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Existing Problems, Developments and Possible Improvements of Modern Clarinet Keywork

by

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University of Queensland

Graduate Diploma of Music, 1986
Canberra School of Music.

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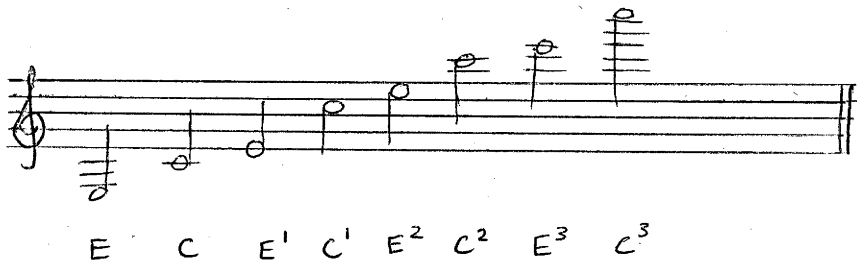
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Pitch abbreviations used:



These pitches correspond to clarinet fingerings, i.e. as written, not as concert pitch.

Introduction

The clarinet has evolved from its origin as a simple peasant pipe without keywork to the complex and varied mechanical instruments available today. Since 1700, its development has been most easily recognised in the progressive addition of keywork, although there have also been adjustments of the bore dimensions, use of better materials, and the application of acoustical knowledge and technology to its construction. The mechanical advancement of the clarinet has lagged somewhat behind the rapid progress of technology, and despite innovations from several inventive instrument makers and players, the current manufacture of the vast majority of clarinets ignores many recent technological developments. Nevertheless, with its complex keywork, the modern clarinet is a highly sophisticated instrument.

The basic function of the keywork is to act as an extension of the fingers, which would not otherwise be able to reach or cover the tone holes. The keywork extends the range and technical freedom of the instrument and corrects faulty intonation. Another function of keywork is to render the repertoire more easily playable, affording the greatest degree of comfort and technical fluency to the player. As the clarinet becomes more highly developed, the repertoire seems to follow in relative complexity from the simple styles of writing found in the concerti of Karl Stamitz (1745-1901) or the sonatas of Johann Baptist Wanhal (1739-1813) to the great technical facility demand by 20th-century works such as the Concerto by Jean Francaix (b. 1912) or Domaines by Pierre Boulez (b. 1925).

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The keywork, however, causes problems. Some of these are due to the acoustical nature of the instrument which dictates hole placement, but others arise in the design and positioning of some keys which seem to bear little relationship to the form and movement of the human hand. Moreover, the shapes and sizes of fingers and stretching abilities vary so greatly from one individual to another that it is impossible to design one system of keywork to satisfy all needs. A basic practical design, with adjustments for individuals and the possibility of custom-made keywork can provide a comfortable position for most hands and thus a fluent technique. Nevertheless, the problems of keywork have by no means been solved.

The present study aims to examine the keywork problems of the modern clarinet and to survey the range of solutions. A brief historical account from the development of the clarinet is useful in illustrating problems associated with the accumulative complexities of keywork, and provides a background to the study. On some instruments excellent innovations have led to the creation of several totally different keywork systems which solve many existing problems, but their unconventional nature and the inability or reluctance of most players to adjust to a new system have prevented such instruments from gaining popularity.

The historical progress of the clarinet is well documented and most literature provides photographs or illustrations of extant instruments. Standard texts in this field are Kroll, O., The Clarinet[1], Rendall, G.F., The Clarinet: Some Notes on its History and

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[1]Kroll, O.: The Clarinet (London; B.T. Batsford Ltd.; 1968)

Construction[2] and Brymer, J., Clarinet[3].

Recent magazine articles and advertisements in The Clarinet[4] and such instrument care and repair manuals as K.A. Mueller's Complete Guide to the Maintenance and Repair of Band Instruments[5] provide useful material in surveying possible solutions, while the problems themselves are most easily discovered and defined through the experience of clarinet playing. However, there is no book solely devoted to the problems of keywork. Among articles there are those by Mazzeo[6], Hanson and Bay[7], van Maarschalkerwaart[8], and Gibson[9], but these deal only with specific problems. Clearly, there is a need for a study which draws together the existing problems and possible solutions for clarinet keywork.

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[2]Rendall, G.F.: The Clarinet: Some Notes on its History and Construction (London; Ernest Benn Ltd; 1978)

[3]Brymer, J.: Clarinet 1st American ed., (New York; Schirmer; 1977)

[4]The Clarinet (Washington; James Schaepflin and Assoc.; Volumes from Feb. 1974 to Winter 1986)

[5]Mueller, K.A.: Complete Guide to the Maintenance and Repair of Band Instruments (New York; Parker Publishing Co.; 1982)

[6]Mazzeo, R.: "The History of the Clarinet's B'-flat Mechanisms" in The Clarinet Vol.7, No.2 (Winter 1980) p.8.

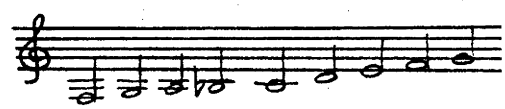
[7]Hanson, S. and Bay, C.: "A New Solution to the Old 'Throat B flat' Problem: the Hanson-Bay key" in The Clarinet Vol.9, No.3 (Spring 1982) p.31.

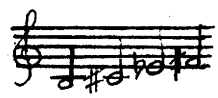
[8]van Maarschalkerwaart, H.: "Automatic Register versus Dual Register Key System" in The Clarinet Vol. 9, No. 3 (Spring 1982) p.31.

[9]Gibson, L.: "Boehm System Alternatives as Custom-made in Germany and Austria" in The Clarinet Vol. 7, No. 2 (Winter 1980) pp.20-21.

The Development of Clarinet Keywork

There is some confusion over the origin of the clarinet. Whether it evolved from the chalumeau (a term used to refer to various folk pipes of the sixteenth century in central Europe)[10] or was invented solely by Johann Christoph Denner (1655-1707), a flute maker of Nuremburg[11], is open to question. The source of confusion lies in the ambiguities of the account of Denner's work by J.C. Doppelmayer in his Historische Nachricht von den Nurnbergischen Mathematics und Kunstlern[12]. It is clear, nevertheless, that Denner's experimentation with chalumeaux and clarinets between 1690 and the year of his death marked the beginnings of clarinet keywork[13].

The chalumeau with which Denner would have experimented at first had a compass of only nine notes: 

The notes  could be obtained by crossfingerings[14]. Such an instrument was rather like a recorder in that six tone holes were bored in a line down the front and a seventh hole was at the back for the thumb. Above these tone holes, Denner

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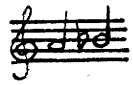
[10]Brymer, op.cit., p.18.

[11]Lawson, C.: The Chalumeau in Eighteenth Century Music (Ann Arbor; UMI Research Press; 1981) p.4.

[12]Doppelmayer, J.C.: Historische Nachricht von den Nurnbergischen Mathematics und Kunstlern (Nuremburg; 1730) p.305; quoted by Lawson, op.cit., p.4.

[13]Clinch, P.: "The Clarinet to the Nineteenth Century" in Studies in Music (Perth; Dept. of Music, W.A.: 1975) pp.19-40.

