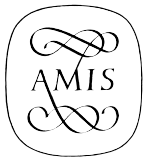
Journal of the American Musical Instrument Society

VOLUME II • 1976



Brasses with Both Keys and Valves

ROBERT E. ELIASON

EARLY in the nineteenth century two ideas for altering the pitch of brass instruments were introduced: a system of side-holes with covers operated by keys, successfully applied to the bugle in 1810; and the invention of valves about 1815. The two systems then existed side by side for twenty to thirty years before the valve gradually gained favor and the key slowly retreated to its former territory among the woodwinds.

A dwindling number of players continued to favor key bugles and their larger brothers, the ophicleides, through the latter part of the nineteenth century. Charles Russell Day, a respected English military musician, had this to say about the key bugle in 1891:

> The key bugle when played by an artist is capable of far more than is now generally supposed; and in agility and rapid articulation it is still preferable to any piston instrument. Shakes and rapid passages, diatonic or chromatic, can be executed upon it with the greatest precision and ease. The key bugle, therefore became, next to the clarinet, the principal solo instrument in military bands from 1820 until 1835, when it began to be superseded by the cornet a piston.[1]

Igor Stravinsky, too, admired the key bugle:

> . . . his trumpet is really a deep-bored, bugle-sounding instrument which reminds me of the keyed bugles I liked so much and wrote for in the first version of *Les Noces*.[2]

Stravinsky is said to have had the idea for *Les Noces* in 1914, and during that summer he made his last trip to Russia. The composi-

1. Charles Russell Day, *A Descriptive Catalogue of the Musical Instruments Recently Exhibited at the Royal Military Exhibition, London, 1890* (London, 1891), pp. 154–155.

2. Igor Stravinsky and Robert Craft, *Conversations with Igor Stravinsky* (Garden City, N.Y., 1959), pp. 131–132.

FIGURE 1. Cornet with e♭ crook. Nickel-silver, three Stölzel valves and MacFarlane' clapper-key; Metzler & Co., London; ca. 1845; photograph courtesy of Mr. Rober Sheldon, Washington, D.C.

tion was completed in 1917. Did he hear the key bugle still being played in Russia at that time?

Certainly the key bugle was a capable musical instrument and for a time competed on fairly equal terms with valve instruments. As the valve gradually gained popularity, however, key bugle play-

ers were faced with the difficult problem of changing from keys to valves. Some of them tried to adapt their key bugles to the changing musical demands by adding valves, while others attempted to preserve some of the advantages of the key bugle by adding keys to valve instruments.

Manufacturers were sensitive to this problem and sought to produce instruments to fill these requirements. Just as harpsichord makers had made instruments with expression attachments and piano-harpsichord combinations to meet a similar crisis in keyboard development in the 1770's, brass makers experimented with combinations of valves and keys. Examination of these instruments provides a unique view of the strengths and weaknesses of the valve and the key as seen by the players and manufacturers of that day.

MacFarlane's Clapper Key

The earliest examples of these hybrid brasses are English valve cornets fitted with one key called MacFarlane's clapper key (Figure 1).

> This was a closed key controlling a hole bored about twelve inches from the bell-mouth; it was worked by one of the fingers of the left hand, and was used to play shakes.[3]

The necessity for the clapper on the cornet seems to stem from a difficulty in obtaining a smooth alternation between some tones. Advantages were twofold. Side-holes by their very simplicity produce a smoother transition from note to note, and where valves lengthened the tubing the clapper shortened it, complementing the action of the valves at certain crucial points. Cornet trills of written a′ to b′ or b′ to c″ in the middle register, notes which are fourth in their respective harmonic series, are quite easily produced. A trill from c′ to d′, however, where one is fourth and the other fifth in its harmonic series is more difficult. This difficulty is removed by the clapper which, by shortening the air column, produces d″ as the fourth note of a harmonic series one tone above that for c″. Similar help was provided at several other such points.

