-flat baritone, and C bass), but the sopranino and tenor, although described, are not shown. This suggests that the prototype tenor of the 1849 exhibit was modified during 1850 to be playable, although with slightly different fingerings on some notes, and resembled the E-flat alto so closely that a separate illustration was unnecessary in the Belgian patent. It now merited its own voice designation; Sax never again referred to *baryton-ténor* or *alto-ténor* saxophones. The changes in the use of the term "tenor" are compelling evidence that this species was not completed until 1850.

In June 1853 Sax founded the *Société de la Grande Harmonie* to demonstrate a band equipped exclusively with his instruments, for which he naturally used the saxophones and the saxhorns which had been removed from military bands in 1848. Two undated concert programs

from this ensemble are presented in Haine; in both, someone named Lépine is listed as playing tenor saxophone.[121] That the tenor saxophone was used in Sax's ensemble implies it was commercially available; why would Sax showcase an instrument that he did not sell?[122] Lists of instruments in French bands in 1854 and 1860[123] and Sax's 1867 prospectus (fig. 16) all list both a B-flat tenor and an E-flat baritone; the saxophone serial no. 13097 (datable to 1855, see appendix 2), which is one of the earliest extant tenors, is clearly marked as a B-flat tenor. Illustrations in both the 1860 list and the 1867 prospectus show B-flat tenor saxophones which are identical to no. 13097 in every detail except the neck. On the early tenor this took a very tight, almost semicircular curve, whereas tenors by Sax and other makers, starting c. 1870, show a more relaxed curve as seen on the modern instrument. This places the neck at a more comfortable angle for the player and lessens turbulence in the bore, thus improving the instrument's playing characteristics.

The 1850 tenor saxophone differed from its relatives in the use of octave keys. The "Tablatures" in Kastner, Cokken, and Hartmann's methods (all c. 1846) extend the saxophones' range only to f‴; the third octave key seen in the 1846 bass is absent. These charts show so-called "short" fingerings for d″ and d-sharp″, using only the left hand palm keys rather than six fingers and the first octave key. Also, the change to the second octave key occurs at b-flat″ rather than at a″ as on later instruments. The tablature in the 1850 patent, however, shows long fingerings for d″ and d-sharp″, using the first octave key from d″–a″ and changing to the second octave key at b-flat″. This last change occurred at c‴ for the tenor only, suggesting the continued imperfection of this species.

These observations are explained by the position of the octave vents. In 1846, a lower vent placed closer to the mouthpiece would pull the long fingerings for d″ and d-sharp″ intolerably sharp (even today, d″ is

121. Haine, *Adolphe Sax*, 108–11, 166. One program lists four saxophones as: "AUROUX (soprano) / PRINTZ (alto) / LÉPINE (ténor) / (Baryton) / ROSE (Basse)." (It is not clear if Lépine doubled on *ténor* and *baryton*, if the baritone saxophone was played by another musician, or if the part was not covered.) Another program shows "AUROUX, soprano solo / PRINTZ, alto id. / LÉPINE, ténor id./ DELISLE, baryton id./ ROSE, basse id." For further detailed discussion see Hemke, "Early Saxophone," 334–37.

122. The Société included neither sopranino nor contrabass saxophones, no doubt for this very reason.

123. For the 1854 list see Comettant, *Histoire*, 426, translated in Hemke, "Early Saxophone," 225; for the 1860 list, see Jacques Cools, "Adolphe Sax, la réorganisation des Musiques militaires sous Napoléon III," *Larigot* 25 (March 2000): 31–35.

better tuned by using the palm d‴ key as an octave vent), while an upper vent farther from the mouthpiece would come into play sooner. This required awkward short fingerings for d″ and d-sharp″. Sax corrected this by repositioning the first vent farther from the mouthpiece. In 1850, the use of the upper vent from b-flat″ and above (c‴ on the tenor) suggests that this vent must have been more proximal than on modern saxophones. Examination of saxophones by Adolphe Sax shows that the upper octave vents are in fact more proximal than on modern specimens, by more than a centimeter on the B-flat tenor.

Why was the B-flat tenor saxophone built so late? For that matter, since the E-flat alto and E-flat baritone saxophones cover the entire range of the B-flat tenor, why was it ever built at all? French bandmasters in the late 1840s had undoubtably felt a gap in the tone between the E-flat alto and the E-flat baritone, which is not as effective as the E-flat alto in its upper register. This is the natural range of the B-flat tenor. Following Fétis' suggestions, Sax had created families of brasses spanning several octaves, pitched alternately in E-flat and B-flat, in the saxhorns and saxotrombas. Perhaps his pride compelled him to fill the gap between two E-flat saxophones pitched an octave apart. The pictures in Kastner's 1848 *Manuel général* show that Sax had previously intended to manufacture a B-flat tenor. Perhaps he could only muster the personnel and financial resources to do so with his restitution to official favor in 1854. Sax probably needed little encouragement to complete his family of saxophones, filling the gap in timbres and ranges with the B-flat tenor.

Why were all of the smaller species of saxophones not developed more quickly? Simply for lack of time: The invention of new saxophone species, while evidently dear to Sax, was never his most important item of business. In 1845, the making of saxhorns, saxotrombas, and saxophones intensified after the adoption of these instruments in the French army. Each regimental band required two of Sax's bass clarinets, twelve saxhorns, and three other brasses unique to Sax, but only two saxophones; each cavalry band required twenty-nine of Sax's brasses.[124] Sax was having trouble getting composers to use saxophones, but saxhorns could play existing trumpet and horn music. All these factors are reflected in his very limited production of saxophones. When Sax entered bankruptcy on July 5, 1852, more than 1,000 finished instruments were in his

124. *Moniteur de l'Armée*, 50 (September 10, 1845): 2, quoted in Haine, *Adolphe Sax*, 104–05.

workshops; only thirty-one of these were saxophones.[125] Sax made over 18,000 instruments between 1843 and 1860; 945 were saxophones, of which 170 are extant.[126] This disparity is reflected in an 1848 view of the Sax factory that shows workers in an enormous room laboring almost exclusively on large brass instruments; only a single baritone saxophone is seen.[127]

Standardization of the Saxophone Family

The saxophone family in the 1850s. On April 8, 1854, three years after Napoleon III established the Second Empire, Sax was appointed Musical Instrument Maker to the Household Troops of the Emperor.[128] The emperor reinstated saxophones into infantry bands, two each of sopranos, altos, tenors, and baritones or basses.[129] Napoleon III further showed his favor to Sax by assisting him in his bankruptcy, allowing Sax to maintain his factory at 50 rue Saint Georges.

Now the saxophone family was as complete as Sax would make it; bass, baritone, tenor, alto, and soprano species were all available commercially (fig. 17). Twelve saxophones are extant from before 1855: one C soprano,[130] two B-flat sopranos, two F altos, five E-flat altos, one B-flat tenor, and one E-flat baritone (appendix 2). It is perhaps no coincidence that these exist in the serial order (baritone-alto-soprano-tenor) of their placement into commerce. Availability of the sopranino, which had been shown in 1849, is first proven by Hector Berlioz. Always an acute observer of things instrumental, Berlioz rewrote the chapter on saxophones in his 1855 revison of the *Grand Traité*,[131] this time including the statement "[The saxophones] are of six kinds: the sopranino; the

125. Haine, *Adolphe Sax,* 127–28.

126. Haine and de Keyser, *Catalogue des instruments Sax,* 221–22.

127. Reproduced in Delage, *Adolphe Sax,* 15; Haine, *Adolphe Sax,* 124; Horwood, *Adolphe Sax,* 107; and Philip Bate and Wally Horwood, "Sax," *New Grove Dictionary of Music and Musicians,* 2nd ed. (London: Macmillan Publishers, 2001), 22:347.

128. "Facteur d'instruments de musique de la Maison militaire de l'Empereur." The text of this document is in Haine, *Adolphe Sax,* 180.