[14]Brymer, op. cit., p. 23.

added two diametrically-opposed holes which were opened and closed by the use of keys[15]. The two added keys enabled production of the notes,  thus widening the range of the instrument to an eleventh.

Experimentation with the position of the two keys and the dimensions of their holes produced an instrument which could overblow a twelfth into a higher register, forming an overall compass of three octaves[16]. The original B^1 key hole was lowered and narrowed in diameter to the extent that, when played in its usual combination with A^1 key, it produced a B^1-flat. This repositioning of the B^1 hole was made to improve the clarity of its dual function as the register key, but created a problem in that the original B^1 was missing from the widened range[17]. By fingering C^1 the player could produce a false B^1, but the intonation and tone quality were imperfect and unreliable[18].

The only solution was to lengthen the instrument and to bore another lower hole operated by a third key, thus producing a B^1 as the lowest note in the upper register. This work has been attributed to J.C. Denner's son, Jacob Denner[19]. An additional advantage of this new B^1 key was that it produced an E in the lower register, thereby increasing the range. The three-key clarinet was common around 1740. At least two decades passed before the G-

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[15] Ibid, p. 19.

[16] Kroll, op. cit., p. 18.

[17] Clinch, op. cit., p. 23.

[18] Kroll, op. cit., p. 18.

[19] Brymer, op. cit., p. 27.

sharp/D^{1}-sharp key and the F-sharp/C^{1}-sharp key were added, but it is not known who was responsible for this advance[20].

Anton Stadler (1753-1812), the Viennese clarinettist for whom Mozart wrote his Clarinet Concerto (K 622) and Clarinet Quintet (K 581), sought to extend the compass of the instrument in the lower register. With the co-operation of Lotz, an instrument maker, he lengthened the clarinet, adding extra keys which extended the lower range by four semi-tones. Unfortunately such an instrument is not preserved in any collection, but it is believed that Stadler used this so-called Basset-clarinet from about 1788[21].

Jean Xavier Lefèvre added a sixth key in 1791 for C-sharp/G^{2}-sharp, and from this point the clarinet developed no further until Ivan Müller's work in 1806. The main reason for the lack of progress were the problems created by leaking pads, which prevented notes from speaking. The extra keys were also noisy, and as more keys were added, the chances of air leakage became greater[22].

Now the clarinet repertoire was rapidly becoming more challenging and further improvements to keywork were urgent. With modifications in padding and springing, the further addition of keys was possible. A clarinet with at least nine keys was needed in order to play the Clarinet Concerto No. 1 by Louis Spohr (1784-1847), written in 1808[23]. The great German virtuoso, Heinrich Baermann

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[20]Kroll, op. cit., p. 19.

[21]Kroll, op. cit., p. 19.

[22]Brymer, op. cit., p. 29.

[23]Kroll, op. cit., p. 25.

(1784-1847), for whom Weber's clarinet works were composed, used a ten-key clarinet made in 1809[24]. Weber's works and the four concerti and other works of Spohr are still considered technically demanding today, even with the advantages of modern clarinet keywork.

Iwan Müller (1786-1854) invented several new keys and presented a thirteen-key clarinet to a committee of experts in Paris in 1812, where it was received unfavorably and with great apprehension. Only a few years later, other instrument makers copied his clarinet with sensational success[25]. The modern German clarinet is based directly on Müller's work[26].

The invention of ring-keys was a great step forward in the development of clarinet keywork. They first appeared as early as 1808, and the concept was explored by Müller and further developed by Theobald Boehm (1793-1881) with his invention of the Boehm flute[27]. The ring keys were fitted around tone hole perimeters, and when depressed would automatically close off smaller holes bored for acoustical adjustments for improved pitch and resonance. This compensated for the compromised positioning of the original tone holes. The close collaboration of the clarinettist Hyacynthe Klosé (1808-1880) with the maker Louis Buffet Jnr., both of Paris, produced the Boehm clarinet almost as we know it today. In 1839, Buffet exhibited the first clarinet based on Boehm's principles. Klosé's clarinet tutor (1844) shows drawings of the first Boehm clarinets

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[24] Ibid

[25] Kroll, op. cit., p. 3.

[26] Brymer, op. cit., p. 45.

[27] Kroll, op. cit., p. 31.

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with the same number of keys in the same positions as they appear today[28], i.e., seventeen keys and six rings. Klosé and Buffet also improved the shape of keys and increased their mechanical efficiency[29].

Adolphe Sax (1814-1894) was a major figure in continuing the line of development of Muller's clarinet. In 1835 he constructed a 24-key clarinet which never gained popularity, despite an honorable mention at the Belgian Industrial Exhibition of the same year[30]. He extended the range by adding an extra key to produce low E-flat, which is uncommon on modern clarinets, and was also responsible for the invention of a second register key, later adopted in principle by other makers and applied to bass clarinet[31].

Oskar Oehler (1858-1936), an organ builder and clarinettist of Berlin, improved Müller's instrument and created the modern German clarinet. Oehler altered the position and shape of the keys and perfected the mechanisms, producing a clarinet with twenty-two keys, five rings and one finger-plate[32].

There are two major forms of modern clarinet: the Klosé clarinet (French or Boehm System) and the Oehler clarinet (German System) (see fig. 1 & 2). These two clarinet systems have remained

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[28]Kroll, op. cit., p. 32.

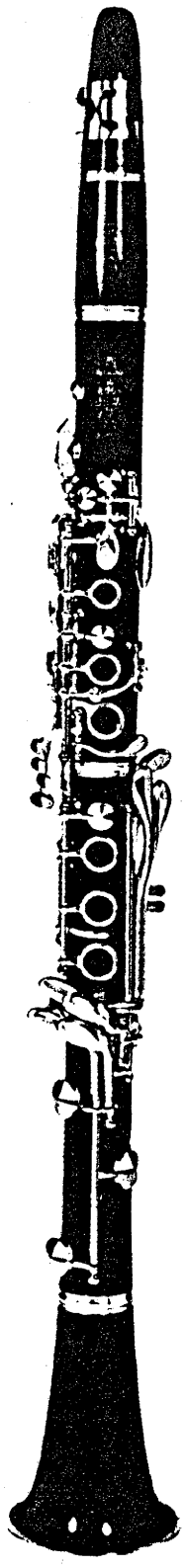
[29]Brymer, op. cit., p. 48.

[30]Kroll, op. cit., p. 32.

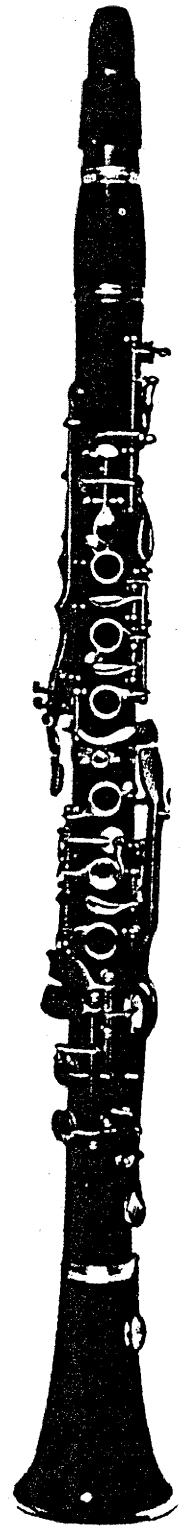
[31]Ibid.

