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Clarinet

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Clarinet

(Fr. *clarinette*; Ger. *Klarinette*; It. *clarinetto*).

Generic term for a wind instrument sounded by a single beating reed; in the system of Hornbostel and Sachs such an instrument is classified as an **AEROPHONE**: reedpipe, with a reed consisting of a single percussion lamella. The clarinet of Western art music (from which the generic term is taken) is of essentially cylindrical bore and is made in a variety of sizes and tonalities; the soprano instrument pitched in B \flat , with the 'Boehm system' of keywork and fingering, is the most widely used today (see §II below).

See also **ORGAN STOP**.

I. General

1. Introduction.

A clarinet consists of a closed tube with a single beating reed; such instruments are widely distributed and exist in a variety of forms. The tube is usually cylindrical, but occasionally funnel-shaped or ending in a bell. A clarinet may be idioglot, with the reed cut from the material of the tube itself and left attached at one end (the reed is sometimes held slightly away from the tube by a hair or straw inserted across the slit at the base) or heteroglot, with the reed, often made of a different material, tied or otherwise fastened on. An idioglot reed may be up-cut (with the reed cut upwards) or down-cut (towards the top of the tube, with the vibrating end facing the bottom of the tube).

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2. Single clarinets.

Instruments consisting of a single tube have been used, generally as pastoral instruments, in Central Asia, the Baltic countries, the Balkans, Greece, Hungary, North Africa, South and South-east Asia and South America. Most are idioglot instruments made of naturally cylindrical material: wood, bone, quill or stalks of straw or reed in northern areas; stalks of rice or bamboo in South and South-east Asia; bone, cane or gourd in Latin America. A chalumeau described by Trichet (c1640) was a rustic pipe made from a wheat stalk with a reed cut into its upper surface. Clarinets sounding a single note are found in South America and on the west coast of North America. Others produce a range of notes through the use of finger-holes or by other means. A form of the Lithuanian *birbynė* is an idioglot instrument of straw, quill, etc. with a reed cut into the tube near the top and one to three finger-holes; the *balaban* of the Uzbek and Tajik peoples is a wooden cylinder with a single reed inserted into the head. The *ole-ole* of North Sumatra has a rice-stalk reed with slits which expand when blown to produce a small range of pitches; the large conical

resonator is made of bamboo or strips of coconut leaf. On the *pega* of Latvia the length of the vibrating tongue is varied by the player and the open end stopped and unstopped. A few types (e.g. the *chamada do carnaval* of Portugal) consist of an animal horn into the top of which a mouthpiece with a single reed is inserted. The Western orchestral clarinet and other members of its family, including the modern Hungarian **TÁROGATÓ** and the Greek *klarino*, are single clarinets with keywork and heteroglot reeds.

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3. Multiple clarinets.

Clarinets with more than one tube are found in North Africa, Nigeria, the Near East, the Balkans and eastern Europe, Central Asia, South Asia and South-east Asia. On some double clarinets, one of the pipes is a drone; on others, both pipes are melodic, but tuned slightly differently to create beats. They are characteristically played using the technique of circular breathing. One of the best known is the **PŪNGĪ**, the 'snake-charmer's pipe' of South Asia. It has a bottle gourd wind cap from which emerge two small pipes of wood, cane, etc. with idioglot reeds. One is a drone pipe with several tuning-holes (the unused ones sealed with wax), the other is the playing pipe; a few have a second drone of metal. The neck of the gourd serves as a mouthpiece and the player employs circular breathing, with the cheeks puffed out to serve as an air reservoir. The *muralī* of Pakistan, Gujarat and Rajasthan is a double clarinet with a long wooden tube, through which the player blows into a wood or gourd wind cap; the two cylindrical pipes, one with six finger-holes, the other a drone, are glued together and the instrument is played in virtuoso style, the player covering a range of over two octaves. The **MIJWIZ** and related instruments of the Islamic world, possibly descended from the ancient Greek aulos, consist of two parallel pipes of equal length, made of reed or metal. Each pipe generally has six finger-holes and a thumb-hole, and one is tuned slightly higher than the other; the reeds are down-cut and placed completely inside the player's mouth. Formerly played by shepherds, it is now played by professional performers for festivals. A single melody is played in unison on both pipes. Another common type is represented by the Egyptian **ARGHŪL**; it is made of bamboo and has a drone pipe and a melody pipe with five or six finger-holes. The *launeddas* of Sardinia is a triple clarinet with a drone and two playing pipes, one for the higher notes and one for the lower. A piece of wax at the lower end of each tube allows the production of quarter tones. Some double clarinets also exist in bagpipe versions (e.g. the *diple* of Bosnia and Herzegovina).

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4. Hornpipes.

A hornpipe may be a single instrument or a double instrument with parallel pipes. Each pipe ends in a horn bell, and there is often a ring of horn around the reed. The instrument was known in medieval Europe and until the 18th century or so in England, Scotland (**STOCK-AND-HORN**) and Wales (**PIBGORN**). Instruments of this family remain in use on the Iberian peninsula and in the Baltic countries. A type of Lithuanian *birbynė* has a reed attached to a cow horn or to a cylinder of wood with a bell of birch-bark or horn; the latter is made in several sizes and is used in traditional music ensembles. The Basque *alboka* is a double-reed hornpipe. Bag hornpipes are known in Central Asia, Russia and south from the Volga region to the Greek islands, the Balkans, North Africa and India (see **HORNPIPE (I)**).

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5. Transverse clarinets.