129. Haine and de Keyser, *Catalogue des instruments Sax,* 17; Haine, *Adolphe Sax,* 112; Deans, "Translated Source Readings," 35.

130. This is wrongly described in Young, *4900,* as an E-flat sopranino; see note 4 to appendix 2.

131. It is curious that he updated the saxophone chapter so diligently; the 1843 and 1855 versions contain identical chapters for oboe and clarinet, despite radical changes to both of those instruments over the intervening twelve years.

Figure 17. Saxophones by Adolphe Sax, 50 rue St. Georges, Paris. Left to right, B-flat soprano no. 32453 (1869), E-flat alto no. 37478 (1873), B-flat tenor no. 13097 (1855), and E-flat baritone no. 22126 (1862). All instruments from the author's collection.

soprano; the contralto; the tenor; the baritone; the bass. Mr. Sax will soon produce even a seventh: the contrabass saxophone." Together with his precise description of the sopranino's timbre as "much more penetrating than that of the clarinets in B flat and C, without having the piercing sourness of the small clarinet in E flat,"[132] this shows that the instrument actually existed, although no specimen or iconography has been found.[133] (He also correctly shows the reduced upper register of the sopranino and soprano saxophones in agreement with the 1850 patent.) Berlioz enumerates six voices of saxophone made in eleven species: while repeating the half-truth that the species were made in pairs pitched in E-flat/F or B-flat/C, he lists no F sopranino saxophone. This is correct but curious, because other writers did make such references, although no F sopranino saxophone by any maker is known. His comment about the imminent construction of the contrabass saxophone shows that the contrabass of the 1849 Paris exhibition was a either prototype or an erroneous description of the bass; we may thus consider previous references to such an instrument, including Kastner's, to be wishful thinking or to refer to prototypes. Had the contrabass saxophone been in use, Berlioz surely would have said so.

At the 1855 Paris Exposition Universelle, Sax displayed eight saxophones, although the species are not specified. Sopranino in E-flat, sopranos in C and B-flat, E-flat alto, B-flat tenor, E-flat baritone, B-flat bass and E-flat contrabass are most likely. The jury noted, "It is complete, in that it embraces a whole family of eight varieties, from high to low [range], which taken as a whole contain the entire extent of perceptible sounds."[134] In his article on the Exposition, Berlioz repeated much of what he wrote about the saxophone in the 1855 *Grand Traité*.[135]

132. Berlioz, *Grand Traité d'instrumentation* (Paris, 1855), ed. Bloom, 481: "[Les saxophones] sont au nombre de six: l'aigu; le soprano; le contralto; le ténor; le baryton; la basse. M. Sax en produira même prochainement un septième: le saxophone contrebasse"; also, "Le timbre du saxophone aigu est beaucoup plus pénétrant que celui des clarinettes en si bémol et en ut, sans avoir l'éclat perçant et souvent aigre de la petite clarinette en mi bémol."

133. The only known E-flat sopranino marked "Sax," now in the collection of Marlowe Sigal, is marked "[Adolphe Sax Fils logo] / MEDAILLE D'OR 1900 / Adolphe Sax / 84, RUE MYRHA / PARIS" and thus must date from after 1900.

134. "Il est complet, car il embrasse toute une famille de huit varietés, de l'aigu au grave, qui, dans leur ensemble, renferment tout le diagramme de sons perceptibles." Deans, "Translated Source Readings," 187.

135. Hector Berlioz, *Journal des débats* (12 January 1856), quoted in Haine, *Adolphe Sax*, 149.

After this, a decree of Napoleon III dated March 26, 1860, again standardized the instrumentation for French infantry and cavalry bands. An illustration accompanying this decree shows the instruments intended and gives their dimensions,[136] clearly showing large-belled soprano, alto, tenor, and baritone saxophones (fig. 15). An illustration of a French African Army unit from circa 1860 shows musicians playing alto saxophones, saxhorns in several sizes, piccolos, horns, trombones, bugles, and ophicleides (fig. 18). By 1860, clearly, the saxophone was an accepted member of French military bands.

The contrabass saxophone and its rivals. Despite the saxophone family's eventual success, it did not achieve Sax's earliest goal, to provide the deepest tones of the band. Why did Sax never produce the contrabass and bourdon saxophones implied before 1850? Probably because this niche was filled in the 1840s by deep saxhorns and tubas, and ultimately by an instrument derived from the saxophone—the contrabass sarrusophone.

A bitter enemy of Sax, Pierre-Louis Gautrot developed the sarrusophones about 1854.[137] These are saxophone-like instruments with a conical bore and large toneholes. The bore expands more rapidly than a bassoon's, but less than a saxophone's.[138] A sarrusophone required less air than a saxophone of the same pitch and permitted the use of a double reed, albeit one much larger than for the corresponding oboe or bassoon. The broad double reed gave a shawmlike tone with more "throw" than a saxophone.[139]

Following Sax's example, Gautrot created sarrusophones in a vast array extending from E-flat sopranino to B-flat contrabass. Except for the soprano and sopranino sizes, all are in ophicleide shape (fig. 19). The

136. Cools, "Adolphe Sax," 31–35.

137. Gautrot Ainé et Companie, *Catalogue des Instruments de Musique,* in *Larigot Spécial* 10 (April 1999): 3–9.

138. Conicities are 2.1% for a Gautrot C bass sarrusophone from c. 1860, 1.6% for a Triébert bassoon from c. 1840, and 6.9% for Sax saxophones of the period.

139. Cecil Forsyth noted of the contrabass sarusophone, "The top octave is poor and thin in quality. It is, however, only the bottom octaves that are needed in the orchestra, and the instrument is specially constructed to produce these in a heavy powerful quality. . . . The taste for its tone quality, one thinks, must be acquired." Cecil Forsyth, *Orchestration* (London: Macmillan, 1914, 2nd ed. 1935; reprint, New York, Dover, 1982), 171. The smaller sarrusophones' blatant tone and weak upper ranges mitigated against their use, especially as the Boehm-system oboes then current in French bands occupied the same tonal niche, were well-established among players, and were made by numerous manufacturers (Howe, "The Boehm Oboe," 44–45).

Figure 18. "Armée Française. Chasseurs d'Afrique." Note the concurrent use of saxophones, saxhorns, and ophicléides. (c. 1860). Reprinted from Haine and de Keyser, *Instruments Sax,* 17, by permission.