[32]Feller, D.: "Comparison of the Oehler and Boehm Clarinet Fingering Systems", in The Clarinet, Vol. 11, No. 4 (Summer 1984) pp.24-27.

Fig 1: *Left*: The French system.
Fig 2: The German system.



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2.

Brymer, J.: Clarinet (New York; Schirmer; 1977) p. 21.

basically the same since they first emerged. Other systems such as the Albert System and the Barret System held considerably popularity earlier this century, but are rarely played today[33].

A completely new approach to clarinet construction came about in 1930 when several instrument makers devised systems in which the clarinet appeared to overblow an octave instead of a twelfth. Clarinets of this kind were made by T. Valand of Norway, and Georgy Carnock and Antonin Konrad of Prague[34]. Through every octave, the fingering remains basically the same, due to an extremely complicated keywork system, thereby being useful for multi-instrumentalists who would be more used to using instruments overblowing an octave.

With the growth of experimentation in musical composition, quarter-tones provided another challenge in the development of clarinet keywork. Fritz Schüller took out a patent for a quarter-tone clarinet in 1933. The instrument was double-tubed, one tube producing normal B^{1}-flat pitch while the other tube, being slightly longer, produced pitch a quarter-tone lower. The instrument had a switch valve below the mouthpiece, so that the mechanism functioned in such a way as to allow the keys and plates to serve the two bores simultaneously.[35] (See fig. 3).

Nevertheless, neither the octave-overblowing clarinet nor the quarter-tone clarinet gained enough popularity to ensure wide and

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[33]Brymer, op. cit., p. 51.

[34]Kroll, op. cit., p. 45.

[35]Mazzeo, R.: The History of the Clarinet's B'-flat Mechanisms in The Clarinet, vol. 7, No. 2 (Winter 1980) p. 8.

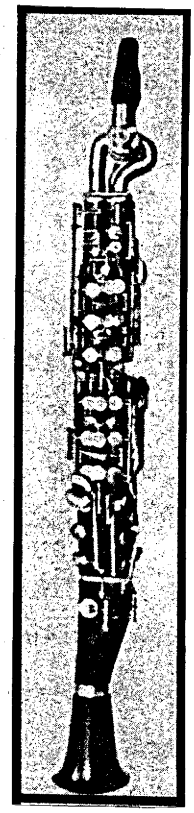


Fig. 3: Quarter-tone clarinet
by Fritz Schüller, Markneukirchen.

Kroll, O.: The Clarinet (London; B.T. Batsford; 1968) p. 31.

continued use, however compositions using quarter-tones are usually playable on the modern clarinet if unusual fingerings can be readily adopted by the player.

Generally speaking, the Klosé clarinet is the most popular clarinet in use today, while the Oehler System is predominant only in Germany, Austria and partially in Holland and Switzerland[36]. This study concentrates mainly on the problems of the Klosé System keywork and possible solutions available, although aspects of the Oehler System and inventions of some German instrument-makers deserve mention.

Problems and Possible Solutions

I The Throat B^1-flat

The imperfections of pitch and dullness of tone of the throat B^1-flat is an inherent problem of the clarinet, which many makers and instrumentalists have tried to solve. Essentially,m the cause of the problem is the positioning and dimensions of the hole of the speaker key, which is used in combination with the throat A' key to produce B^1-flat. This key thereby serves two purposes. Firstly, to enable the second register to speak, and secondly to play the throat B^1-flat. Therefore a compromise is necessary in its acoustic construction[37]. An alternative B^1-flat key made its first appearance as one of two trill keys, operated by the right hand index finger, on

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[36]Feller, op. cit., p. 24.

[37]Brymer, op. cit., p. 52.

Klosé's new Boehm clarinet[38]. This key enables the existence of a tone hole at the correct acoustical position for B¹-flat; however the key is awkward to use outside of it's function as a trill key. The distance that the index finger has to travel to reach the key and the angle at which the hand is subsequently placed prevent it's use in passages requiring a smooth legato between B¹-flat and notes involving use of the right hand. Some players with long fingers and wider hands are more able to make use of this key in a variety of passages; nevertheless, the movement required is awkward and clumsy.

Seven attempts have been made to solve the problems of poor intonation and timbre of the throat B¹-flat:

1. In 1934, Clemens Wurlitzer of Wernitzgrun, made a clarinet for Hans Beringer, a Leipzig clarinet soloist. The instrument featured a new key operated by the left thumb, simultaneously opening the throat A' key pad and the side key trill B¹-flat pad. Wurlitzer also fitted another key in the position of third trill key, which, when pressed together with the throat A' and speaker keys, produced a true B¹-flat[39].

2. In the 1940's, Rosario Mazzeo, a member of the Boston Symphony Orchestra from 1933 to 1966, constructed a mechanism of extreme simplicity which effectively divided the thumb speaker key into two separate keys, one operating as the regular speaker key and the other serving as a lever to directly open the true B¹-flat pad

[38]Mazzeo, op. cit., p.9.

[39]Mazzeo, op. cit., p. 9.

normally operated by the top of the index finger of the right hand as the side B flat trill key. This was made by Mazzeo for his own use and not patented[40].

3. William Stubbins was, in 1932, granted a U.S. patent for the Stubbins-Kasper mechanism which operated the pad of a new resonance hole whenever the throat A' key was used in conjunction with the speaker key, thus providing a more finely tuned and resonant throat B^1-flat. This mechanism was taken up by Leblanc and was applied to a student model clarinet in 1980[41].

4. Towards the late 1950's Thomas F. & Robert J. McIntyre of Naugatuck, New Haven, U.S.A., developed a new approach the throat B^1-flat problem. A new clarinet was designed where the throat notes G'-sharp, A' and B^1-flat were operated by the Boehm rings surrounding the first three tone holes on the upper joint and played by the fingers of the left hand[42].

There are several advantages in this design. Firstly, the mechanism involved in producing a throat B^1-flat makes use of a vent hole drilled in the ideal position for resonance and intonation on this note. Secondly, the fingers of the left hand remain on or above the tone holes rather than awkwardly shifting to operate the conventional throat note keys; thirdly, the awkward thumb motion for B^1-flat is eliminated. Moreover, a new trill key was added to the

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[40] Ibid.

[41] Brymer, op. cit., p.52.

[42] Advertisement in The Clarinet, Vol. 8, No. 2 (Winter 1981) p.59.

clarinet, operated by the thumb, and, in combination with various fingerings on the rings of the left hand, enabled trilling from the break notes to two notes normally within the next register (i.e. B^1 and C^1). These trills, however, are available on both the French and German systems, operated by different keys. One other advantage was that the speaker key served only as the overblowing key, without is usual compromised function as a B^1-flat key. The compromise usually made in its positioning was therefore unnecessary; and so a better position for this venting hole was calculated, and the diameter of the hole was widened[43].