Transverse clarinets are so-called because the position of the reed requires the instrument to be held horizontally. They are mainly found in West Africa (the only known instance of such instruments outside Africa is the *caña de millo* of Colombia) throughout the savanna region, from Senegambia to Chad. They are made from a stem of sorghum from which the pulp has either been pulled with a piece of wire (as among the Angas people of Nigeria), or pushed out with a metal rod (among the Berom of Nigeria) or with a stick of henna shrub (the Hausa of Nigeria and Niger). Small clarinets consist of a single internode, and larger ones of two internodes; others are intermediate in length. Short versions include the clarinet of the Kilba people, Nigeria (23 cm), the Hausa *tilboro* (30 cm), the *tsiriki* of the Kebbi, Nigeria (35 cm), the *tilibartci* of the Fali, Cameroon (40 cm), and the *veng-kung* of the Angas (35 to 40 cm). Longer clarinets include the Hausa *damalgo* (50 cm), and in Nigeria the Dakakari *k'cindo* (60 cm) and the Berom *gworitod* (63 cm). All are idioglot with a single beating reed consisting of a thin strip cut from the stem about a third or a quarter of the distance from one end. For example, the reed of the Hausa *tilboro* is 5 cm long and 5 mm wide. Some have a tuning noose (a piece of thread wound loosely round the reed) with which the player controls its movement. Short instruments conform to this pattern, for example, the *tunturu* of the Maninka people of Mali, the *leru* of the Dogon of Mali, the Fali *tilibartci* of Cameroon, and, within Nigeria, the Angas *vengkung*, Cham *birong*, Duka *otwah*, Gunga *hitiribo*, Hausa *tilboro*, Kebbi *tsiriki*, Kambari *kungagiwa*, Kilba *ligaliga* and Nupe *binakun*. Larger instruments have either one end inserted into a small calabash resonator (about 8 cm in diameter), with up to four holes (1 cm) cut in the surface (Hausa *damalgo*), or both ends inserted into calabash resonators (for example, the clarinet of the Bassari people of Togo), or, more commonly, both ends inserted into whole calabashes with side windows (See [BURKINA FASO](#) [not available online]): the *boū-kām* or *bumpa* of the Bisa people, Upper Volta, the *k'cindo* of the Dakakari and the *tukpolo* of the Gwari, Nigeria. In more recent times resonators have been made of cow horn or discarded torch heads. When the instrument has no resonators, differences in pitch are obtained by closing the open end with the hand (as among the Fali and Kilba peoples), the index finger of the left hand (Hausa *tilboro*) or the thumb of the right (Zamfara Hausa *tagalabu*, Kebbi Hausa *tsiriki*), according to the playing position. Instruments with calabash resonators usually have a finger-hole at the distal end which may be stopped by the left thumb, as with the Hausa *damalgo*. All versions are played in an approximate horizontal position with the reed brought up to the mouth in such a way that it can be made to vibrate by both blowing and sucking.

Most instruments are made by boys or young men, usually by copying old models. The maker is usually owner and performer. The most common time of performance is either during or after harvest (November–December), when material is plentiful, and during the remainder of the dry season. Most performance is outdoors: the Dogon people of Mali regard the clarinet as a shepherd's instrument; the Teda of Tibesti, Chad, allegedly acquired their clarinets from Fezzan shepherds; among the Songhai of Mali and Niger, solo performance on the *dillia* is by children; and Kilba boys in Nigeria use theirs while herding goats. Most performances are solo, though these may alternate with a number of players performing together, as among the Berom and Hausa, where, on moonlit nights, groups of young men play for dancing and entertainment of the young men of the town in front of the chief's palace. While most performance is for enjoyment, Lela players use the *k'cindo* to praise people, the Zamfara Hausa call the names of their friends and girl-friends, and Berom groups perform, with scraper accompaniment, at special times of rejoicing. It is extremely common for the transverse clarinet to be used for speech-imitation; the player imitates the syllable-tones of the language on the instrument.

K.A. Gourlay/Roger Blench

II. The clarinet of Western art music

1. The clarinet family.

Clarinets have probably been made in a wider range of sizes and pitches than any other instrument. The following list is intended to give an impression of this variety, and of the periods and areas of currency for the separate instruments. Of these, the following are discussed in

individual articles: [ALTO CLARINET](#), [BASS CLARINET](#), [BASSET CLARINET](#), [BASSET-HORN](#), [CLARINETTE D'AMOUR](#) and [CONTRABASS CLARINET](#).

Piccolo or octave clarinets

C ?Italy, mid-19th century

B \flat 19th century, ? mainly military

A early 19th century; rare

A \flat from early 19th century; chiefly military, especially in Hungary and Italy; also in 20th-century clarinet choirs

Sopranino clarinets

G late 18th century to mid-19th; especially Austria

F early 18th century to early 19th; very widespread military use

E late 18th century to mid-19th; rare

E \flat from late 18th century, replacing clarinet in F; military and orchestral

D from early 18th century; more rare in western Europe after early 19th century

Soprano clarinets

C from early 18th century; becoming more rare in 20th century

B late 18th century to early 19th; rare

B \flat from early 18th century; predominant from mid-18th century

A from 18th century

A \flat mid-18th century to mid-19th, often as clarinette d'amour

G from mid-18th century, often at first as clarinette d'amour; rare – virtually obsolete except in Turkey

Basset-horns

G late 18th century (rare)

F from late 18th century

D late 18th century (rare)

Alto clarinets

F 19th century, especially early

E \flat from 19th century

Bass clarinets

C late 18th century to early 20th

B \flat from early 19th century

A from late 19th century; rare by the end of the 20th century

Contrabass (pedal) clarinets

E \flat from late 19th century

B \flat from late 19th century

2. Structure.

The clarinet is generally made in five separate parts: mouthpiece, barrel, upper or left-hand joint, lower or right-hand joint (the two 'joints' constituting the 'body'), and bell. These sections are fitted together by tenon-and-socket connections, the seal being effected by lightly greased cork. Occasionally, and more especially in the smaller clarinets, the body is made in one piece rather than divided into parts ('joints'). A fully assembled B clarinet is about 66 cm long.

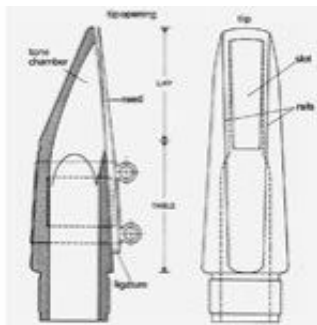


Diagram of the clarinet mouthpiece: (left) in profile; (right) from...

The mouthpiece ([fig.1](#); Fr. *bec*; Ger. *Mundstück*; It. *bocchino*) is tapered on the upper side to fit in the player's mouth. The underside has a slot, over which the reed vibrates, being secured against it by a metal ligature or (on German-made instruments) by stout twine (*Spannschnur*). Below the slot, the underside is flat; this surface is called a 'table'. The 'rails' to either side of the slot constrain the vibration of the reed; the slight curving away from the reed at their upper ends is called the 'lay'. Internally, the mouthpiece makes a transition from the cylindrical bore of the instrument to the complex wedge-shaped tone chamber opposing the reed. The precise shape and finish of the mouthpiece, together with the curve of the rails, are of extreme importance in determining the tone of the

instrument; indeed, variation among mouthpieces (and reeds) more than anything else accounts for the differences of tone-colour among good clarinetists in an age when the rest of the instrument is so nearly standardized the world over (a wider lay tends to produce a louder, less refined tone). For this reason it is particularly important that the mouthpiece should preserve its shape exactly whether warm or cool, wet or dry; ebonite has been the favoured material for the mouthpiece in France and England for almost a century, although cocus wood is still commonly used in Germany.