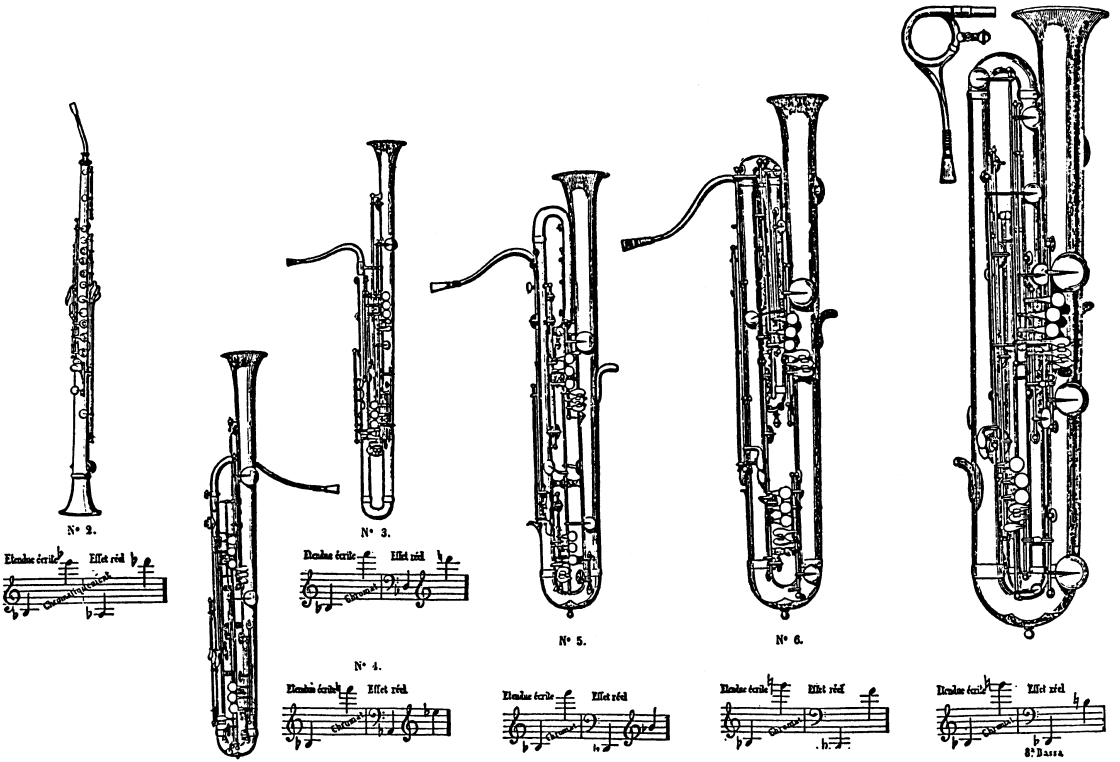

Figure 19. Sarrusophones by Gautrot, 1867. From *Catalogue des Instruments de Musique de la Manufacture Générale de Gautrot Ainé et Cie.* (Paris, 1867), reprinted in *Larigot Spécial* 10 (April 1999): 10–12. Courtesy of Bruno Kampmann.

larger varieties had three octave keys like Sax's original bass saxophones. Sarrusophones appear to my eyes to be virtual copies of the 1846 bass saxophones but with double reeds. Sax thought so as well and sued Gautrot for patent infringement.[140] That he was right is proven by the early twentieth-century development of rothophones, which are sarrusophones in saxophone form.[141]

Gautrot built contrabass sarrusophones in E-flat, C, and B-flat; with a lowest tone of AAA-flat, this last is the deepest woodwind ever produced. The contrabass sarrusophones filled the "bourdon" range that Sax meant to explore and filled it well. There is little evidence of contrabassoons in Paris in the nineteenth century; sarrusophones played their parts.[142] As late as 1935 Cecil Forsyth noted that "In France, when the Double-Bass-Reed-Part is not played on a Sarrusophone, a heavy brass Double-Bassoon is used," showing the sarrusophone to have been the standard band instrument in this range.[143]

The contrabass sarrusophone was a useful instrument in the first seventy-five years of its existence, being light enough to use while standing or marching. Families of sarrusophones could be found in French, Italian, and Spanish bands into the twentieth century.[144] In 1862 the Spanish instrument maker, clarinettist, and conductor Antonio Romero y Andía visited the London exhibition at which Sax and many other makers displayed instruments. Back in Madrid he recommended military

140. Horwood (*Adolphe Sax*, 122–25) states that Sax lost the case, but Hemke says he won. Haine (*Adolphe Sax*, 208–09) references the court documents but makes no comment. *Faits et documents relatifs au procés entre M. Sax et M. Gautrot*, translated in Hemke, "Early Saxophone," 161.

141. Gunther Joppig, "Sarrusophone, Rothophone (Saxorusophone) and Reed Contrabass," 68–106.

142. Michel Jolivet, "An English Translation of a Monograph on the Sarrusophone Written by Roger Leruste," *The Double Reed* 24/3 (November 2001): 73–88; also Forsyth, *Orchestration*, 170–72.

143. Ibid., 247. The sarrusophone is not mentioned by Berlioz in his 1855 *Grand Traité*, having only been invented the previous year; that Richard Strauss, in his 1904 revision, did not add a chapter on the instrument shows how the German contrabassoon (invented by Heckel c. 1870) had taken hold in Eastern Europe. Buffet-Crampon did not introduce a modern French system contrabassoon until 1905 (Seltmann and Angerhöfer, *Das Fagott*, 6:15). As the French contrabassoon improved, the contrabass sarrusophone became obsolete after World War I.

144. Baines, *Woodwind Instruments*, 166–68. E-flat contrabass sarrusophones by Conn (Elkhart) were used in United States military bands in the 1920s. The author's experience playing such an instrument in outdoor band concerts confirms Forsyth's assessment: its tone is forceful but blends well with tubas.

bands of piccolos, flutes, F piccolo and B-flat soprano clarinets, Boehm system oboes, "Saxophones en Mi b, Sarrusophones ou bassons en Si b," and numerous brass instruments. Whether these are E-flat alto or E-flat baritone saxophones is uncertain; although listed in score order, either could be intended.[145] Romero's preference for the B-flat bass sarrusophone over the B-flat bass saxophone may have been due to the lighter weight and more cutting tone of the sarrusophone.

Sax could not spare the time and money to develop the contrabass and the bourdon saxophones shown schematically in 1846, although he made at least one contrabass saxophone in 1849.[146] Although his circumstances improved after 1854, after 1855 the sarrusophone sealed the larger saxophones' fate.

"Orchestral" saxophones in C and F. Numerous sources after 1844 describe an "orchestral family" of saxophones in F and C and a "band family" pitched in E-flat and B-flat. This common misunderstanding has been propagated by some very illustrious authors.[147] It is true that Sax created altos in F and sopranos, tenors and basses in C; however, a register of 170 saxophones built during Sax's working life shows only a single C soprano, two F altos, and four C tenors, or 4.1% of the total number (appendix 2). Sax also mentions the alternate keys in his 1846 and 1850 saxophone patents; in fact, in the latter the C bass is presented as the standard bass, although the other five saxophones are in B-flat and E-flat.[148] The few extant C soprano and F alto saxophones have serial numbers below 11,000, dating them to before 1855. Only C tenors and E-flat or B-flat saxophones are found after 1854. No F sopranino, F baritone, or F contrabass saxophone has ever been reliably described, and no specimens of C bass are extant.

An 1864 Adolphe Sax advertisement offers music for saxophones ranging from solos to octets.[149] Sizes specified are B-flat soprano, E-flat

145. Beryl Kenyon de Pascual, "Quelques observations sur les instruments de la musique militaire faites par Antonio Romero après sa visite à l'exposition internationale de Londres de 1862," *Larigot* 18 (February 1996): 5–7.

146. The only exact reference to Sax making a contrabass saxophone is from the 1849 exhibition. However, Adolphe Sax fils made at least one contrabass at the turn of the twentieth century. Ignace de Keyser, personal communication, August 9, 2001.

147. For example, Carse, *Musical Wind Instruments,* 176.

148. Dullat, *Internationale Patentschriften,* 1:27–31.

149. Deans, "Translated Source Readings," 190. Composers included Arban, J. Cressonnois, Klosé, Savari, J. B. Singelée, and others.

alto, B-flat tenor, E-flat baritone, and B-flat bass saxophones; no work calls for a saxophone in F or C. A published history of the F alto saxophone lists every work known to exist for that saxophone; only six works are listed, half of them dating from after Sax's death.[150] Kastner used the C bass in *Le Dernier Roi de Judah* (1844), but asked for the B-flat bass (and two F altos!) in his *Festival Overtures* of 1855–60.[151]

The choice of B-flat and E-flat as nominal pitches for band saxophones and of C and F for orchestral instruments is not claimed in Sax's patents, nor in Kastner's or Berlioz's many writings. This assumption appears to have been imposed by later writers, probably by analogy to the clarinet, whose version in A is used only in orchestras. Several lines of evidence suggest that this assumption is wrong.