There is one major disadvantage with the McIntyre design, and this involves the excessive amount of cross-fingerings that players would be faced with in many passages[44]. Despite its advantages, this design has not appeared to gain any recognition or popularity amongst professionals; however McIntyre clarinets are still available today through the makers in the U.S. (See fig.4)

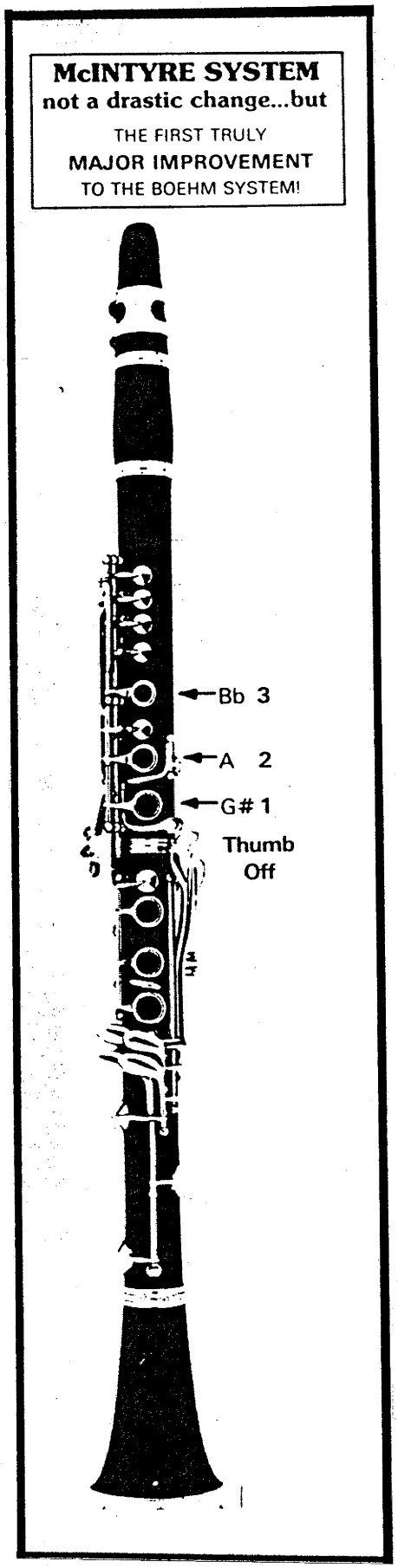
5. The Mazzeo System.

This system was devised during the 1950's, also by Rosario Mazzeo, who had previously devised a simple mechanism for the problems associated with the throat B^1-flat for his own use. Mazzeo studied most of the designs of instruments made before the 1950's, and through his experiences in the Boston Symphony Orchestra, he was able to observe the problems encountered by his woodwind colleagues. The principal patent for the Mazzeo clarinet was issued in 1959.

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[43] Ibid.

[44] Mazzeo, op. cit., p. 33.



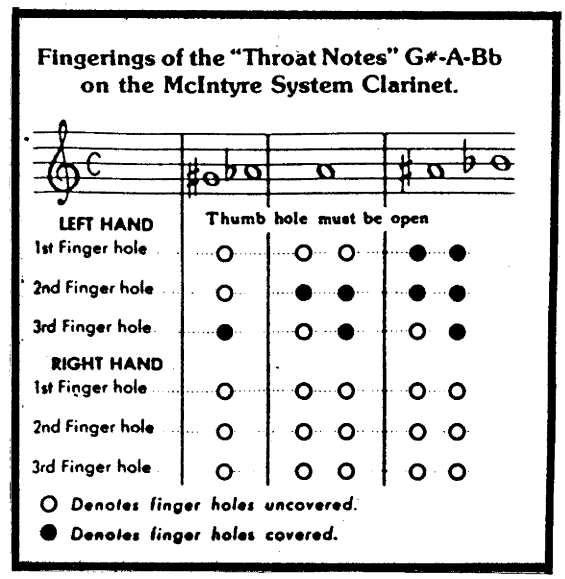
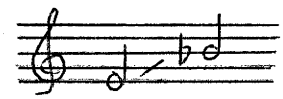


Fig. 4: Advertisement for the McIntyre System.

The Clarinet Vol. 8, No. 2 (Winter 1981) p. 59.

Mazzeo sought to eliminate the throat B¹-flat problems by designing separate tone holes for the register change function and the B flat function, while still retaining the usual side B¹-flat trill key normally operated by the right hand, and the usual throat G¹-sharp and A¹ keys. The thumb, being the strongest digit, yet most lacking in dexterity should therefore be relieved of as much responsibility as possible in operating keys. Mazzeo recognised this fact, and shifted the responsibility of operating the throat B¹-flat mechanism from the left thumb (which would also normally control the speaker key) to the right hand, through linking the true B¹-flat venting hole to the right-hand rings. In this way, the left thumb was only required to perform two simple actions - in raising and lowering itself to and from the tone hole, and in operating the speaker key. The awkward twisting action encountered in using the Klose system in, for example, the interval  was thereby completely eradicated[45]. Mazzeo's arrangement of keywork enabled the left hand to remain in a more constant and comfortable position. The left hand is used far more often than the right because all right-hand notes can only be produced if the left-hand fingers are covering the holes. Therefore Mazzeo's logic was to take some of the burden of technique from the left hand and give it ot the right hand.

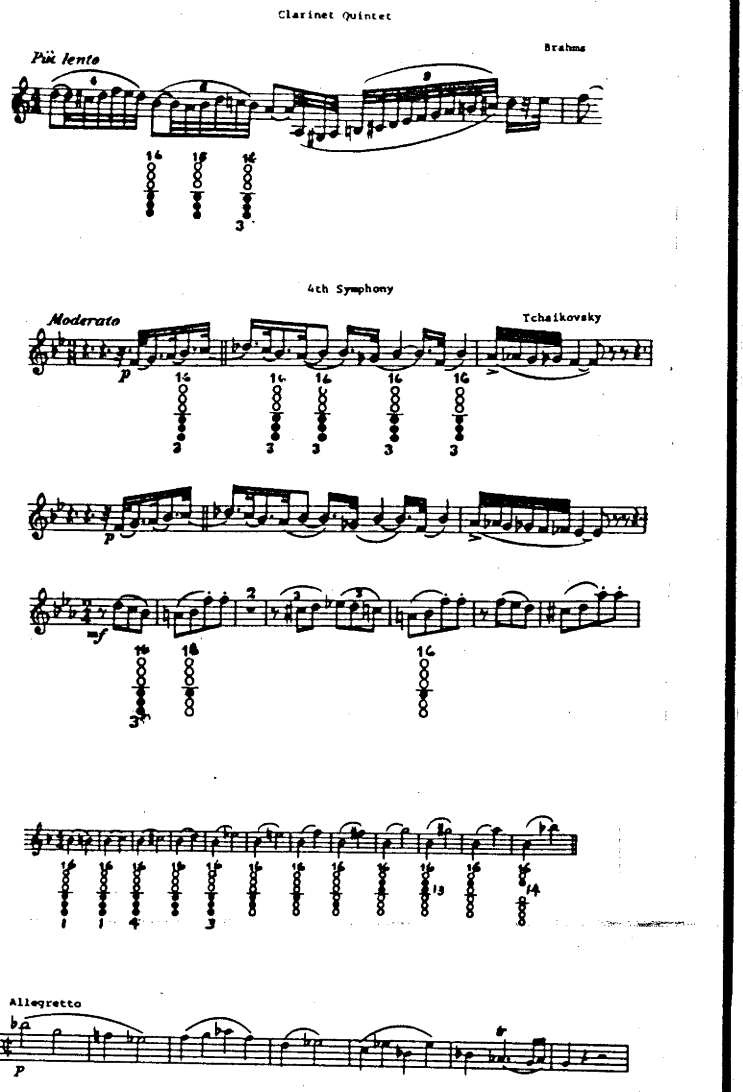
With the improved intonation and resonance of the throat B¹-flat of Mazzeo's system, a more even, homogeneous quality of tone was thus enabled. A sonorous B¹-flat could be produced by using any or all of the right hand rings in conjunction with the throat A¹ key, and a more fluent legato between the B¹-flat and any other note was

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[45] Ibid.

made possible.