The barrel (Fr. *barril*; Ger. *Birne*; Austrian *Fassl*; It. *barilotto*) is a short section coupling the mouthpiece to the upper (left-hand) joint. Precisely why it survives is not clear (the patent specification of the Boehm-system clarinet dispenses with it): in part, through conservatism; in part, because of the rather inelegant appearance of most barrel-less clarinets; and perhaps in part to provide an easily replaceable section to take the strain (and possible resultant cracks) from excessive contrasts of moisture and warmth near the mouthpiece. Most players make small adjustments to the pitch during performance by slightly separating the barrel and upper joint at the tenon, while many possess two barrels of slightly different lengths for the same purpose.

The upper and lower joints carry all the finger-holes and keywork and the greater part of the bore. At the lower end the funnel-shaped bell serves to radiate the sound of the lowest few notes. Over most of the range, however, the sound is radiated almost entirely through the side holes rather than the bell.

The weight of the instrument is taken by the right thumb, supporting a projection (thumb-rest) on the underside of the lower joint. The fingers and the left thumb control the seven open holes and 17 keys on a standard instrument. Much of the keywork is interconnected and in particular there is a connection (Fr. *correspondance*) between the upper and lower joints which requires correct alignment in assembling the instrument.

The favoured material for the clarinet since the mid-20th century has been the heavy African blackwood *Dalbergia melanoxylon*. Also in the second half of the century, suitable plastics were developed from which numbers of lower-priced instruments have been made; metal clarinets have been made from the 19th century onwards and are widespread in the USA and in Italy. At the end of the 20th century the diminishing reserves of the slow-growing African blackwood resulted in efforts being made to make better-quality clarinets from other materials or from a wood-based composite (the Buffet-Crampon 'Greenline' clarinet).

While the bore of the clarinet is essentially cylindrical, there are deviations at the lower and upper end; these are for tuning purposes and are measured in hundredths of a millimetre. The overall form of the bore is critical and must be carefully preserved, and proper care of the instrument is thus important. Also important is the finish of the bore: both makers and players take pride in producing and in maintaining or improving it. It is chiefly in this respect that a good instrument can be recognized to improve with use; work by A.H. Benade (C1976) has shown that the subtle smoothing of any sharp edges on tone holes and tenons that may result from regular wiping of the bore is surprisingly important.

3. Compass, registers and intonation.

The lowest note of the standard Boehm-system clarinet is (written) *e*, sounding *d* for a B \flat instrument. A few players possess 'Full Boehm' clarinets extended by about 5 cm and having a key for *e \flat* (sounding *d \flat*); that note, required from time to time by a few composers (Mahler, for example), is otherwise unattainable (*but see* [BASSET CLARINET](#)).

At the upper end of the range the limit is less clearly defined. Most tutors for the instrument give fingerings to *c'''* and some virtuosos are prepared to perform a 3rd or more higher, but many orchestral players would prefer to see nothing above *g'''*.

The compass of the clarinet has long been commonly divided into four registers: chalumeau, throat, clarinet and extreme. The chalumeau register corresponds roughly to the range of the former [CHALUMEAU](#), from the lowest note of the instrument to about *g'* (produced with all fingers and left thumb removed). The clarinet register, which mainly comprises the (overblown) 12ths above this series, from *b'* to *c'''*, has also been called the 'clarion' or 'clarino' register (Walther, discussing the clarinet in 1732, wrote that it 'sounded from afar rather like a trumpet'). The chalumeau and clarinet registers are separated by a region of slightly less interesting timbre, the throat register (also called 'break' or 'intermediate'). The chalumeau register is tonally the most distinctive, being characterized by a marked predominance of odd-numbered partials in the tone, which is often described as 'hollow'.

In the extreme (or acute) register the relationship between fingering and the note produced becomes progressively less obvious. From *c \sharp '''* to *f'''* the notes can be seen as 5th harmonics of corresponding fingerings from *a* to *c \sharp '* in the chalumeau; above this point a large range of possible fingerings becomes available, and the lips are as important as the fingers in achieving a particular note.

In the manufacture of clarinets the chief difficulty lies in the maintenance of precise 12ths between the chalumeau and clarinet registers. The width of these 12ths is controlled mainly by the cones at the top and bottom of the bore. Intonation within each register may be refined by subtle alterations to the tone-hole size, and by undercutting or 'fraising' the tone holes.

At the bottom of the bore there is a transition from a cylinder to the widely flaring cone of the bell. In early clarinets, and almost to the end of the 18th century, the transition was rather sharp and was situated below the lowest tone hole. By the first quarter of the 19th century makers, especially in France, were controlling intonation by making a conical section as far up as the fourth hole above the bell, using different reamers to produce the desired effect. There is still appreciable variation in the length and extremity of this cone among instruments of different manufacture.

At the top of the clarinet, the shape of the mouthpiece bore, the barrel and the top few centimetres of the body can all be used to control intonation. In the earliest clarinets there appears to be a slight contraction in the upper part of the bore leading to the mouthpiece (this in instruments where mouthpiece and barrel are not separate entities). Such late 18th-century instruments as survive in good condition seem to be purely cylindrical right to the mouthpiece tone chamber. By the beginning of the 19th century there were several different traditions for coping with difficulties in this region. In Dresden, for example Grenser apparently evolved the rather short barrel with a bore over a millimetre wider than that of the body of the instrument, and with a fairly sharp gradation in the top tenon of the body. French instruments (with a much longer barrel) seem to have had a rather less extreme variation in the region, while in England (where the mouthpiece carried a very long tenon) the bore seems to have remained cylindrical, as in the earlier clarinets. The mouthpieces and barrels of extant early clarinets are so often missing or damaged that it is difficult to make confident statements about the evolution of this part of the bore.

4. Organological history.

(i) Early history.