First, the use of saxophones in F and C for orchestral music offers little advantage to the player. Hartmann's *Méthode* noted that "The keys most suitable to the saxophone are those of [written] C, G, D, F, B-flat and their relative minors." Using this list of facile keys, two alto saxophones pitched a whole step apart in E-flat and F would comfortably play in concert-pitch D-flat and A-flat (the E-flat alto); E-flat, B-flat, and F (both); and C and G (the F alto). Thus only two keys are gained by the smaller instrument. Had Sax truly intended an orchestral family of saxophones, a half-step alteration would have been more logical. An alto saxophone in D would add the concert keys of C, G, D, A and E to the D-flat, A-flat, E-flat, B-flat and F played on the E-flat alto—ten of the twelve possible keys. Thus an orchestral family in D and A would have allowed much greater versatility in sharp keys than one in F and C. Sax was capable of making this analysis, yet never offered saxophones in D or in A.

Second, saxophones in F and C were redundant. Although Hartmann's preferred keys are indeed the easiest, early saxophones are more omnitonic than then-contemporary oboes and clarinets. It would be entirely reasonable to write for E-flat alto saxophones in B major (i.e., a piece in concert D major). The saxophones' relative versatility in all keys worked against a need for F and C saxophones. Third, saxophones were especially costly; in the c. 1848 and 1850 prospectuses, they are the most expensive instruments listed. The high cost of saxophones would make it

150. Paul Cohen, "There really is an F alto," *Saxophone Journal* 14/3 (1989): 8. Also available online as "The Saga of the F Alto Saxophone" at *www.classicsax.com*. There are three works by Kastner, the Strauss *Domestic Symphony* (1902–03), Gustav Bumcke's *Sextett* (1907), and Joseph Holbrooke's *Symphony No. 1* (1910).

151. Fred Hemke, personal communication, February 5, 2002; Cohen, "F alto."

impossible for musicians to own instruments in both E-flat and F, as one routinely carries A and B-flat clarinets.

Finally, the existing parallel instruments a tone apart are really different species, being much more dissimilar than A and B-flat clarinets. Twentieth-century American makers briefly made sopranos in C, a few altos in F, and tenors in C.[152] These have different bores, require different mouthpieces and reeds, and do not play like their relatives pitched in B-flat and E-flat; they disappeared quickly when the 1929 Depression struck. The timbres of C and B-flat soprano, F and E-flat alto, and C and B-flat tenor saxophones (fig. 20) vary remarkably. They are not relatively interchangable, as are A and B-flat clarinets (to most ears), but rather more like C and B-flat clarinets. The "band"-pitched saxophones have a more mellow tone than the species pitched a tone higher and are in fact more atttractive for orchestral use than the so-called "orchestral" saxophones.

Most probably, Sax was uncertain initially what the best keys would be for saxophones; F and C, or E-flat and B-flat. As the E-flat baritone and alto caught on with French military bands, it made sense to retain the keys of E-flat and B-flat and to suppress the saxophones in F and C. Sax saw the redundancy and danger of the F and C species and therefore minimized their production; having a clearly-established family of instruments in E-flat and B-flat made composers more secure in writing for the saxophone.

The myth of the orchestral saxophone family seems to have its roots in the intended use of F and C saxophones in orchestral works by Richard Strauss and Maurice Ravel. The F and C saxophones are mentioned in Berlioz's *Grand Traité* of 1855. Strauss edited a translation of this work (published in 1904) while he was also writing his *Domestic Symphony,* which called for C soprano, F alto, F baritone, and C bass saxophones. Carse reports that when the *Domestic Symphony* was first produced in Berlin (circa 1904) the necessary saxophone quartet could not be recruited locally.[153] That Strauss wrote for rare or nonexistent instruments undoubtably played a part in this difficulty; modern players trans-

152. During the saxophone craze of the 1920s, American makers produced vast numbers of C tenor ("C-Melody") saxophones, a few C sopranos, and a very few F altos ("mezzosopranos"). These instruments were not intended for orchestral use but to facilitate reading at home off piano scores and, in the case of the mezzo-soprano, to augment lagging sales with a novel species. Perhaps Sax had the same idea.

153. Carse, *Musical Wind Instruments,* 179.

Figure 20. "Orchestral" versus "Band" tenor saxophones by Sax. Left, C tenor no. 40582 (1879). Right, B-flat tenor no. 39116 (1876). Both instruments from the author's collection.

pose the parts onto a quartet of B-flat soprano, E-flat alto, and two E-flat baritones.[154]

Maurice Ravel calls for F sopranino saxophone in *Boléro*, to play one long solo and many tutti passages. The highest note of the solo is a sounding d-flat‴, iterated eleven times in a dramatic crescendo. Ravel was compelled to finish the solo, which goes too low for any sopranino, on the B-flat soprano; modern players play the entire part on this instrument. As no F sopranino saxophone has ever been documented, Ravel's choice is without explanation; certainly he had opportunities to study saxophones. Perhaps Ravel read Berlioz, who gives the B-flat soprano's highest note as c‴, and worried that the B-flat soprano could not play d-flat‴ safely. In fact, the solo is very playable on the B-flat or C soprano and lacks but one note on the E-flat sopranino saxophone.

Nineteenth and early twentieth-century orchestration texts give disparate families of saxophones. F.-A. Gavaert (in 1890)[155] and Emil Teuchert (in 1927)[156] noted only saxophones in B-flat and E-flat. Arthur Lange, who spoke from extensive experience, in 1926 mentioned both soprano and tenor saxophones in C.[157] The British writer Cecil Forsyth swallowed Berlioz's statements unquestioningly, noting in 1914 that "The whole series of these seven military instruments, alternately in E-flat and B-flat, is also reduplicated abroad by orchestral Saxophones alternately in F and C."[158] It is interesting that he specifies "reduplicated abroad"; apparently he never encountered such saxophones in Britain.

Adolphe Sax did not make many saxophones in F or C; but did his competitors? A study of the catalogs of twenty European wind instrument makers, dated 1867 through 1926,[159] reveals that all saxophone

154. For this transposition to work, the alto and one of the baritones must play to g‴ and the other baritone must be keyed to low A.

155. F.-A. Gevaert, *Cours Méthodique d'orchestration, Deuxième partie* (Paris: Lemoine & Fils 1890), 305. Gevaert notes the use of saxophones in French and Belgian bands as a single or double quartet of B-flat sopranos, E-flat altos, B-flat tenors, and E-flat baritones. He bemoans the prejudice that kept saxophones out of other nations' bands.

156. Emil Teuchert and E. W. Haupt, *Musik-Instrumentenkunde in Wort und Bild. 2. Teil, Holzblasinstrumente* (Leipzig: Breitkopf & Härtel, 1927), 50–53. They describe E-flat sopranino, B-flat soprano, E-flat alto, B-flat tenor, and E-flat baritone.

157. Arthur Lange, *Arranging for the Modern Dance Orchestra* (New York: Arthur Lange, Inc., 1926), lists these saxophones: E-flat sopranino, C and B-flat soprano, E-flat alto, C Melody and B-flat tenor, E-flat baritone, and B-flat bass.

158. Forsyth, *Orchestration*, 167.

159. Twelve of these catalogs—issued by the firms of Association Générale des Ouvriers (Paris, 1898), Besson (Paris, 1910), David (Paris, 1883), Decart (Lierre,

makers produced the standard quartet of B-flat soprano, E-flat alto, B-flat tenor, and E-flat baritone saxophones. The greatest variety of saxophones was made by three Parisian firms: Besson (twelve species), Evette et Schaeffer, and *Association Générale des Ouvriers* (ten species each). The latter was a worker-owned Parisian wind instrument manufacturer which made saxophones under license to Sax in the 1860s[160] and later to their own designs. Their 1898 catalog includes every species in F, E-flat, C, and B-flat from E-flat sopranino to C and B-flat bass *except* the F sopranino and F baritone. Evette et Schaeffer and Bottali were the only makers to supply the E-flat contrabass. The 1910 Besson catalog includes the C bass and saxophones in high B-flat and C; this is the only reference outside of Kastner to any *suraigu* saxophones.[161] The lack of availability of the sopranino, bass, contrabass, and any saxophones pitched in F or C sugests that these instruments played little if any role in European musical life, and confirms Sax's implicit judgement that the F and C instruments were redundant.