The following are examples of the use of the Mazzeo system:



Mozart, *Quintet for Clarinet and Strings,* first movement.

Brahms, *Sonata in E-flat,* first movement.

Mazzeo, R.: "The History of the Clarinet's B'-flat Mechanisms in The Clarinet Vol. 7, No. 2, (Winter 1980) p. 8.

Another advantage of the Mazzeo System is that an alternative throat A can be produced by putting all four right hand fingers down. Other smaller features have been added, such as the articulated E^1/F^1-sharp[46].

Apparently there are only two disadvantages in using the Mazzeo System. Firstly, on first using the instrument, players may have some trouble co-ordinating the left hand index finger in pressing the throat A^1 key cleanly together with the right hand motion necessary to pass from throat A^1-flat to B^1-flat. This is normally only an initial problem, and most players seem to quickly overcome the lack of co-ordination.

Secondly, there are problems for players who regularly and automatically use the right-hand fingers to add sonority to, and to alter the pitch of, the troublesome break-notes[47]. If this habit is too deeply instilled, a player changing to the Mazzeo system may find that he cannot adjust to the new system using the right-hand rings to produce a throat B^1-flat only, rather than keeping the right-hand fingers down as a matter of course in playing the usual throat note fingerings. Mazzeo himself, and several other well-known American clarinet players have been able to adjust to this system of keywork successfully; however, being advertised as a new system, and involving certain fundamental changes in fingering, the Mazzeo system has been successful in gaining only a small foothold in the professional world. Mazzeo-system clarinets have been produced in the keys of B-flat and A by Selmer and Company within the last twenty

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[46]Mazzeo, op. cit., p. 34

[47]Brymer, op. cit., pp.54, 55

years, followed by more recent production of models in E-flat, D, C, B-flat Bass Clarinet, A Bass and Basset-Horn in F[48].

The Mazzeo System seems to provide solutions for many problems, but primarily solves those associated with the throat B[1]-flat. It offers ample advantages, however most clarinettists appear to be unwilling to make the initial change to adapt their fingering to suite the Mazzeo clarinet.

6. The Hanson-Bay Key.

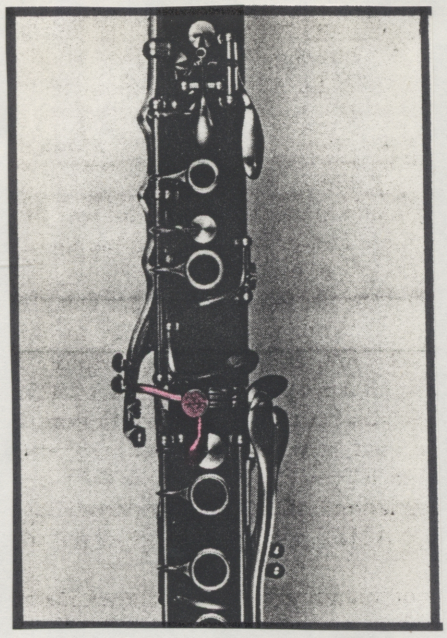
Of all the attempts to solve the throat B[1]-flat problems, the Hanson-Bay key appears to be the most easily adaptable to the Klosé clarinet. Dr. Shelley Hanson, of California State University at Fresno, and Dr. Charles Bay of California State University at Northridge, obtained a patent for this invention in 1980[49]. The key can be attached to any French-System clarinet without interfering with any of the other fingerings or keywork. It essentially provides an alternative key to operate the side B[1]-flat trill key. Installation is simple and only requires a little careful soldering.

The Hanson-Bay key lies above the right-hand index finger hole in a position similar to that of the A[1] key operated by the left index finger. The key has been designed to provide for adjustment for variations in hand size and position among players. Adjustment is made possible by two set screws, to alter the distance of the key from the first finger hole of the right hand and to change the height

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[48]Mazzeo, op. cit., p. 35

[49]Hanson, S. and Bay, C.: A New Solution to the Old "Throat B-flat" Problem: the Hanson-Bay Key in The Clarinet, Vol. 9, No. 3, (Spring 1982) p.31



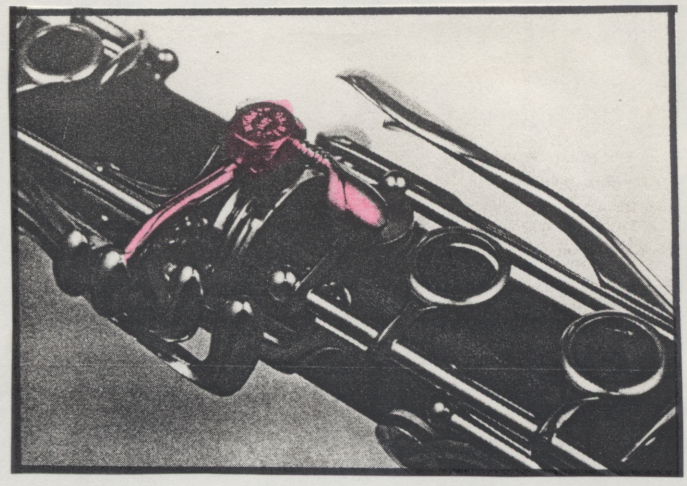


Fig. 5: The Hanson-Bay Key installed on a B-flat clarinet. Set screws are in the key-linkage block for position adjustment.

The Clarinet Vol. 9, No. 3 (Spring 1982) pp. 30, 31.

of the key above the body of the instrument. Only a small amount of practice is required to gain the technique needed to operate the key. The makers were able to assimilate the key's usage with their existing techniques within one week[50]. (See fig. 5)

7. Ted Planas B^1 Mechanism.

The American clarinettist, John Denman, owns a pair of clarinets with a specially designed B^1-flat vent by Ted Planas of London. These clarinets were originally made by E.J. Albert in about 1900 and were based on the Boehm system, but the register key which normally opened a hole at the back of the instrument, was designed with an arm curving round to open a hole at the top. This allowed Ted Planas more recently to cut another hole near the trill key hole with identical dimensions, to be operated only when both the throat A^1 key and thumb key were depressed through a rocking-beam mechanism. With heavy springing on the A-key, the register key remains closed, allowing the thumb key to open only the extra B^1-flat hole[51].

This mechanism is very practical; however, it is only viable on clarinets with the register key opening a hole on top of the instrument. If the mechanism fails to operate the usual B^1-flat is produced. It cannot easily be adapted to the standard Boehm clarinet manufactured today.

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[50] Ibid, p. 30

[51] Livingwood, M.D.: John Denman's Improvements to Standard Boehm-System Keywork, in The Clarinet, Vol. 5, No. 4 (Summer 1978) pp.12, 13.