The invention of the clarinet, about the beginning of the 18th century, is usually ascribed to Johann Christoph Denner of Nuremberg, an excellent woodwind maker whose fame would be assured

even without the invention of the clarinet to his credit. The details of its early history have been confused through widespread uncertainty as to what exactly constitutes a clarinet, as distinct from a chalumeau, in the interval when the two instruments co-existed. However, the musical difference between the two seems quite clear. The clarinet was designed to operate in the clarinet register (and later, above it); it was rather unsatisfactory in the chalumeau register. The chalumeau, on the other hand, was designed to have a good chalumeau register and to rise to the clarinet register scarcely if at all. Whether composers actually used the names consistently in this sense is a question on which there is considerable room for speculation. However, it is clear that the single innovation which would constitute 'inventing' the clarinet is the devising of the 'speaker key', the key operated by the left thumb, which opens a small hole some way up the bore, causing the instrument to sound easily the 12ths of the notes in the chalumeau register. Who invented this is not known for certain. The well-known instrument by J.C. Denner in Munich (Bayerisches Nationalmuseum 136.Mu.K20) is not a clarinet but a chalumeau. The status of an incomplete three-key instrument bearing his mark at the University of California, Berkeley is uncertain. Three clarinets by his son, Jacob Denner, are known to be extant. The earliest known Nuremberg records of the clarinet date from 1710 when Jacob Denner made a quotation which included prices for both clarinets and chalumeaux in a total of 23 woodwind.

Of the three clarinets by Jacob Denner mentioned (Staatliche Hochschule für Musik und Darstellende Kunst, Berlin; Brussels Conservatory; Germanisches Nationalmuseum, Nuremberg), all have two keys; two are pitched in C and one is in D. Two more in D have been missing from Nuremberg since World War II. Denner clarinets are characterized by a large bore – about that of a modern B \flat clarinet – and as wide a mouthpiece. Later in the century instruments of D pitch were built with a smaller bore, favouring the higher part of the range, and with a very much narrower mouthpiece, for example the instrument by Zencker. The attribution of any improvements to the clarinet during the 18th century to particular individuals is unsubstantiated, and the extant, good instruments from this period are at present poorly documented.

The bottom note of the two-key instrument was *f*. If the hole for the right fourth finger on the foot joint was doubled, opening one of the holes would yield an *f* \sharp , from which point an ascending chromatic sequence of acceptable quality might have been obtainable, with the assistance of liberal 'lipping', to *g*' (all fingers off). Opening the front key would give *a*', and opening the rear in addition *b* \flat or *b* \natural '. A key for *g* \sharp ' was added only at the beginning of the 19th century, but early tutors refer to the speaker key as the *g* \sharp key; opening the speaker key alone could produce a *g* \sharp , though it is not known from when this practice dates. The early fingering chart by Majer (B1732) gives no *g* \sharp ', but the chart is somewhat curious and may well be unreliable, at least as far as expert clarinet playing is concerned.

From *c*" onwards, a chromatic sequence (rather better in tune) would be obtained by repeating the same series of fingerings with the speaker key open. The concertos by J.M. Molter for D clarinet go up to *g*"', and there is no particular difficulty in fingering the two-key clarinet that high. The *b*' at the break is difficult: it could not have been satisfactorily obtained either by lipping down the *c*" or by lipping up the *b* \flat '. Molter, significantly, did not use that note.

The next technical development was the addition of an extended bell and a third, open-standing key which extended the range downwards a semitone and, more importantly, provided the missing *b*' at the bottom of the clarinet register. Fig.4d [not available online] shows a fine three-key clarinet by R. Baur of Vienna. The third key was operated by the thumb of the lower hand. There are two alternative holes (not twinned) for the lower-hand fourth finger, so that the instrument was playable with right or left hand uppermost. The unwanted hole would have been filled with wax or with a peg. The bore is about 13.5 mm, and the instrument plays well to *g*"'. A pair of clarinettes d'amour in Vienna by the same maker, and of similar construction, testify to the next step in the clarinet's history. On these instruments an extra section has been added to the thumb-key by another maker or repairer so that, when the foot joint is turned around, the key is within reach of the left-hand fourth finger. The redundant hole is now at the rear, and may be permanently blocked.

A fourth key to provide *a* and *e*" was also added about the middle of the 18th century by some makers. A number of clarinettes d'amour had a 'fish tail' key for those notes, thus retaining the option of right or left hand uppermost (e.g. Nuremberg, Germanisches Nationalmuseum, MIR

761), but by this time the tradition of left hand uppermost was becoming established. A fifth key, for $f\sharp$ and $c\sharp$, completed the clarinet in the form in which it first achieved widespread use in the last quarter of the 18th century. (In France the $f\sharp/c\sharp$ key was added earlier than the $a\flat/e\flat$ key.) Fig.4f [not available online] shows such an instrument, with the type of keywork available to the average musician playing the clarinet in Classical symphonies etc. as well as in the popular wind bands of central Europe, and in military bands, where the clarinet became firmly established well before the end of the 18th century.

By this time the roots of the different characteristics of the clarinet in various parts of Europe can be discerned, although comparisons are hampered by the lack of dated specimens. It is only for developments in England that a detailed history of the instrument has been written for the last quarter of the 18th century; there, curiously, it appears that the five-key clarinet had entirely supplanted more primitive versions by 1770, whereas on the Continent even distinguished and innovating makers such as August Grenser were making four-key instruments later than this. The mouthpiece and barrel had still not been separated. In England the separation seems to have been introduced from about 1785 in order to provide a long tuning-slide; elsewhere, the separation may have occurred about the same time, but as only a short tenon was provided the motive is unclear.

Clarinets in C and $B\flat$ are particularly abundant from this period. For orchestral use the almost universal custom, at least in continental Europe, was to use alternative top joints (*pièces de rechange*) for $B\flat$ and A. Where a $B\flat$ instrument was needed an alternative joint would be added to the C clarinet, and (less commonly) alternative pieces were available to lower an $E\flat$ clarinet to D. Although not an ideal procedure, it was a convenient compromise. The most expensive piece of the instrument is the lowest part, with thicker wood (for the bell) and three keys. The inconvenience of providing a clarinet in A is greatly mitigated if all that need be substituted are the two middle joints. (An English instrument by Astor in the Bate Collection, Oxford, with alternative pieces for C, $B\flat$ and A, if genuine, can hardly have been acceptable with respect to intonation.)