A Developmental Chronology of the Saxophone

The data reviewed above establish a plausible early history of the saxophone, as follows:

1838–40 Sax's experiments in Brussels with ophicleide and B-flat bass clarinet lead to the development of a bass saxophone, probably in B-flat.

Belgium, 1905), Evette et Schaeffer (Paris, 1897), Gautrot (Paris, 1867), Hawkes (London, after 1903), Mahillon (Brussels, 1926), Martin (Paris, 1905), Millereau (Paris, 1910), Ullmann (Paris, 1907), and Van Engelen (Lierre, Belgium, 1913)—have been reprinted in various issues of *Larigot* between 1989 and 2000. The eight others, all from Italian makers—Tito Belati (Perugia, c. 1920), Bottali (Milan, c. 1916), Maino e Orsi (Milan, 1898), Pupo Pupeschi (Florence, c. 1900), Ferdinando Roth (Milan, 1895), Ambrogio Santucci (Verona, c. 1900), Saporetti e Cappelli (Florence, 1908), and Luigi Zelweger (Biella, 1894)—were made available to me through the courtesy of Dr. Francesco Carreras.

160. Waterhouse, *New Langwill Index*, 11–12; van Oostrom, *Saxofoons*, 35.

161. It is easy, but reckless, to dismiss this as a mistake; the catalog twice mentions these saxophones, gives their prices in different finishes, mentions their cases and accessories and notes that the C sopranino is only available on special order, thus implying that the B-flat sopranino was of standard manufacture. Certainly Besson was making something here. Possibly this is a misprint, substituting "B-flat" for "E-flat"; otherwise it appears that such instruments were in fact made, although apparently very few were produced, as no examples of these species are known today.

1841	Sax brings the bass saxophone to the Brussels Exhibition; it is damaged by a malicious competitor and is not shown.
1842	Sax moves to Paris, showing the B-flat bass saxophone in ophicleide form with three octave vents to visitors including Berlioz. His first instruments are manufactured in June, 1843.
1842–44	Sax continues to refine the B-flat bass saxophone, extending the lower range from written c′ to b, then b-flat. He develops the C bass saxophone and experiments with sopranos, altos, and contrabasses built with three octave vents and an extended range. These prove impractical for unknown reasons.
1844	At a Salle Herz concert on February 3, Sax introduces the B-flat bass saxophone.
April 1844	At the Champ de Mars battle between bands, the roster of Sax's band includes B-flat bass saxophones, but these are not actually played.
Dec. 1844	The C bass saxophone is used in Kastner's opera *Le Dernier Roi du Juda*.
1844–46	Sax develops the E-flat baritone saxophone in saxophone form.
1845	Sax attempts to patent the saxophone; legal wrangling by other Parisian wind instrument makers delays this patent.
1846	Sax is granted a fifteen-year patent on the saxophone in France. His patent drawings show the bass in ophicleide form with three octave vents and the E-flat baritone in saxophone form with two octave vents; other species are presented in theory only. Bass and baritone saxophones existed in playable form; the baritone is used as a prototype for the design of all other saxophone species.
1847–48	The E-flat alto saxophone is introduced. E-flat baritone saxophones are in use by French army bands and supplant the B-flat bass saxophone; the latter is probably not in production, as it is being redesigned in saxophone form.
1848	E-flat baritone and possibly E-flat alto saxophones, but not the B-flat tenor, are drawn from life by Sax and Kastner's artist. Sax loses military contracts with the overthrow of King Louis Philippe, even as he develops the B-flat soprano.
1849	Sax displays a family of saxophones ranging from E-flat sopranino to E-flat contrabass in Paris, including B-flat soprano and B-flat tenor. The bass is redesigned.

1850 B-flat soprano, E-flat alto, E-flat baritone-tenor, and B-flat bass saxophones are in production; the B-flat tenor is not. The B-flat soprano lacks keys for written d‴–f‴. The E-flat alto is still made with a doubly-curved neck. Changes in the E-flat baritone simplify production and playing. The B-flat bass is now in modern form.

1852 Sax's *Grande Harmonie* includes soprano, alto, tenor, and bass, later adding baritone saxophones. The tenor is possibly in general production.

1854 Sax regains official support and simplifies his nomenclature, referring now to B-flat tenor and E-flat baritone species. French army bands adopt a double quartet of sopranos, altos, tenors, and baritones.

1850–56 Sax alters the shape of the alto's neck, straightening it into modern form, and begins to make smaller bells. He extends the range of the soprano from d″ to d-sharp″ by adding two palm keys.[162]

162. Many people contributed to this study. Peter Bloom (Smith College), Bruno Kampmann (Paris), and Ignace de Keyser (Musée des instruments de musique, Brussels) generously provided extensive French reference material. Thomas MacCracken edited the manuscript with patience and tact. Tony Bingham (London), Susan Boiron and Guy Laurent (Vichy Auctions, Vichy, France), Gene Bruck (Wurlitzer-Bruck, New York), Francesco Carreras (ISTI-CNR, Pisa, Italy), Paul Cohen (Manhattan School of Music and Oberlin Conservatory, Oberlin, OH), Günter Dullat (Nauheim, Germany), Yale Fineman (Music Library, University of Maryland at College Park), Fred Hemke (Northwestern University, Evanston, IL), Samuel Hudak (Farmington [CT] Valley Band), Pamela Juengling (W. E. DuBois Library, University of Massachusetts, Amherst), Gail Beth Levinsky (Susquehanna University, Lehigh, PA), Chip Owen (Fox Products, South Whitley, IN), Albert Rice (Fiske Museum, Claremont, CA), and Bettina Schwemer (Bärenreiter-Verlag, Kassel, Germany) all provided further valuable information. Information on specific saxophones in museums and private collections was kindly provided by Margaret Downey Banks (National Music Museum, Vermillion, SD), Atillio Berni (Italy), Paul Brodie (Canada), Toshi Kamakura (Japan), Tomasz Kiefer (Germany), Darcy Kuronen (Museum of Fine Arts, Boston), Valérie Maleski and Patrice Verrier (Musée de la Musique, Paris), David Neills (Wilbraham, MA), and Marlowe Sigal (Newton, MA). Thomas Potter (Ludlow, MA) and Catherine Bloom (Northampton, MA) kindly helped me with French translations. Financial support for this work was provided by Patrick Selmer, Director, H. & A. Selmer, Paris. Finally, my wife Joyce and our children Ben, Jon, Sarah, and Katie suffered my moodiness and hours at the computer, responding with kindness and unwavering support.

APPENDIX 1

Berlioz's Saxophone Chapter in 1843

From *Grand Traité d'instrumentation et d'orchestration modernes.* Paris, 1843, ed. Peter Bloom, New Berlioz Edition, vol. 24 (Kassel: Bärenreiter, 2003), 576.

LE SAXOPHONE

Est un grand instrument grave en cuivre, inventé par Ad. Sax, qui lui a donné son nom. Il se joue non pas avec une embouchure, comme les ophicléides auxquels il ne ressemble sous aucun rapport, mais avec un bec de clarinette basse. Nous n'hésitons donc pas à le ranger parmi les membres de la famille des clarinettes.

Le saxophone est un instrument transpositeur en si bémol; son étendue est celle-ci: EXEMPLE 58.1a.

Le trille est possible sur toute l'étendue de cette gamme, mais je crois qu'on n'en devra faire qu'un usage très réservé.