3. Adam Carse, *Musical Wind Instruments* (London, 1939), p. 247.

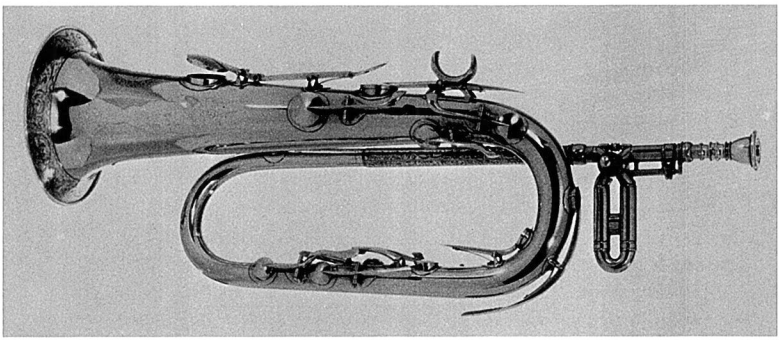


FIGURE 2. Key bugle in e♭. Gold plated, twelve keys, one rotary valve on the tuning shank; D(avid). C. Hall, Boston; ca. 1850; photograph courtesy of the Henry Ford Museum, Dearborn, Michigan.

Several London makers produced cornets with this attachment during the 1840's. It was also added to some six-key bugles of about the same date. (Bugles with seven or more keys already had a key in the same position operated by the right thumb.)

The D. C. Hall Bugle

In 1850 band leader D. C. Hall was given a solid gold key bugle by the Lowell Brass Band of Lowell, Massachusetts. Shortly thereafter he made a gold-plated duplicate of this instrument (Figure 2), possibly because the solid gold one was too valuable to use as a regular playing instrument. The plated instrument is equipped with twelve keys and a whole-tone Allen rotary valve. Although the solder joint where it was mounted remains visible, the lever operating this valve is missing. Its logical position would have been down toward the left thumb. The right-hand fingers would all have been busy and the position of the right palm would have blocked any reasonable possibility of the lever going to the left-hand fingers.

The left thumb is used only for written e′ and f′ (just above middle c′), notes that could also have been produced with the valve.

The use of this valve is not documented by any contemporary source; however, some possibilities come readily to mind. By 1850 the valve cornet was rapidly replacing the bugle and much music had been written and arranged with the newer instrument in mind. The cornet had a low register down to written f♯ and could make very good use of several notes below middle c′. The bugle could play some good notes low in its fundamental register, but lacked the most useful of these, written b♭ and a just below middle c′. The whole-tone valve alone would provide a good b♭ and in combination with the first key a good a as well.

Another likely use of the valve is for playing written e′ and f′ just above middle c′. When vented properly by opening holes below e′ and f′, these are fairly good notes, but still they are weaker than any others on the instrument. The same fingerings used for low a and b♭ would produce a better e′ and f′. Other uses for the valve probably existed, but these alone were enough to justify its addition.

Thomas D. Paine Bugle

This instrument (Figure 3) is equipped with three Paine rotary valves and two keys positioned approximately in the same place as keys nine and ten on a twelve-key bugle. The history of key bugle development shows that these keys were the first to be added after the basic seven. Their primary use was to aid in producing written a″ and b♭″ above the treble staff. A similar function is assumed on the Paine bugle but the instrument is not in playing condition and could not be tried. Other uses could include notes in the lower octave below the treble staff and some trills. An American instruction book for key bugle mentions the following about additional keys:

> The compass of the bugle is about the same as that of the post horn, with this exception—the notes are not good below B (some bugles having extra keys for producing high and low notes with).[4]

4. B. A. Burditt, *The Complete Preceptor for the Bugle* (Boston [ca. 1850]), p. 2.

FIGURE 3. Bugle in e♭. Nickel-silver, three Paine rotary valves and two keys; Thomas D. Paine & Co., Woonsocket, Rhode Island; ca. 1850; photograph courtesy of Central Missouri State University, Warrensburg, Missouri.

FIGURE 4. Overshoulder bugle in e♭. Nickel-silver, three rotary valves and five keys; E(lbridge). G. Wright, Boston; ca. 1852; photograph courtesy of the Henry Ford Museum, Dearborn, Michigan.

E. G. Wright Overshoulder Bugle

E. G. Wright was America's foremost key bugle maker during the mid-nineteenth century and most of the finest presentation bugles found in American collections were made by him. Because he also made valve instruments of excellent quality it can be assumed that he was well qualified to attempt a workable combination of the systems (Figure 4).

The following excerpt is from *Dodworth's Brass Band School*, a band instruction book published by Allen Dodworth in New York in 1853 (p. 16):

> *Soprano cornets* have lately been made in this country, combining the advantages of both valves and keys; they have three valves, like the ordinary Cornet, with the addition of five keys for the upper notes; the one nearest the bell for the highest A♭, that with the next for A, the second and third for B♭, the third and fourth for B, and the fourth and fifth for C; this is a very great improvement, as they combine the fullness of tone in the lower notes peculiar to valve instruments, with the greater ease and facility of the upper notes, which is peculiar to keyed instruments.