Instruments of this type are generally excellent in the clarinet register but possess serious weaknesses in the chalumeau register. The cross-fingered $c\sharp$ and $e\flat$ are particularly unsatisfactory, although a skilled player with a good instrument could produce the whole chromatic range. Trills, though regarded as rather important and invariably enumerated in full in instrumental tutors of the 19th century, were available only on a few notes. In England, at least, the next key to be added to the instrument (just before 1790) was a trill key $a\flat/b\flat$, and into the 19th century additional keys were widely regarded primarily as aids to trilling.

The English instruments of the late 18th century were probably tonally similar to continental instruments of two or more decades earlier. The Bohemian clarinet of Mozart's time had already evolved somewhat further than in other countries. From the mechanical point of view we find a sixth key was known to Jan Karel Rohn as early as 1768 when his *Nomenclator artifex, et mechanismus* was published in Prague. Thus the developments made by Stadler and Lotz may well have built on something somewhat more advanced than the five-key clarinet. From the tonal point of view, the rather larger tone holes in the Bohemian clarinets, especially at the lower end of the instrument, led to a fuller tone in the chalumeau register that was exploited more effectively by Mozart than by his predecessors.

Much significant innovation took place around the first decade of the 19th century, most noticeably the addition of more keys. In France, Xavier Lefèvre is credited with the invention, about 1790, of a sixth key, the cross c ' g ' for the left fourth finger. It seems highly probable that players elsewhere had added this key independently at about the same time or earlier; it required much less imagination than the bold downward extension of range conceived by Anton Stadler (see [BASSET CLARINET](#)). Simiot of Lyons is credited with the next innovations in France; fig. 5a [not available online] shows his 1808 model. With a 15 mm bore and relatively large tone holes, this instrument has an excellent tone throughout its range. Whereas much of the innovation at this time consisted merely in the random addition of poorly placed and mechanically inefficient keys, Simiot's improvements testify to a fine maker with a really inventive mind: an ingenious mechanism for opening a speaker-hole at the front of the instrument, where it is less susceptible to blockage by water; a brass tube in the left thumb-hole for the same purpose; a tuning-slide of

thin brass between the barrel and the body; a mark indicating the position to which the bell should be drawn out when using the *A pièce de rechange*. The side key on the lower joint, giving a good *b* in the chalumeau register, and hence a good G major arpeggio, is a particularly important addition. The same maker was responsible for what is arguably the finest surviving clarinet from the first half of the 19th century, in the Rendall collection).

The most influential player at this time was Iwan Müller, who initiated developments first in Vienna and later in Paris. Müller's famous tutor (B1825, dedicated to George IV) illustrates a clarinet with 13 keys, two of which had extra levers to be operated by the right thumb. He had an enormous influence, and the 13-key instrument (later, with the ring-keys or *brille* added by Sax) became the standard instrument for most clarinetists until the early part of the 20th century. Müller's ideas were taken up in England, where Thomas Lindsay Willman also recommended two thumb-branches. These, however, are clumsy and difficult to operate; few instruments with them survive. Again it was Simiot who devised a practical key for the right (weight-bearing) thumb, a hinge that can be activated without taking weight off the thumb. Simiot's thumb-key had the added advantage of being operable in conjunction with a thumb-rest.

(ii) The mouthpiece and reed.

Study of the development of the reed and mouthpiece is hampered by the surprisingly small number of good clarinets in public collections which possess a demonstrably, or even possibly, original mouthpiece. The most important development in playing technique since the 18th century has been the gradual transition from a style of playing with the reed on the upper lip to the present, almost universal, style of playing with the reed on the lower lip. If one is to judge from the positioning of the maker's stamp on the mouthpiece, by far the majority of instruments made during the first half of the 19th century were intended to be played reed uppermost. However, as there was no demonstrable change in mouthpiece design or even in the shape of the lay to accompany the change of playing style, it is impossible to say which instruments were actually used reed uppermost.



Thomas Lindsay Willman:
lithograph from his 'A Complete
Instruction Book...

The earliest text to recommend that the reed should be placed on the lower lip is the little-known one by Berg (B1782). Müller's tutor makes a similar recommendation. J.G.H. Backofen (B2/1824) noted that about 50% of players at that time used each method. The Paris Conservatoire changed officially to reed-below in 1831. Willman, in England, retained the reed-uppermost style (fig.2) to the end of his life (1840) and it is likely that in England this remained the more common style through the first half of the century. The early mouthpieces had tapered profiles and rather narrow slots, and they carried narrow, rather short reeds. (In England particularly the length of table on which the reed could be tied was inconveniently short.)

Accompanying the gradual widening of the slot, the tapering of the upper side towards the tip became less acute, and the upper side became more rounded in cross-section. The Viennese mouthpiece, throughout the century, retained a narrower slot than did the English or French.

The metal screw ligature invented by Müller was introduced near the beginning of the 19th century, although most mouthpieces were styled for tying until about 1850 (in Germany the metal ligature is still unpopular). Even then, they were at first made with a step at the bottom of a short length of table, limiting the length of reed to about 5.5 cm, though soon afterwards the table was taken right down the length of the mouthpiece and longer reeds were used.

Mouthpieces in early clarinets were regarded as the top section of the instrument rather than as separate entities, and were made of the same wood as the rest of the instrument (box or fruitwood). As soon as the concept of a separate mouthpiece became established, makers started using more resistant materials so as to reduce the effect of moisture on the shape of the lay. Harder woods were tried, and some (for example Simon Hermstedt) made their lays of metal; other makers constructed mouthpieces of ivory, glass, metal etc. Ebonite was introduced only in the last quarter of the 19th century, and by the mid-20th century was almost universal. Today plastics are also widely used.

Little research has been done on the vital shape of the lay. Perhaps the only safe generalization to be made is that until well into the 20th century there was very little curvature on the lay at the tip end.

A few early reeds exist, distributed among various collections. Remarkably, a reed which may date from the time of the instrument's use survives with one Jacob Denner clarinet. To modern eyes it is extraordinarily wide (as is the mouthpiece) and thick; this is consistent with the earliest instructions for reed making, which show no tapering of the thickness of the reed towards the tip. Fig.9e [not available online] shows a typical early 19th-century English reed, approximating more closely to the modern reed in general shape. Interestingly, this reed is much thinner at the heel than are modern reeds, with the consequence that the active part of the reed includes some of the harder outer part of the cane. Possibly it would as a result have been a little more water-resistant, and longer-lived, than a modern mass-produced reed.