Le timbre du saxophone a quelque chose de pénible et de douloureux dans les sons aigus ; les notes graves, au contraire, sont d'un grandiose pour ainsi dire pontifical. Il possède comme les clarinettes la faculté d'enfler et d'étendre le son, d'où résultent, surtout dans l'extrémité inférieure de son échelle, des effets inouïs qui lui sont tout à fait propres. Le saxophone, pour des morceaux d'un caractère mystérieux et solennel, est, à mon avis, la plus belle voix grave connue jusqu'à ce jour. Il tient à la fois de la clarinette basse et de l'orgue expressif, ce qui indique suffisamment, je crois, qu'on ne doit, en général, l'employer que dans les mouvements lents. Il serait aussi admirable mis en évidence dans un solo, qu'employé à soutenir et à colorer l'harmonie d'un ensemble de voix et d'instruments à vent.

Malgré la force extraordinaire de sa sonorité il est peu propre aux effets énergiques et brillants de la musique militaire.

APPENDIX 2

Extant Saxophones by Adolphe Sax

The following list includes all saxophones known to the author that were made by Sax during his working life. Many of these have come to light since the publication of Phillip T. Young's *4900 Historical Woodwind Instruments* (London: Tony Bingham, 1993). Saxophones in any references which lack serial numbers or which cannot be substantiated have been excluded. From the ease with which I located more than thirty unpublished specimens, I suspect that this list constitutes fewer than half of those extant.

Saxophones up to 39778 are marked "rue St Georges"; saxophones 40316 and following are marked "26 rue Rocroy & 39 rue de Dunkerque." Thus the 1878 move of Sax's workshop can be placed in his oeuvre at approximately

40,000. Dates will often disagree slightly with those given in the original references; they were assigned as described in appendix 3.

Anyone aware of Adolphe Sax saxophones not listed here is invited to contact me at *arehow@charter.net* or *arehow@gcq.net*, by fax at 413-525-5170 (USA), or by letter at One Baldwin Lane, Wilbraham, MA 01095 USA.

Serial	Date	Species	Location	Reference
5140	1848	E♭ baritone	Thomaz Kiefer, Germany[1]	
5828	1848	E♭ alto	MFA, Boston	Bessabaroff,[2] CIS, 4900
5918	1848	E♭ alto	Bruno Kampmann, Paris[3]	
6497	1849	B♭ soprano	MdM (E.714), Paris	CIS, 4900 (listed in 4900 as an alto)
9935	1854	E♭ alto	MIM (9935), Brussels	CIS, 4900
10183	1854	C soprano[4]	Horniman Museum, London	CIS, 4900
10228	1854	E♭ alto	Karl Burri, Bern	CIS, 4900
10534	1854	F alto	Leo van Oostrom, Amsterdam[5]	
10538	1854	F alto	Paul Brodie, Canada[6]	
10831	1854	B♭ tenor	Thomas Kiefer, Germany	
11658	1854	E♭ alto	GNM (MIR 486), Nürnberg	CIS, 4900
12345	1854	B♭ soprano	Wijsberg Collection, Bruges	CIS, 4900
12966	1855	E♭ alto	Thomaz Kiefer, Germany	
13097	1855	B♭ tenor	Robert Howe, USA[7]	
14320	1856	E♭ alto		Vichy auction, December 1995, lot 374[8]

1. For all Keifer specimens, Thomaz Keifer, personal communication, January 11, 2002. Herr Kiefer notes that the baritone saxophone no. 5140 has thicker metal in the tonehole walls, and larger key touches, than his later Sax baritones. The mechanism is the same.

2. Nicholas Bessaraboff, *Ancient European Musical Instruments* (Cambridge, Mass.: Harvard University Press, 1941), 105–07, Plate III.

3. Bruno Kampmann, "Catalogue de la collection d'instruments de musique a vent, tome 2," *Larigot Spécial* 1 (September 1991): 62, 119.

4. Saxophone 10183 is described in Young as an E-flat sopranino saxophone; if so it would be the only known sopranino by Adolphe Sax. It is actually a C soprano, as evidenced by the length of 54.0 cm, versus 57.7 for Adolphe Sax B-flat soprano, serial no. 32453. An E-flat sopranino saxophone with range to low B by E. Gras, Lille (circa 1890) in the collection of Dr. Paul Cohen has a length of 43.3 cm. Circa 43 cm would thus be the expected length of a Sax E-flat sopranino saxophone. An E-flat sopranino saxophone by Adolphe Sax Fils (circa 1900) sold at the Vichy auction in June, 2002.

5. van Oostrom, *Saxofoons*, 10.

6. Paul Brodie, personal communication, September 6, 2001.

7. For all Howe saxophones, collection of the author.

8. For all Vichy specimens, Guy Laurent, *Instruments de Musique* (auction catalog) (Vichy: Hotel des Ventes, date as given), lot number as given.

Serial	Date	Species	Location	Reference
14718	1856	E♭ alto	Musée Rhone-Alps 33, Pont de Vaux France[9]	
14792	1856	B♭ soprano	Museu de la Música, Barcelona	4900
14911	1856	E♭ alto	Tony Bingham, London	4900
15117	1856	E♭ alto	Toshi Kamakura, Japan[10]	
15353	1857	B♭ tenor	MdM (E.716), Paris	CIS, 4900
15511	1857	E♭ alto	Selmer, Paris	CIS, 4900
15830	1857	B♭ soprano	Toshi Kamakura, Japan	
16062	1857	E♭ baritone	Stiftelsen Musikkult., Stockholm	4900
16142	1857	B♭ tenor	Bruno Kampmann, Paris[11]	4900
16149	1857	E♭ alto	NMM (4038), Vermillion	4900
16495	1857	B♭ soprano	Leo van Oostrom, Amsterdam[12]	
16497	1857	B♭ soprano	Bruno Kampmann, Paris[13]	
16531	1858	E♭ alto	Robert Howe, USA	
16676	1858	B♭ tenor	Arno Bornkamp, Netherlands[14]	
16722	1858	E♭ baritone	NMM (4040), Vermillion	4900
16872	1858	B♭ tenor	MDM (E.013), Paris	CIS, 4900
17059	1858	B♭ tenor	MIM (3765), Brussels	Young,[15] CIS, 4900
17077	1858	B♭ soprano	Lonköpings Stads Mus., Sweden	CIS, 4900
17146	1858	E♭ baritone	Bruno Kampmann, Paris[16]	4900
17401	1858	C tenor	Interlochen Arts Academy, USA	CIS, 4900
17459	1858	B♭ tenor	Günter Dullat, Germany[17]	

9. Frédéric de La Grandville, "Index des noms de facteurs d'instruments à vent ayant des instruments conservés dans les musées de France," *Larigot Spécial* 12 (April 2001): 29.

10. For all Kamakura specimens, Toshi Kamakura, personal communication, July 2001.

11. Bruno Kampmann, "Catalogue d'instruments de musique a vent," *Larigot Spécial* 1 bis (December 1986): 42, plate 27.

12. van Oostrom, *Saxofoons*, 32.

13. Bruno Kampmann, "Catalogue de la collection d'instruments de musique a vent, tome 3," *Larigot Spécial* 9 (September 1998): 61, 104.