II Variations in the Shape and Size of the Hand

Other problems arise from the physical differences in shape and size of hands and fingers. Not every hand will fit perfectly to the layout of modern standard keywork. Custom-made keywork is usually expensive, but should be carried out on all instruments belonging to one player to facilitate changing from one clarinet to another. Several hand problems are described below; in general, more study into the shape and movements of the hands is needed to create a better design of keywork placement for the average hand.

1. Plateaux clarinets

Not all children and few adults have large or flat enough fingers to adequately cover the finger holes of the clarinet. The sealing of the lowest finger hole is often problematic due to its larger size. Great pressure is sometimes applied to spread the finger over the hole, causing tension in the hand which limits technical fluency.

The covered hole or a plateaux instrument allows all tone holes to be covered by pads, but few makers at present apply this to the clarinet, apart from the bass clarinet which requires a surface area more than most fingers could provide to cover its tone holes. On soprano instruments, the ring keys could be filled in and padded, but the keys would then need to be raised higher in order not to muffle the sound or flatten intonation. Such an addition to clarinet keywork would greatly help those with smaller fingers and would also

aid the multi-instrumentalist[52].

2. Thumb rests.

While the right-hand thumb rest does not have any function as a key, it is still part of the metal-work and plays an extremely important role in dictating the position of the right hand. The thumb rest is often too low on the instrument to allow comfortable access to the F-sharp/C[1]-sharp key. Repositioning of the thumb-rest is possible, and the alteration can be made more versatile by fitting an adjustable thumb-rest. Both Buffet and Leblanc manufacture such a product.

3. Left hand thumb.

The left hand thumb operates the register key and the tone hole below it. The register key is normally located directly above the thumb-hole ring, but its acceptable proximity should be decided by the shape and size of the player's thumb. The key itself can be bent to raise or lower its position, and if necessary, the end can be filed off to shorten the key[53].

4. Slippery keys.

The eight keys operated by the little fingers of the left and right hands are often slippery due to their smooth surface, shape and position.

Touchpieces could be made flat or slightly concave so that

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[52]Richmond, S.: Clarinet and Saxophone Experience (London; Darton Longman & Todd; 1972) pp. 31, 32.

[53]Richmond, op. cit., p. 26

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fingers could have a greater surface area contact, thus minimizing the risk of slipping[54]. The existing convex shape of most touchpieces allows a wide range of angles of approach by the fingers, thereby being suitable for a wide range of hand shapes and sizes. Unfortunately, the nature of this convex shape increases the possibility of slipping. Flatter or concave keys would dictate the precise position of the fingers, and would therefore be unsuitable for general manufacture, but could be very effective when custom-made for the individual.

Some current models have grid etching on the touchpieces to promote a better grip between the surface of the metal and the skin. This simple idea is effective and could be applied more often, especially to the left-hand F-sharp/C^1-sharp key. A similar but temporary effect can be obtained by the application of tailored pieces of sticking plaster to the touchpieces.

The height and length of keys can be adjusted to suit the individual. Keys can be bent (preferably with the aid of heat, depending upon the type of metal) to a suitable height, although padding and linking alignments would have to be adjusted in turn. The tips of touchpieces can be filed if shorter keys are needed, but custom-made keys are the only solution when longer keys are required.

Some models are currently produced with an alternative G-sharp/D^1-sharp key operated by the little finger of the left hand. Many players find its placement too low in relation to the surrounding keys, and it is often difficult for the finger to stretch

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[54]Richmond, S., op. cit., p. 30

so far downward in comfort. This touchpiece could be slightly lengthened in cases where the key is awkward to operate, however sufficient clearance of the other keys must be allowed.

5. Changing from B-flat to A clarinet.

Once again, the player with smaller hands is disadvantaged when changing from one instrument to another, especially from B-flat to A clarinet as the finger spacing and diameter of some holes are larger. A pair of clarinets of the same make is advisable, and similar adjustment of key heights and spring tensions can minimize loss of control. Plateaux clarinets would be useful in this situation, where precise placement of fingers, especially on the lowest finger hole, is not necessary.

6. Offsetting holes.

The tone holes closed by fingers are quite often drilled in line with each other. Offsetting tone holes to correspond with the natural falling position of the fingers is very helpful in promoting a relaxed playing position and operation of the little finger keys. Some makers offset the third finger-hole of the left hand towards the left which provides a more comfortable position for most players. The rings around the finger holes should be precisely level with the tops of the holes when the fingers press the rings down[55].

III Finger Agility and Co-ordination

With the constant growth of challenging repertoire,

[55]Richmond, op. cit., p. 24

incredible technical demands are increasingly placed upon the clarinet player. The development of keywork owes much to the composition of virtuosic works. As mentioned earlier, several makers have gone far beyond the limitations of the standard modern clarinet to provide solutions for problem fingerings, but often their systems were far too complicated to be adopted, or were simply overlooked.
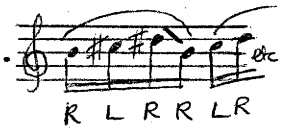
1. Boehm System and Variations

The standard seventeen-key, six-ring Boehm clarinet is the most popular model in general use, but further models with extra keywork are also available, including one or more of the following additions:-
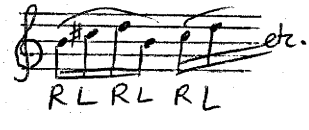
(i) An extra ring around the third finger hole on the upper joint, providing a forked fingering for E-flat/B^2-flat and F^3 notes. This also enables a more acceptable trill from C-sharp to D-sharp by raising the left hand index finger.

(ii) An articulated mechanism for the C-sharp/G^2-sharp key, enabling a more appropriate tone-hole position moved from the side of the instrument to the front (in line with the other finger-holes). This arrangement also reduces the possibility of large water droplets condensing in the hole. The main advantage of such a mechanism is that the troublesome F^2-sharp to G^2-sharp trill is greatly simplified and only requires trilling of the G^2-sharp key, whereas co-ordination of two fingers is required on the standard Boehm system.

(iii) An alternative G-sharp/D-sharp key is provided for the left hand little finger. This key completes the duplication of the four right-hand little-finger keys and eradicates the need for sliding from one key to another in some passages, e.g.



becomes:



(iv) The clarinet is lengthened to provide for an extra key for low E-flat. A touch-piece for this key is grouped with the others, operated by the right hand little fingers. This key also provides an excellent second register B^1-flat alternative which can be useful in trilling and in legato passages[56].