(iii) The Boehm clarinet.

The clarinet known today in the English-speaking world as the Boehm-system clarinet was the product of a collaboration (c1839–43) between the clarinetist Hyacinthe Eléonore Klosé and the maker L-A. Buffet. Buffet had some experience with Theobald Boehm's flutes and used some of the same mechanical principles in the new clarinet. Boehm himself, however, had nothing to do with the clarinet's design and it was not constructed according to the same acoustical ideals as the flute; in fact the inherent mechanical difficulties in making a satisfactory clarinet have largely dissuaded makers from attempting to mould the clarinet to an acoustical ideal.

The new clarinet was named *clarinette à anneaux mobiles* and it was the ring-keys (*brille*; as in the early Boehm flutes) that overcame the chief mechanical difficulties. About the same time (c1840), Adolphe Sax also used ring-keys to improve the clarinet. The difference between the two approaches was that Sax used rings to improve the Müller clarinet while retaining the same system of fingering, whereas Klosé used them to eliminate the limitation of cross-fingering altogether. On clarinets with Sax's rings, with the left-hand holes closed, closing the right-hand first finger-hole produced a good $b \natural$, and the first and third together a good $b \flat$. Klosé achieved a good $b \flat$ with the first finger alone and a good $b \natural$ with the second; analogous changes are made on the upper joint.

Buffet is credited with the introduction of the needle spring now used for all keys other than those with extremely short pivoting axes. Interestingly, virtually the only immediately detectable mechanical difference between his earliest instruments and those made today is an increase in the number of these needle springs (from four in the earliest example known to 11 in a typical modern instrument). Acoustically, the chief change has been a slight reduction in hole size. A few of the tone holes on the first Boehm clarinets were excessively large, perhaps through the influence of the Boehm flute in which large holes were regarded as an ideal.

The only modification of Klosé's clarinet that has wide currency is the so-called 'Full Boehm', which incorporates four improvements: a seventh ring, adding a cross-fingered $eb//bb$ to the range (this was introduced by Buffet-Crampon in the 1870s, based on an invention of Paul Goumas); an 'articulated' $c\sharp/g\sharp$, permitting a $b/c\sharp$ and $f\sharp/g\sharp$ trill to be made perfectly; an eb , required by some composers, and convenient in enabling A clarinet parts to be transposed at sight on the B instrument; an alternative a/e lever for the left-hand fourth finger, slightly easing certain kinds of passage. The Full Boehm is noticeably heavier than the 'plain' Boehm but is nonetheless popular in some quarters, and especially in Italy. In the 1970s two modifications to the Boehm system attracted sufficient interest to have become available commercially: the Mazzeo system (see Mazzeo, D1980) and the McIntyre system. For several years after the appearance of the Klosé- or Boehm-system clarinets, makers continued to experiment with improvements to Müller's system, and instruments using that system (often called the 'Simple system') remained popular. Müller-system instruments manufactured by Eugène Albert of Brussels were very well made and allegedly had a better tone and intonation than Boehm models of the time. In Germany Heinrich Baermann encouraged development and Oscar Oehler improved the instrument further; at the end of the 20th century the majority of German players still used a model very similar to Oehler's final one, although modifications continued to be made.

The Schmidt-Kolbe system instrument represents one of the later developments of the Oehler system. In the late 20th century there was a slight revival of interest in the Oehler system in the USA. However, in countries such as Switzerland, Slovakia and the Czech Republic it had lost ground to the Boehm system, although in Germany it was still difficult to find employment with a Boehm-system clarinet. Although the Oehler system is undoubtedly less satisfactory for ease of fingering, and is not so well designed from an engineering point of view, it offers very significant advantages in terms of tone and intonation. Carl Baermann's treatise (B1864–75), the most comprehensive of the 19th century, is useful for this instrument although there have been some changes in practice since his day (for example, Baermann favoured sliding a left-hand finger on to a cross key on the instrument's upper joint, rather than using a side key). A good tutor for the Oehler system is Jettel's *Klarinettenschule* (B1949–50).

5. Acoustics, mode of operation and fingering.

The clarinet is unique among modern wind instruments in behaving acoustically as a stopped cylindrical pipe. Such a pipe has two distinguishing features. First, the lowest frequency of sound vibration that will cause it to resonate has a wavelength four times the length of the pipe, with the result that the clarinet in its lower (chalumeau) register sounds an octave lower than do flute or oboe notes using equivalent pipe-lengths. Second, the pipe will resonate only at odd harmonics of these fundamental resonances; consequently the timbre of the notes in the chalumeau register is characterized by a near absence of even harmonics, and, because the resonances available for overblowing to higher registers are odd harmonics of the notes in the chalumeau register, a rather more complex fingering system than for other woodwind instruments is required, particularly to bridge the 12th instead of the usual octave at the first overblowing level.

Like other woodwind instruments, the clarinet operates as a coupled system, the coupling being between the resonating air column, whose resonant frequency is determined by the configuration of closed and open finger-holes, and the reed-lip complex. The latter also acts as a valve, admitting energy from the player's higher-pressure mouth cavity. In loud playing, the reed closes the end of the tube completely for part of each cycle of vibration, while in very quiet playing the tip of the reed oscillates almost sinusoidally without contacting the tip of the mouthpiece at all. In such a coupled system, energy must be fed in at the appropriate part of each cycle for the vibration in the tube to be sustained. For this to occur, the natural frequency of the reed-lip system must be higher than the frequency at which the whole system is vibrating. This means that, even if the correct fingering is selected for a very high note, the note can be produced only if the lips are able to control the reed so that its natural vibrating frequency is high enough: the player achieves this control mainly by his or her ability to vary the position on the lay where the reed makes contact, thus varying the length of reed that is actually vibrating. The stiffness or strength of the reed selected by the player is also important, since it determines the restoring forces acting when a particular length of reed is in operation. The strength of the reed also determines the amount of muscular effort needed to keep it in a particular configuration. A soft reed may be less tiring to use, and may respond well in the lower part of the instrument's range, but there may be no position on the lay which enables it to produce the highest notes. (The acoustics of the clarinet, and especially the operation of the reed, have been discussed in some detail by Worman, C1971.)