14. For all Bornkamp saxophones, Arno Bornkamp, personal communication, September 11, 2002.

15. Phillip Young, *The Look of Music* (Vancouver: Douglas & McIntyre, 1980), 202.

16. Kampmann, *Catalogue* 42, plate 27.

17. Dullat, *Saxophone*, 30.

17609	1858	E♭ baritone	MdM (E.717), Paris	CIS, 4900
17650	1858	E♭ alto	Lonköpings Stads Mus., Sweden	CIS, 4900
17849	1858	B♭ soprano	NMM (4076), Vermillion	4900
18046	1859	E♭ alto	Karina Rascher, USA	CIS, 4900
18672	1859	B♭ soprano	Marlowe Sigal, USA[18]	Sotheby's, December 17, 1997, lot 20
18838	1859	E♭ alto	Interlochen Arts Academy, USA	CIS, 4900
19077	1859	E♭ baritone	Thomas Kiefer, Germany	Vichy auction, May 31, 1997, lot 551
19555	1860	B♭ tenor	Toshi Kamakura, Japan	
19572	1860	B♭ soprano	Anon, Germany	4900
19575	1860	B♭ soprano	Leo van Oostrom, Amsterdam[19]	CIS, 4900
19077	1860	E♭ baritone	Thomas Kiefer, Germany	
19804	1860	E♭ alto	Jeremy Montagu, UK	CIS, 4900
19812	1860	E♭ alto	Anon., Germany	4900
20139	1860	E♭ alto	NMM (5768), Vermillion	CIS, 4900
20149	1860	E♭ baritone	MIM (3765), Brussels	Young[20]
20200	1860	E♭ alto	P. Pareille, France	CIS, 4900
20432	1860	B♭ soprano	MIM (3111), Brussels	CIS, 4900
20449	1860	E♭ baritone	MIM (3663), Brussels	CIS, 4900
20461	1860	E♭ baritone	Leo van Oostrom, Amsterdam[21]	CIS, 4900
20572	1860	E♭ alto	Marlowe Sigal, USA	
20655	1860	B♭ soprano	(now lost)	4900
20669	1860	C tenor	Univ. of Michigan (641), USA	CIS, 4900
20674	1860	E♭ baritone	Attilio Berni, Italy[22]	
21--3	1861	E♭ alto	Leo van Oostrom, Amsterdam	CIS, 4900
21061	1861	E♭ baritone	Tony Bingham, London	4900
21202	1861	B♭ soprano	J. P. Vignon, Paris	CIS, 4900
21307	1861	E♭ baritone	Bruno Kampmann, Paris[23]	
21308	1861	E♭ baritone	Randy Emerick, USA	4900
21401	1861	B♭ tenor	MIM (200), Brussels	CIS, 4900

18. For all Sigal specimens, Marlowe Sigal, personal communication, July 2001.
19. van Oostrom, *Saxofoons,* 9.
20. Young, *The Look,* 203.
21. van Oostrom, *Saxofoons,* 9.
22. For all Berni specimens, Attilio Berni, personal communication, September 2001.
23. Bruno Kampmann, "Catalogue . . . tome 2," 64.

Serial	Date	Species	Location	Reference
21455	1861	B♭ soprano	MMI, Tokyo	4900
21494	1861	E♭ alto	Robert Howe, USA	
21678	1861	E♭ baritone		Vichy auction, June 1, 1996, lot 453
22126	1862	E♭ baritone	Robert Howe, USA	
22201	1862	E♭ baritone	Robert Howe, USA	Vichy auction, December 2001, lot 339
22627	1862	B♭ soprano	NMM (5767), Vermillion	CIS, 4900
22634	1862	E♭ alto	Günter Dullat, Germany[24]	
23049	1862	B♭ tenor	NMM (4039), Vermillion	4900
23243	1862	B♭ soprano	Paul Cohen, USA	Vichy auction, December 2001, lot 317
23307	1862	E♭ alto	J. P. Vignon, Paris	CIS, 4900
23539	1863	E♭ alto		Versailles auction[25]
23969	1863	B♭ soprano	E. W. Buser, Switzerland	CIS
24123	1863	E♭ alto	Arno Bornkamp, Netherlands	
24125	1863	E♭ alto		Vichy auction, June 1, 1996, lot 451
24338	1863	B♭ tenor	(now lost)	4900
24361	1863	B♭ tenor	MM Stockholm	4900
24412	1863	E♭ baritone	Günter Dullat, Germany[26]	
24495	1863	E♭ alto	Leo van Oostrom, Amsterdam[27]	
24637	1863	E♭ baritone	MMI, Tokyo	4900
24662	1863	B♭ soprano	Leo van Oostrom, Amsterdam	CIS, 4900
25037	1864	B♭ soprano		Priestly[28]
25095	1864	E♭ alto	Leo van Oostrom, Amsterdam[29]	
25234	1864	E♭ baritone	Anonymous, Germany	4900
25307	1864	E♭ alto	MIM (3769), Brussels	CIS, 4900
25587	1864	E♭ alto	Thomaz Kiefer, Germany	
25620	1864	E♭ alto	Arno Bornkamp, Netherlands	
25715	1864	E♭ alto		Vichy auction, December 2001, lot 319b

24. van Oostrom, *Saxofoons*, 19.

25. Jacques Martin & Gilles Chausselat, *Instruments de Musique* (auction catalog, March 24, 1996) (Versailles: Galerie des Chevau-Légers, 1996), lot 58.

26. Dullat, *Saxophone*, 16

27. van Oostrom, *Saxofoons*, 9.

28. Brian Priestly, Dave Gelly, Paul Trynka, and Tony Bacon, *The Sax & Brass Book* (San Francisco: Miller Freeman, 1998), 34.

29. van Oostrom, *Saxofoons*, 34.

25827	1864	B♭ tenor	Karl Ventzke, Germany	CIS, 4900
26063	1864	E♭ baritone	Marlowe Sigal, USA	
26688	1865	E♭ baritone	Karl Ventzke, Germany	CIS, 4900
26695	1865	E♭ baritone	(now lost)	CIS, 4900
27340	1865	B♭ tenor	Marlowe Sigal, USA	
27401	1865	E♭ alto		Vichy auction, June 1, 1996, lot 456
27403	1865	E♭ alto	MdM (E.1685), Paris	4900
27741	1866	B♭ tenor	Jean Marie Londiex, Bordeaux	CIS, 4900
27870	1866	E♭ alto	Deutsches Mus. (16809), Munich	CIS, 4900
27996	1866	B♭ soprano	Bruno Kampmann, Paris[30]	
28---	1866	E♭ alto	MIM (S68), Brussels	CIS, 4900
28155	1866	B♭ tenor	Fanfare de Schiltigheim, France	CIS, 4900
28160	1866	B♭ tenor		Vichy auction, November 30, 1996, lot 515
28251	1866	B♭ soprano	J. Sebille, Brussels	CIS
28623	1866	B♭ tenor	Attilio Berni, Italy	
29073	1867	E♭ alto	Anon, Netherlands	4900
29082	1867	B♭ tenor	Charles Thymel, France	CIS
29829	1867	B♭ soprano	Attilio Berni, Italy	
30037	1867	B♭ tenor	Leo van Oostrom, Amsterdam	CIS, 4900
30141	1867	E♭ alto	Bruno Kampmann, Paris	4900
30460	1867	B♭ tenor		Priestly[31]
30462	1867	B♭ tenor		Vichy auction, December 3, 1994, lot 441
30637	1868	B♭ tenor	Leo van Oostrom, Amsterdam[32]	
31178	1868	E♭ alto		Priestly[33]
31204	1868	E♭ baritone	Arno Bornkamp, Netherlands	
31207	1868	E♭ baritone	Karl Venztke, Germany	CIS, 4900
31215	1868	E♭ alto	Karl Burri, Bern	4900
31648	1868	B♭ tenor	Arno Bornkamp, Netherlands	Vichy auction, June 1, 1996, lot 452; December 2001, lot 331b
31651	1868	B♭ tenor		Sotheby's November 19, 2002, lot 234

30. Kampmann, "Catalog 1991," 60.
31. Priestly, *Sax Book,* 32.
32. van Oostrom, *Saxofoons,* 9.
33. Priestly, *Sax Book,* 33–34.