Additional documentation is provided by a piece of sheet music entitled *Shelton's Quick Step*, published in 1852 (Figure 5). The cover lithograph shows James Shelton, Esq., band leader and soloist, holding an instrument almost exactly like the Wright overshoulder bugle. Five keys and three valves are plainly visible.

The five keys on these instruments correspond roughly with keys eight, nine, ten, eleven, and twelve on typical twelve-key American bugles.[5] Apparently their primary function both on the key bugle and the valve-and-key bugle was to facilitate playing in the high register.

The Wright instrument played very well when tried by a fine trumpet player of my acquaintance, and the keys produced exactly the notes described in *Dodworth's Brass Band School*. Although carrying power in a large hall was not tested, the high notes produced with keys seemed to be of better tone quality than those played with the valves. They were also easier to produce and at least as well in tune.

5. Robert Eliason, *Keyed Bugles in the United States* (Washington, 1972), p. 31.

IGURE 5. *Shelton's Quick Step* cover illustration showing a valve and key bugle. Pub-shed by C. G. Christman, New York; 1852; photograph courtesy of the Newberry ibrary, Chicago, Illinois.

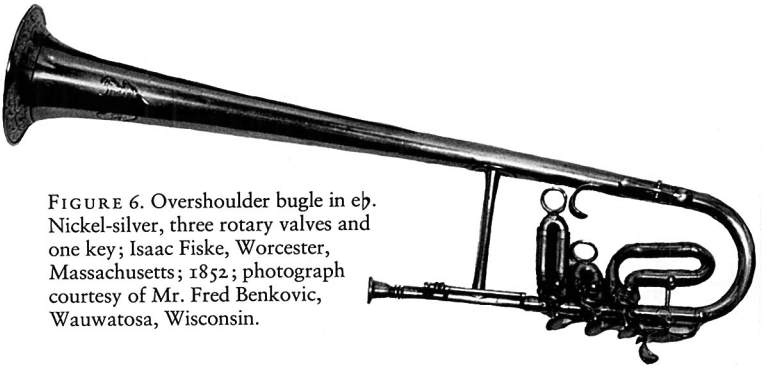


FIGURE 6. Overshoulder bugle in e♭. Nickel-silver, three rotary valves and one key; Isaac Fiske, Worcester, Massachusetts; 1852; photograph courtesy of Mr. Fred Benkovic, Wauwatosa, Wisconsin.

Isaac Fiske Overshoulder Bugle

Of all the instruments described here, this is the most puzzling (Figure 6). Isaac Fiske was a reputable and experienced maker by the early 1850's, but the key added to this instrument provides no discernible playing advantage. It is even located poorly when considered as a water key. Its position is approximately that of the twelfth key on twelve-key bugles. Although written high c‴ can be played with the key open, it shows no advantage over the same note with the key closed. With this key f″ can also be played and a d″–f″ trill is effective. In these instances also, use of the valves is equally good or better.

Joseph Higham Bugle

On this instrument (Figure 7) we find valves and keys combined in a very logical system. It is not a key bugle with a valve to extend the range or to improve certain notes, and it is not a valve instrument with keys to aid legato, or to help with high and low notes: it is a combination using most of the advantages of both systems with a minimum of equipment. The instrument is in B♭ and provides the necessary range for typical band playing. Fingering technique is just a bit more complicated than three valves, but easier than seven to twelve keys. This would be a most interesting instrument to hear if it were in playing condition.

The first key and valve together followed by valve alone and then first key alone would give a good low a, b♭, and b, while the three