As the (B \flat) clarinet plays successive semitones from f (sounding $e\flat = 156$) to $b\flat'$ (sounding $a\flat' = 415$), the distance from the tip of the mouthpiece to the highest open hole is diminished from 54 to 16 cm. Free-air wavelengths for these frequencies extend from 221 to 83 cm at room temperature. The discrepancy between the air-column lengths, and one quarter of the corresponding free-air wavelengths, is due to several factors: the mouthpiece is not a continuation of the cylindrical bore of the instrument, neither is it completely closed; the tone hole defining the lower end of the resonating air column is rather small in relation to the bore of the tube; the bore as a whole is not smooth, but is punctuated at irregular intervals by the closed tone holes, each of which constitutes a bump in the bore with a slightly absorbent surface (the pad); and the air in the instrument is warmed above room temperature, and moistened, by the player's breath. Taking these factors into account, a satisfactory relationship between fingering and note produced may be evolved. For each fingering in this part of the range, the acoustic behaviour of the instrument may be understood by obtaining a resonance curve (see Backus, C1969, 2/1977,

and [ACOUSTICS, §IV](#)). In addition to the resonance which determines the fundamental sounding frequency, well-marked resonances around its 3rd and 5th harmonics are present. When the instrument is sounded, these harmonics in particular, of the many generated by the reed, excite the air column to resonance and so are particularly prominent in the tone-colour of the clarinet. Although the 2nd and 4th harmonics are also generated they are scarcely perceptible since they do not coincide with any resonance in the air column.

The operation of the speaker key (or register key) may be understood as follows: when it is opened the lowest resonance is a broad, low resonance associated with the distance from the mouthpiece to the open speaker-key hole. Because this is a very small hole, with no venting from nearby holes, it is difficult or impossible to induce the air column to resonate at this frequency. The next resonance is a sharp one at the same frequency as the second resonance which was present before the speaker key was opened, that is to say at the 3rd harmonic of the note previously sounded (a 12th above). It is at this frequency that the air column resonates freely. When the instrument is sounding in this mode (the clarinet register), the disposition of higher resonances is not particularly important, and consequently the tone does not possess the same distinctive quality as that of the chalumeau register. Both odd and even partials are present.

Analysis of the fingering for higher notes is not particularly illuminating, although some of the fingerings may be easily comprehended in terms of 5th and higher harmonics of equivalents in the chalumeau register.

Although the predominance of odd harmonics in the chalumeau register tone is quite different from the tonal spectrum of any other instrument, it is hardly sufficient to explain all the characteristics of clarinet tone. Work by Benade and his colleagues has shown that the most important feature in determining the tone of the clarinet is the cut-off frequency. In a clarinet tube there is a marked drop in resonance at about 1500 cycles per second, the so-called cut-off frequency. That figure is determined primarily by the array of open holes which radiate the sound or, when all holes are closed, by the design of the bell. Although this observation does not have any immediate meaning for a non-physicist, it explains certain features of clarinet tone that could not be comprehended by simple analogies with stopped organ pipes. In particular it is easy to perceive that the pre-Boehm clarinet, with rather small tone holes spaced about 2 cm apart, should have very different characteristics from the Boehm instrument carrying tone holes every centimetre or so. The lesser tonal differences between the modern German-system clarinet and the Boehm can be explained on a similar basis. Both the tone of particular notes, and the intonation in moving between registers, are critically dependent on the exact relationship between the resonances. If the second prominent resonance is not exactly a 12th above the fundamental, the resonance will not be adequately excited by the relevant partial in the reed motion, resulting in a duller tone. Moreover when the lower resonance is shifted by opening the speaker key, the instrument will rise to a note in the clarinet register not exactly a 12th higher. The maker has two means of combatting such deficiencies. Deficiencies affecting only a single note can be tackled by adjusting the shape of the tone hole – most commonly by fraising, or undercutting, the hole. Deficiencies affecting several adjacent notes may be tackled by subtle adjustments to the bore. In most modern clarinets the bore widens out in the lower joint towards the bell, and in many there is also an expansion towards the mouthpiece. In both these regions skilled makers can exercise a substantial amount of control over the final characteristics of the clarinet (see Gibson, C1994). Many early clarinets have suffered a contraction at the tenons resulting from the effects of excessive pressure and moisture on the wood over long periods, and cannot function satisfactorily unless the bore is restored to its original dimensions.

6. Musical history.

(i) The 18th century.

The earliest mention of the clarinet by that name is in an order dated 1710 for a pair of clarinets (along with oboes, flutes and chalumeaux) from the maker Jacob Denner of Nuremberg. The earliest music written for the clarinet has been investigated by Rice (D1992). Two anonymous collections of airs for pairs of chalumeaux, trumpets, oboes, violins, flutes, clarinets or horns were

advertised in Amsterdam between 1712 and 1715. Vivaldi may have used the B \flat clarinet as early as 1716, in *Juditha triumphans*, although other interpretations are possible for the 'clarenì' specified. Certainly he used the instrument somewhat later in the concertos p73/RV560, p74/RV559 and p84/RV556, writing genuine clarinet parts ranging from *g* to *c'''*, suitable for the two-key C clarinet (the note *b'* does not appear).

In the 1740s J.M. Molter composed six concertos for the D clarinet which exploited the clarinet and acute registers fully, extending to *g'''* and scarcely exploring the chalumeau at all apart from passages where leaps between chalumeau and clarinet registers (such as Mozart and subsequent composers exploited so effectively) appear, perhaps for the first time. The narrowing of bore and mouthpiece exemplified by the contrast between instruments by Denner and Zencker must have contributed to the ease with which such a high-lying part could be played. Apart from the questionable 'clarenì' mentioned above, all the established early clarinet parts are suitable for two-key instruments in C or D, consistent with surviving instruments. It is possible that the lower-pitched clarinets in B \flat and A that are standard today did not appear before about 1750.

In 1765 F.X. Pokorny composed an interesting pair of concertos, in E \flat for 'first clarinet' and in B \flat for 'second clarinet'. The 'second' player would have needed great expertise to produce satisfactory intonation in the chalumeau register; plainly the concerto in B \flat was composed for a specialist in this part of the instrument's range. It seems not unlikely that he would have had an instrument adjusted to provide good intonation in the chalumeau register as a primary desideratum.

Handel seems to have written at least twice for the clarinet. The Overture in D for two clarinets and horn is in the Fitzwilliam Museum, Cambridge (if a complete piece, this may have been written for 'Mr Charles, his wife and son', as suggested by Weston, D1971); he also used two chalumeaux in the opera *Riccardo Primo* (1727), and a later copy (c1744–5) of the opera *Tamerlano* (1724) shows the original cornett parts replaced by clarinets.