2. Some very simple additions to keywork can have the effect of speeding particular aspects of a player's technique. Two examples of such additions can be seen in fig. 6 made by Hans Erikson in Johnson City, U.S.A. Photograph A shows the hands in a normal playing position, with the obvious additions exposed. Photograph B shows the right hand index finger pressing the new alternative C-sharp/G^2-sharp key, enabling a faster trill than usually accomplished by using the original key with the little finger of the left hand. Photograph C shows the left hand index finger slightly lower on the tone hole than usual, thereby pressing a small sliver key which produces an E-flat or B^2-flat. This simple invention is very useful in fast passages involving these notes and in a tremolando from G^2 to B^2-flat.[57]

IV Intonation

The acoustical nature of the clarinet has created many problems for the instrument maker. Altering the dimensions of one tone hole, for example, can have far greater implications than

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[56] Richmond, op. cit., p. 22

[57] Schmidt, R.: An Entrepreneurian Approach, in The Clarinet, Vol.12, No. 1 (Fall 1984) p. 43

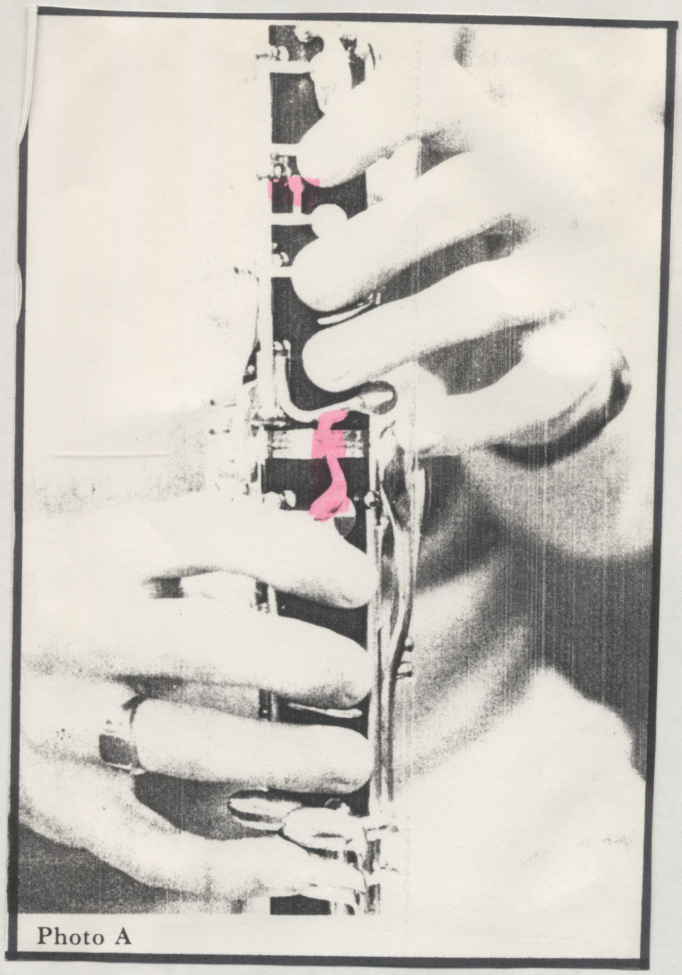


Photo A

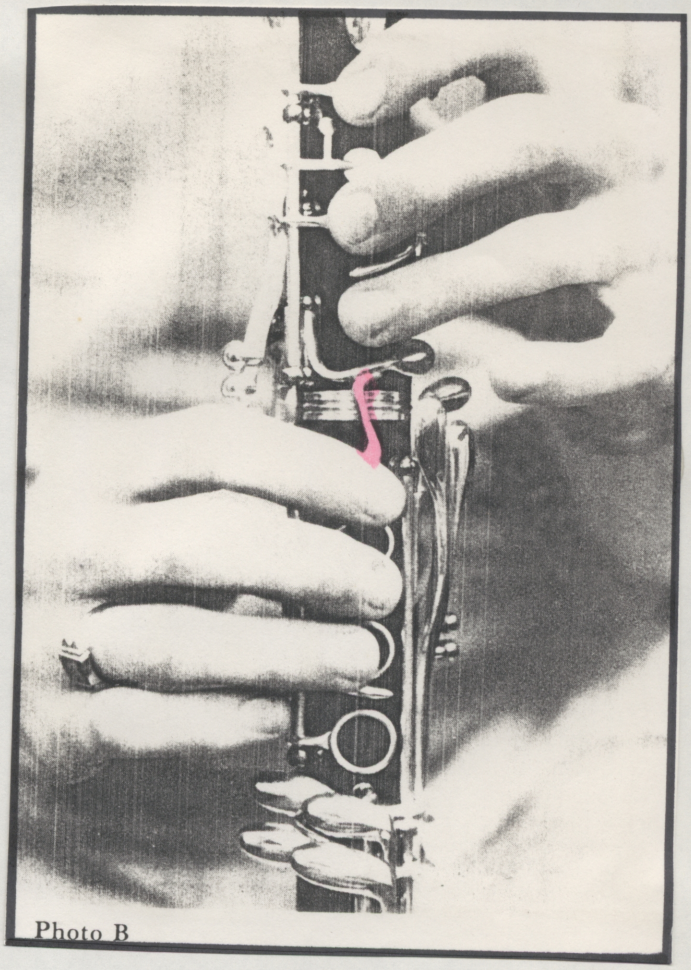


Photo B

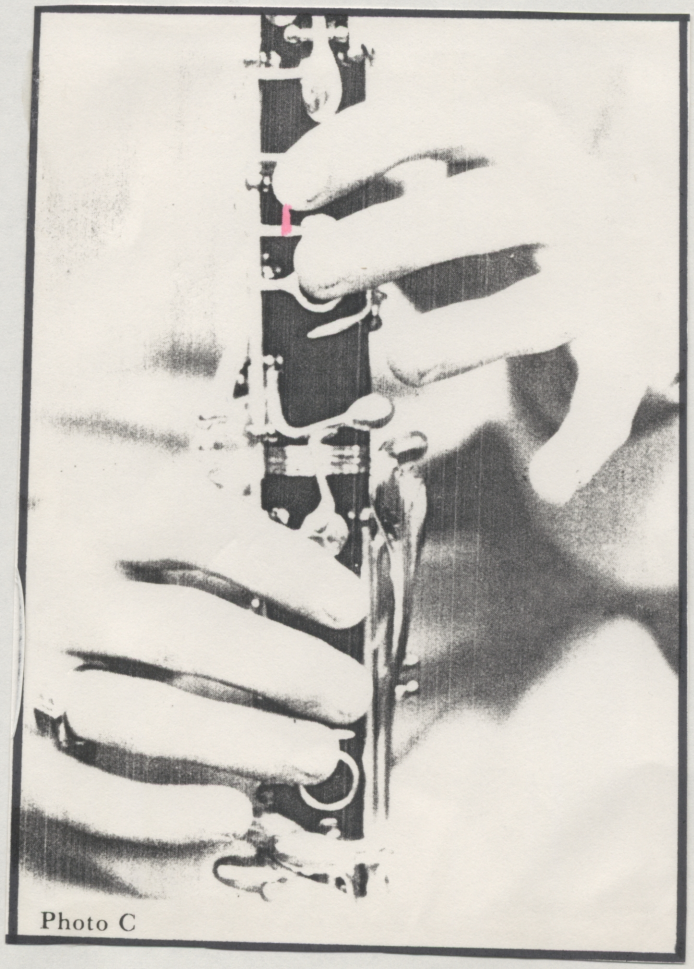


Photo C

Fig. 6: Keys invented by Hans Eriksen, Johnson City, U.S.A.

Photo A: Hands in normal playing position. Extra keys highlighted.

Photo B: Right-hand finger (index) pressing C-sharp / G^2-sharp extension key.

Photo C: Left-hand index finger holding down E-flat / B^2-flat alternative key.

Schmidt, R.: "An Entrepeneurian Approach", in The Clarinet Vol. 12, No. 1 (Fall 1984)

originally expected. Generally, the lower notes of the clarinet tend towards flatness, and the upper notes tend towards sharpness, although great variations in intonation occur from instrument to instrument.