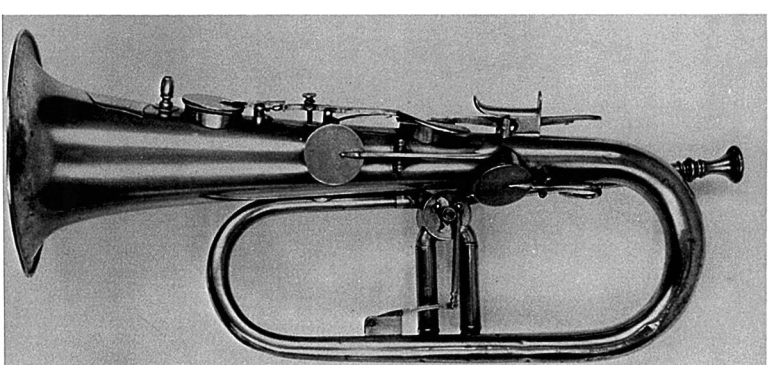
other keys would produce c♯′, d′, and d♯′ above open c′. With the same use of the first key and valve, e′, f′, and f♯′ would bring us to open g′. The same keys used for c♯′, d′, and d♯′ then produce g♯′, a′, and a♯′, etc.

Couturier Ophicleide

On 13 October 1852 the following French patent was obtained by Couturier of Lyon:

> The ophicleide of the present time is played with ten keys placed along the bell and along one branch of tubing. The sounds from the last four keys which are on the narrow tube are always very dull or muffled. In order to make them strong and clear I would substitute a piston or rotary valve. New fingerings would be required, but they would be simpler and more facile than on the old instrument. The elimination of the four keys and the alteration which makes up my new combination gives the ophicleide greater sonority, and its bass part is rendered more correct and more precise. Thus the obstacles to its remaining in the musical score are removed.

An example of Couturier's ophicleide (Figure 8) is found in the collection at the Paris Conservatory, No. 654–E721. It has six keys and one rotary valve. If I have traced the tubing correctly, the pro-



GURE 7. Bugle in C. Copper with brass trim, four keys and one rotary valve; Joseph gham, Manchester, England; ca. 1859; photography courtesy of the Brighton Museum, ghton, England.

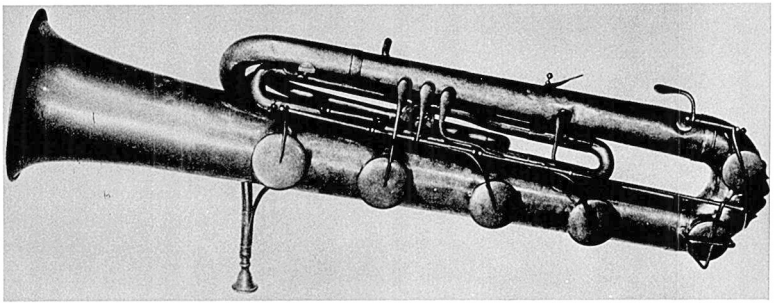


FIGURE 8. Ophicleide. Brass, six keys and one rotary valve; Couturier, Lyon; ca. 1852 photograph courtesy of the Conservatoire Nationale de Musique, Paris.

portion of the valve tube to the rest of the instrument suggests an addition of sufficient tubing to lower the pitch a fourth. The interval of a fourth is also the logical choice since only that interval will replace the four keys as described in the patent. The usual ophicleide fingerings using the first six keys will lower the pitch one half tone and raise it chromatically a fourth. Assuming for convenience an ophicleide in C, the lowest notes produced by these keys would be BB to F (below the bass clef staff) and B to f (an octave higher). Bringing the valve into play, the same fingerings would produce FF♯ to C and F♯ to c increasing the downward range a fourth and filling in the gap from F♯ to B♭ with two notes to spare. All of the higher notes would be available with the keys.

Unfortunately the combination of valves and keys produces problems of intonation similar to those which occur when two or more valves are used together. The keys are placed to produce half tone intervals on the C ophicleide. When the ophicleide is lengthened by the valve to the key of F these intervals are not long enough to produce accurate half steps. The practical results are a slightly sharp F♯, a good G, a slightly flat G♯, and a progressively flatter A and B♭. Against this difficulty is set the decided advantages of a full clear tone on notes that are stuffy and insecure when produced with keys, increased low range, and some simplification of fingering. The instrument was not successful.

Henry Distin Patent

Mr. Phillip Bate recently brought to my attention provisional patent 2729 of 1856 granted in England to Henry Distin (Figure 9).

Brass and like wind instruments.—In cornets, trumpets, and other wind musical instruments a hole B in the bell may be closed or left open by means of the key A. The position and diameter of the hole depend on the size of the bell and the kind of instrument.

The position of the opening on the drawing suggests a half-step key corresponding to the first key on a key bugle. It may have been intended for use on certain half-step trills or as a means of transposition. Many cornets of the second half of the nineteenth century were equipped for rapid change from B♭ to A.