Serial	Date	Species	Location	Reference
31699	1868	B♭ soprano	NMM (5766), Vermillion	CIS
32063	1869	E♭ alto	Karl Ventzke, Germany	CIS, 4900
32089	1869	E♭ alto	Jean Marie Londiex, Bordeaux	CIS, 4900
32131	1869	B♭ soprano	MdM (E.1684), Paris	CIS, 4900
32269	1869	B♭ tenor	Northwestern University, USA	CIS, 4900
32453	1869	B♭ soprano	Robert Howe, USA	
32457	1869	B♭ soprano	Arno Bornkamp, Netherlands	Vichy auction, June 1, 1996, lot 450
32649	1869	E♭ alto		Vichy auction, December 5, 1992, lot 21
32849	1869	E♭ baritone	MM 435, Stockholm	CIS, 4900
32934	1869	E♭ alto	Thomaz Kiefer, Germany	
33012	1869	E♭ alto	(now lost)	4900
33215	1870	B♭ tenor	Alain Coulet, France[34]	
33304	1870	E♭ alto	Robert Howe, USA	
33451	1870	E♭ alto	MdM (E.1890), Paris	CIS, 4900
33467	1870	E♭ alto	Marcel Josse, Paris	CIS, 4900
33741	1870	B♭ tenor	Anon, Germany	4900
33777	1870	E♭ alto	Thomaz Kiefer, Germany	
33886	1870	B♭ tenor	MdM (E.1686), Paris	CIS, 4900
33921	1870	B♭ soprano	Stockholm, Musikmuseet	4900
34132	1870	E♭ alto		Vichy auction, December 9, 2000, lot 265
34285	1870	B♭ bass	Deutsches Museum, Munich	CIS, 4900
34287	1870	B♭ bass	Marlowe Sigal, USA	
34289	1870	B♭ bass	Selmer, Paris	CIS, 4900
34463	1870	E♭ baritone	MdM (E.1687), Paris	CIS, 4900
35557	1871	E♭ alto	MdM (E.715), Paris	CIS, 4900
36458	1872	B♭ tenor	NMM (5769), Vermillion	CIS, 4900
37338	1873	E♭ alto	Charles Thymel, France	CIS, 4900
37342	1873	E♭ alto	MMI, Tokyo	4900
37478	1873	E♭ alto	Robert Howe, USA	
37637	1873	E♭ alto	MIM, Markneukirchen Germany	CIS, 4900
37739	1873	B♭ soprano	Thomaz Kiefer, Germany	
37870	1873	B♭ tenor	Kunsthistorisches Mus., Vienna	CIS, 4900
38896	1875	E♭ baritone	David Neills, USA	

34. Alain Coulet, "Catalogue de Collection d'Instruments de Musique à Vent," *Larigot Spécial* 7 (April 1997): 37.

38986	1875	E♭ alto		Vichy auction, December 3, 1994 lot 440
39116	1876	B♭ tenor	Robert Howe, USA	
39342	1876	B♭ tenor	MMI, Tokyo	4900
39557	1877	E♭ alto	Marceau Claverie, France	CIS, 4900
39561	1877	E♭ alto	Raulin Collection, France	CIS, 4900
39612	1877	E♭ alto	Musikmuseet, Stockholm	4900
39730	1877	E♭ baritone		Priestly[35]
39778	1877	E♭ alto	Arno Bornkamp, Netherlands	Vichy auction, June 1, 1996, lot 454
39789	1877	B♭ bass	NMM (7457), Vermillion	
40316	1878	B♭ soprano	Alain Coulet, France[36]	Vichy auction, November 30, 1996, lot 510
40415	1878	E♭ baritone	NMM (5764), Vermillion	CIS, 4900
40582	1879	C tenor	Robert Howe, USA	
40623	1879	C tenor	MMITMK (53), Russia	CIS, 4900
40990	1880	B♭ tenor	Alain Coulet, France[37]	Vichy auction, December 2, 1995, lot 375
41121	1881	B♭ soprano	MMA (89.4.2138), New York	CIS, 4900
41168	1881	E♭ alto		Versailles auction[38]

Abbreviations (Locations):
GNM = German National Museum, Nuremberg
MdM = Musée de la Musique, Paris
MFA = Museum of Fine Arts, Boston
MIM = Musical Instrument Museum, Brussels
MMA = Metropolitan Museum of Art, New York
MMI = Musashino Academia Musicae, Museum of Musical Instruments, Tokyo
MMITMK = Musei Muzïkalnïch Instrumentov Teatra Muzïki i Kinematografii, St. Petersberg
NMM = National Music Museum, Vermillion, South Dakota

Abbreviations (References):
4900 = Phillip T. Young, *4900 Historical Woodwind Instruments*, 203–206
CIS = Malou Haine and Ignace de Keyser, *Catalogue des Instruments Sax*, 254–261.

35. Priestly et al., *Sax Book*, 32.
36. Alain Coulet, "Catalogue," 36, 37.
37. Coulet, *Catalogue*, 37.
38. Jacques Martin and Gilles Chausselat, *Instruments de Musique* (auction catalog, April 26, 1997) (Versailles: Galerie des Chevaux-Légers, 1997), lot 161.

APPENDIX 3

Dating of Adolphe Sax Instruments

Adolphe Sax gave most of his Parisian brass instruments serial numbers. Unfortunately, no ledger exists to establish their dates, and existing instruments are dated somewhat erratically by their owners. Although sufficient dated specimens exist to allow the establishment of a reasonable chronology after 1855, dates have never been accurately assigned for the period of this paper, 1840–55. Several facts can be used, however, to arrive at a series of approximate dates. The first of these is the opening of Sax's Paris factory in June 1843, which Haine and de Keyser suggest corresponds to a serial number of 2000, although 1000 or 0001 seem more likely as a beginning number. Moreover, no commercially sold saxophone can date from before June 1846, when the patent was granted; therefore, the earliest surviving saxophone, an E-flat baritone whose serial number is 5140, must have been made in that year or later. The earliest extant alto, no. 5828, provides another point of reference, for the design of its low B key shows that it was made after the drawings in Kastner's *Manuel* (1848). Finally, the earliest instrument inscribed "Facteur de la Maison Militaire de l'Empereur" is a parade trumpet bearing serial no. 9977, which must therefore have been made after Sax's appointment to this position by Napoleon III in April 1854. Other military inscriptions show that serial no. 11926 corresponds to 1854 or after, 15511 to 1856 or after, 18046 to 1859 or after, and 20200 to 1860 or after.

Sax struggled for work between June 1843 and September 1845, a period of 28 months. Having won army contracts, he flourished from October 1845 to March 1848 (30 months), then suffered again from April 1848 until April 1854 (73 months). If we arbitrarily assume a 1:2 ratio of production during lean and busy months, the monthly production from June 1843 to April 1854 (a total duration of 131 months) is solved by the equation $(28 + 73)x + 30(2x) = 9977$. Since $161x = 9977$, Sax's calculated monthly production during slow months thus is 62 instruments.

The following list assumes a starting serial number of 0001 and a doubling of production during good times; these are assumptions, not facts, and it thus may be imperfect. However, they fit the conditions imposed by the saxophone patent, by instruments nos. 5140, 5828, and 9977, and by the dates of military inscriptions. Dates after 1854 are based on the chart given on pp. 219–32 of Haine and de Keyser's *Catalogue des instruments Sax,* but with the line they drew down the middle of their data points moved approximately one year to the right to avoid dating several specimens before they could have been manufactured. Dates after 1867 are less certain than those from 1855 to 1867.

Date	Serial number
1843, June	0001-0062
1843, July–December	0063-0434
1844	0435-1178
1845, January–September	1179-1736
1845, October–December	1737-2108
1846	2109-3596
1847	3597-5084
1848, January–March	5085-5456
1848, April–December	5457-6014
1849	6015-6759
1850	6760-7503
1851	7504-8247
1852	8248-8991
1853	8992-9735
1854, January–April	9736-9993
1854, May–December	9994-12000
January 1855	12000
January 1856	14000
January 1857	15200
January 1858	16500
January 1859	18000
January 1860	19400
January 1861	21000
January 1862	22000
January 1863	23500
January 1864	25000
January 1865	26300
January 1866	27600
January 1867	29000
January 1868	30500
January 1869	31800
January 1870	33200
January 1871	34500
January 1872	35800
January 1873	36600
January 1874	38000
January 1875	38500
January 1876	39000
January 1877	39500
January 1878	40000
January 1879	40500
January 1881	41000
January 1885	41500

Figure 21. Adolphe Sax's trademark.