1. Flatness of lower notes.

Puchner, the German firm better known for the manufacture of bassoons, currently have an advanced design for their clarinets. The lowest F on both Klosé and Oehler clarinets is usually flat, therefore Puchner has installed a key operated by the thumb to open a small venting hole near the closed F tone-hole to raise the pitch slightly when required. This has been applied to both systems[58].

Another German instrument maker responsible for similar advances is Herbert Wurlitzer. On his Oehler clarinet, he has installed a similar key to that of Puchner's, to raise the pitch of low E.

2. Extreme altissimo intonation.

The extreme altissimo is difficult to play well in tune, and most notes above A^3 are awkward to play without a suitable reed. Mouthpiece dimensions and reed quality play important roles in the production of high notes, but keywork can provide some help in this aspect of playing.

A second register key has been applied to some clarinets, with the hole being bored in a more suitable position for the

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[58]Gibson, L.: Boehm System Alternatives as Custom-made in Germany and Austria, in The Clarinet, Vol. 7, No. 2 (Winter 1980) pp. 20, 21.

production of notes in the extreme register. The key is operated by the left-hand thumb and lies next to the original register key.

3. General Improvements.

Herbert Wurlitzer's instruments are custom-made and he is currently developing a new model Boehm system clarinet. This instrument has several new venting keys and also has the B/F^2-sharp/D^2-sharp resonance venting mechanism available on Boosey and Hawkes 10-10 clarinets[59]. This mechanism was originally patented by Geoffrey Acton of London, but was first invented in principle by Oskar Oehler. Standard Boehm systems do not include this key, which provides better intonation for the three fork fingerings, especially D^2-sharp. A forked fingering is simply one in which the fingering forces the air column to emerge from two holes. Usually the tone of a forked note is unclear and the D^2-sharp on most standard Boehm clarinets is unacceptably flat. The Acton patent provides an extra key governed by the forked finger (the second finger of the right hand), which opens another hole at the side of the clarinet so that it is produced with correct acoustical venting[60].

V Mechanical Weaknesses

Modern clarinet keywork, when observed in detail, is primitive in many ways. Many basic mechanisms could be improved, but common weaknesses can be found among even the most recently produced clarinets. Some mechanical weaknesses are discussed below.

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[59]Gibson, L.: The Herbert Wurlitzer Boehm Soprano Clarinets, in The Clarinet, Vol. 9, No. 4 (Summer 1982) p. 3.

[60]Brymer, op. cit., p. 50

1. Pivots.

Keywork pivoted on point screws gives a light and responsive action, but the points are prone to wear and the action becomes slack as a result. With play in the keywork, pads do not seat precisely on tone-holes and the action develops a rattle. One possible improvement is the use of screws with a "finger" extension rather than a point. Keys with through rods as an alternative to pivot screws need stronger springs to counteract the greater friction of rods, especially if a rod or its sheath are slightly bent. Lubrication of all pivots and rods assists in cutting down friction[61].

2. Rattling keys.

Nylon sheaths, fish skin, cork and felt can be applied to keys to decrease the rattle on some clarinet keywork. Simpler designs seem to be less noisy in this aspect, e.g. Boosey and Hawkes 926 model clarinets have a simple lever to corked-lever mechanism for the left hand F♯/C¹-sharp and E/B¹ keys, whereas Buffet R13 clarinets have one lever penetrating another, requiring a fine cork lining to quieten the action. This cork piece is fragile and wears quickly, so that the key develops a rattle.

3. Pad-cup shape.

Most pad cups are shaped in a slightly conical fashion, however the shape of the backing card of pads is completely flat. If pad cups were flat such as on flute or saxophone, there would be less chance of the pad sliding out of position during fitting, and there

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[61]Richmond, op. cit., p. 24

would be more support for correct pad seating and alignment[62].

4. Posts.

Many clarinets are being produced with posts (pillars) which screw into the wood. Precision of alignment between two posts for the fitting of the rod or pivot is absolutely necessary, but quite often one post becomes slightly twisted due to spring tension. All posts should have foot screws on either side to lock their position, or alternatively they should be mounted together on metal strips or plates[63].

5. Springs.

Most needle springs are made of blued-steel and leaf springs are made of brass. Many players find that such needle springs are difficult to adjust due to their brittleness. The metal often snaps when increased tension is brought to bear upon the spring. Piano wire can act as a good substitute as it is more easily adjustable without the brittle quality of blued-steel. The problems of sticking leaf-springs can be solved by the application of a lubricant.

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[62]Richmond, op. cit., p. 31.

[63]Richmond, op. cit., p. 31.

Conclusion

Throughout the historical development of the clarinet, instrument makers and players have been greatly concerned with the instrument's limitations imposed by it's acoustical nature. Later developments have mainly centred around the problems associated with the throat B^1-flat and the break between the lower and middle register. Keywork advances have provided some solutions for these problems, and have been invented to effectively speed technique, correct faulty intonation and extend the range of the instrument.

Despite the existence of advanced keywork inventions, the majority of clarinets produced today still take the form of the Klosé-standard Boehm system. One reason for the continued production of this instrument is its obvious popularity in serving as an institution of assured success. The addition of keys and the lengthening of the tube only adds more weight, which must be born by the right hand thumb, already under great stress from supporting the instrument. Many players find such extra weight undesirable and therefore opt to play standard Boehm clarinets. However, with the increasing popularity of neck straps and supports for the instrument, the weight of the clarinet is becoming less of an important issue. New systems such as the Mazzeo System, are often greeted with disapproval in the professional world because of the relearning involved in adopting a different fingering pattern. Small instrument makers are reluctant to risk their sales while only a small market exists for such instruments, but some larger companies are becoming more versatile in their approach, producing a greater variety of models and additional key options.

In the abstract, modern clarinet keywork offers a strong basis for fluent technique and intonation, and many existing problems can be dealt with by the addition of custom-made keys. Individual technical weaknesses can thereby be improved or overcome. Practically, however, the more efficient systems are never utilized: they remain in the hands of the inventor and the converted few. It seems the future of the Klosé-Boehm system clarinet is still secure, even if some manufacturers are updating their instruments and increasing the range of possible solutions for existing problems of modern clarinet keywork.

BIBLIOGRAPHY

Books

BRYMER, J., Clarinet (London; MacDonald & Jane's; 1976)

KROLL, O., The Clarinet (London; B.T. Batsford Ltd.; 1968)

LAWSON, C., The Chalumeau in Eighteenth Century Music (Ann Arbor, Michigan; UMI Research Press; 1981)

MEULLER, K.A., Complete Guide to the Maintenance & Repair of Band Instruments (New York; Parker Publishing Co.; 1982)

NEDERVEEN, C.J., Acoustical Aspects of Woodwind Instruments (Amsterdam; Fritz Knuf; 1969)

PINO, D., The Clarinet and Clarinet Playing (New York; Charles Scribner's Sons; 1980)

RENDALL, G.F., The Clarinet: Some Notes on its History and Construction (London; Ernest Benn Ltd; 1978)

RICHMOND, S., Clarinet and Saxophone Experience (London; Longman & Todd; 1972)

THURSTON, F., Clarinet Technique (3rd edition; London; Oxford University Press, 1977)

Periodicals

International Clarinet Society's Magazine, The Clarinet, (Washington, James Schaepflin & Assoc., Volumes from February 1974 to Winter 1986.