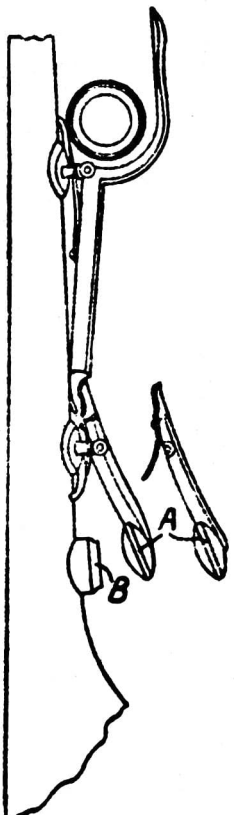


FIGURE 9. Drawing from British patent (provisional) 2729 of 1856 granted to H. J. Distin.

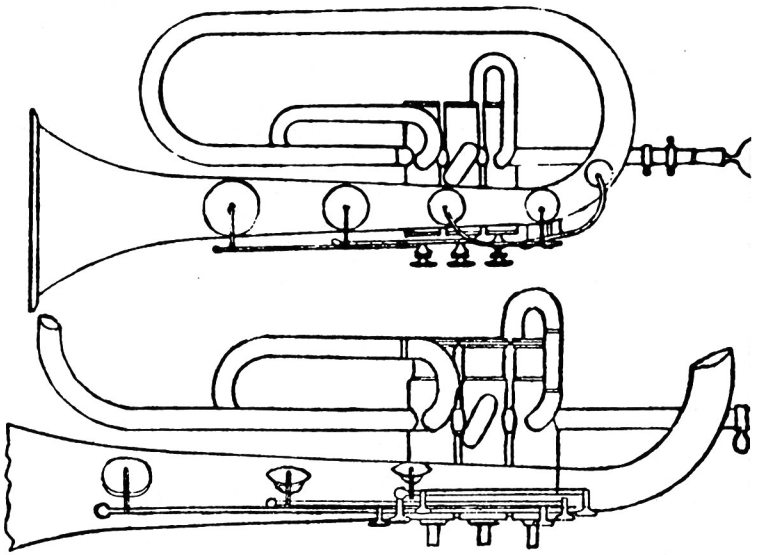


FIGURE 10. Drawings from British patent 1284 of 1859 granted to Adolph Sax of Pa

Adolph Sax Bugle

In French patent 22148 of 3 January 1859 Adolph Sax discusses at length the advantages to be obtained by combining valves and keys on the same instrument.

Without question brass instruments with valves which are being built presently have great advantages over the instruments with keys made previously. But these instruments still have disadvantages which, though less great than instruments with keys or side holes, do nonetheless exist. For example, trills are difficult to play on valve instruments; there is a certain inflexibility in the passage from one note to another, and indeed at times the trill between certain notes is completely impossible because of the difficulty of the fingering.

A great advantage of brass instruments with keys or side holes is that the main pipe is not interrupted, and that extra lengths of air column

are not added that did not exist for the preceding note, or that a portion of this column is not eliminated for the following note. It is always into the air column vibrating in the pipe that one opens or closes an opening at a certain point on the pipe, and under better conditions in the case of which I speak than when it is done by placing the finger on a violin-string; for with the keys opening and closing necessarily in a progressive manner, despite the rapid movement of the fingers, there is in a way a portamento between the two notes, which makes the trill much smoother. It is not at all abrupt as happens on the piano, where nonetheless there is no interruption; the sound is smooth, without a gap. That is the advantage of instruments with side holes or keys.

The observation of this fact has led me to think that if one added to valve instruments one or several keys near the bell, keys which would serve to raise the pitch of the instrument one, two, or three half-tones, one would achieve in valve instruments all the advantages which keyed instruments have had until now. On the other hand, these keys added to the valves, will produce, so to speak, a scale higher by a half-tone, by one tone etc. When these keys remain open, they will produce the usually stuffy low notes of the valve instrument with more sonority and a different tone quality. Thus one will have the same notes produced in two or three ways, and it is easy to understand the musical advantages which will be gained from this by artists who choose to play this kind of instrument.

By means of this combination of keys with valves, there will be different timbres like those obtained by the voice, especially what is called a dark or covered tone. It will be easy to execute, with the help of the keys, certain passages which are difficult using the valves or in which the effect, the expression, is better rendered by using the keys than by using the valves whose sound might be too sonorous.

Keys, in instruments of former times, also offered this advantage: that in reducing a large part of the pipe's length they produced the highest notes of the scale much more easily than by means of the valves used today, which, rather than shorten the instrument, proceed almost always by lengthening. . . . Thus, on the old bugle with keys one generally could play higher than on the bugle with valves.

There is another difficulty which I attempted to remedy to some extent in my patent of 1843 . . . , but the method which I indicated then has not been as widely used as I had hoped because of the increased effort which it involved for the artist: I refer to the compensator. In that patent of 1843 I added a valve whose purpose was to rectify or to compensate the lack of rapport between the length of the main pipe and that of the additional pipes when they were played simultaneously. . . .

The flaw which I am correcting today is much more significant. . . . In

1843, I sought to compensate intervals of one tone, a half-tone, etc. Today it is a matter of a fourth which is to be corrected in a regular manner. . . . Thus in the four-valve bass saxhorn meant to be in C, the fourth valve serves by its additional pipe to increase the instrument by the length equivalent to a fourth, that is, to lower it from C to G. Each of the additional pipes of the three valves which was used for the C instrument accordingly needed to be increased by almost half their length.

In order as much as possible to allow for long established habits, I had the idea of placing next to the fourth valve a fifth valve which is for the purpose of lengthening instantaneously each of the additional pipes by the length equivalent to the interval of a fourth lower. . . .

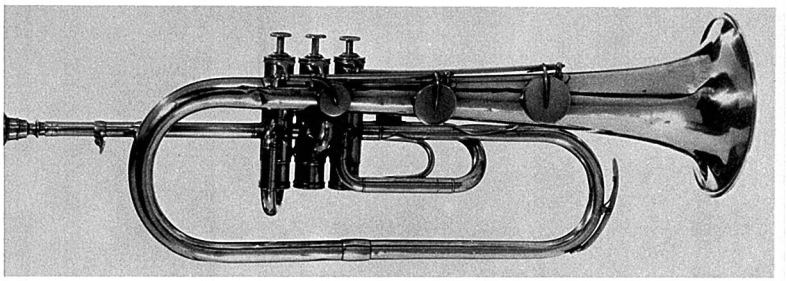
I achieved approximately the same purpose but under conditions perhaps less resonant by opening keys which shortened the pipe by a fourth, a fifth, etc. With the fundamental notes, or the first notes in the bass of each of those keys, and the combining of the valves, one gets the notes obtained with the fourth valve. . . .[6]

Although there are no illustrations with this patent, another patent obtained by Sax in England a few months later, No. 1284 of 24 May 1859, gives drawings of one instrument with three valves and three keys, and another with three valves and five keys (Figure 10). A few of these were produced (see Figure 11) but they did not find favor with players.

To put the matter of keys versus valves in proper perspective one must realize that direct competition between the two systems occurred only on instruments of the conical-bore bugle family. Keys were tried on French horns without success. The key trumpet was only marginally successful, and the post horn-cornet family, to my knowledge, has rarely been tried with keys except for the occasional use of MacFarlane's clapper.

The valve system with its additions of largely cylindrical tubing was more successful on instruments of cylindrical or more gradually tapering conical bore such as the trumpet, French horn, and cornet. On the wide-tapering bugle, where keys worked so well, valves were at a distinct disadvantage. It is perhaps because of this that the faults of the valves were so clearly perceived.

6. I am indebted to Dr. Sarah White for her assistance with this translation.



IGURE 11. Bugle in B♭. Brass, three Berlin valves and three keys; Adolph Sax, Paris; ca. 59; photograph courtesy of the Stearns Collection, Ann Arbor, Michigan.

In summary one can say that in general the key bugle produced a smoother legato, better trills, and truer intonation than the valve bugle, and was also easier to play in the high register. On the other hand, the valve instrument played easier and had greater range in the low register. Valves also had the enormous advantage of being adaptable to all types of brasses—trumpets, cornets, and horns as well as bugles, and they were also easier to maintain than keys. The valve was added to key instruments to extend and improve the low range. Keys were added to valve instruments to improve legato and trills, to facilitate playing in the high register, to provide means of transposition, to give alternate fingerings and choice of different tone quality, and to substitute for valve combinations which were out of tune. Although none of the instruments described here was successful enough to attract many players, they illustrate an interesting but little-known stage in the development of brass instruments.

Henry Ford Museum