The clarinet came into widespread use only after the middle of the 18th century, although there is sporadic evidence of its use earlier. 'Mr Charles' appeared in Dublin in 1742 and in London, Edinburgh and elsewhere during the next two decades. He was a performer on both the clarinet and the chalumeau (as well as on his first instrument, the horn, and on the oboe d'amore). It is likely that his influence led to the spread of the clarinet in England. Although the earliest known English instrument is dated 1770, there is evidence that clarinets were being made and advertised for sale from the 1750s; in the list of Samuel Shaw-Helier's instruments is a pair of clarinets by Caleb Gedney, Thomas Stanesby (ii)'s successor. Two English players (Mr Habgood and Mr Pearson) performed in 1758. Burney reported favourably on what he deemed the first appearance of clarinets in the opera orchestra, in J.C. Bach's *Orione* (1763); Arne had already used them in the English operas *Thomas and Sally* (1760) and *Artaxerxes* (1762).

In France, the instrument was used in Rameau's *Zoroastre* (1749) and *Acante et Céphise* (1751). Gossec favoured the clarinet and was particularly responsible for its spread. There are no known French clarinets from this period, however; I. Scherer, maker of two-key clarinets, worked not in Paris, as was once believed, but in Bützsch. The 'Lutherie' section of the *Encyclopédie* of Diderot and D'Alembert describes and illustrates the two-key clarinet of the 1760s, and it is only in the supplement (1776) that a more elaborate instrument, with four keys, is similarly treated, with the writer also mentioning a clarinetist's having recently passed through Berlin with a six-key instrument.

The Mannheim orchestra deserves much of the credit for popularizing the orchestral use of the clarinet. It seems that there were two clarinetists in the orchestra from 1758, but if the attribution of a clarinet concerto to Johann Stamitz, who died in 1757, is correct, there must have been good players even earlier. Christian Cannabich, C.J. Toeschi and Carl Stamitz made fairly extensive use of clarinets in their orchestral writing, although in the 1760s the instrument is usually specified only as an alternative to flute, oboe or both. By the 1780s it had become widespread, although there certainly remained orchestras lacking in clarinets; Mozart's famous remark in a letter to his father after visiting Mannheim (1778) underlines this: 'Alas, if only we also had clarinets'.

Soon after this Mozart did have clarinets, played by Anton Stadler and his brother Johann.

However, he had become acquainted with the instrument as early as 1764 in London, through copying C.F. Abel's Symphony op.7 no.6. His own first use of the instrument is in the Divertimento K113 (strings, two clarinets and two horns), composed in 1771 in Milan. Here the clarinet parts are very straightforward, as would suit orchestral players of the time, suggesting a five-key instrument. The divertimentos K166/159*d* and K186/159*b* of 1773 are a little more demanding.

Mozart did not use the clarinet in the full orchestra until the 1780s and then only sparingly.

Idomeneo requires clarinets in A, B \flat , B and C and from then on every opera (except the fragment *Lo sposo deluso*) makes extensive use of the instrument. The Kyrie K341/368*a* is the only piece of church music using clarinets (in A; the Requiem uses two basset-horns). Of the symphonies, only the Paris K297/300*a* and K543 were composed with clarinet parts though they were later added to the Haffner K385 and to K550. Only three of the piano concertos (K482, 488 and 491) require clarinets.

The pieces by which Mozart changed the course of the clarinet's history are those composed for Anton Stadler: the so-called 'Kegelstatt Trio' K498 (for clarinet, viola and piano), the Quintet K581 and the Concerto K622. Obligato parts for Stadler on both clarinet and basset-horn also occur in *La clemenza di Tito* (K621). Apart from the trio, these clarinet parts were all intended for Stadler's basset clarinet. The original solo part in the concerto frequently descended to *c*, and there are good reasons to suppose that the clarinet part in the quintet did so too (a contemporary

manuscript, *A-Wn* 39981, shows notes available only on the basset clarinet). The part for B \flat clarinet in *La clemenza di Tito* descends to *c*. The trio has a relatively straightforward part with virtually all the melodic writing in the clarinet register, and only occasional arpeggios in the chalumeau. However, the other pieces, as well as the serenades K375, K388/384*a* and K361/370*a*, and the Quintet K452 for piano and wind, were clearly written for a clarinet possessing a full and satisfactory chalumeau register. It is this aspect in particular of Mozart's writing for the clarinet (and Stadler's playing of it) that is so important: from then on the clarinet was expected to be equally beautiful and fluent over the whole of its wide range.

Apart from Mozart's compositions, most of the extant clarinet music from this period to about 1790 is in the wind ensemble repertory, music written for the *Harmoniemusik* that was available to play at every large establishment in Europe. Many of these groups, prototypes of the military band in its developed form, contained clarinets from the 1750s, and indeed the clarinetists for many early orchestral performances were drawn from their ranks. In Prussia, Frederick the Great specified an octet of two each of clarinets, oboes, horns and bassoons in 1763, and at about the same time such a combination was established in France. In England the Royal Regiment of Artillery consisted in 1762 of eight men who were required (as is the modern military bandmaster) to be expert on a variety of instruments; the complement of instruments, provided by the regiment, included 'four hautbois or clarinets'. It would have been for such groups that the many wind octets, by Haydn, Rosetti (Rössler), Mysliveček, Krommer and innumerable others were written, as well as the more lasting pieces by Beethoven and the many occasional pieces for various combinations by Mozart.

Late 18th-century French composers often used the clarinet in chamber music for various combinations, and as a solo instrument in *symphonies concertantes*.

(ii) The 19th century.

The most intense technical development of the clarinet came early in the 19th century. It coincided with the collaboration between Spohr and the clarinetist Hermstedt; with that between both Weber and Mendelssohn and the clarinetist Heinrich Baermann; and with the influences of Iwan Müller, T.L. Willman and the composer and player B.H. Crusell. Performance of Spohr's first concerto for clarinet was unthinkable without a clarinet with at least 13 keys, as Spohr explained in the introduction to the first edition in 1812. Spohr composed four clarinet concertos as well as several smaller pieces, all for Hermstedt. Weber composed his first clarinet concerto for Baermann in 1811, and later in the same year his second concerto. He wrote a number of other works for clarinet, including a quintet with strings (1815). Like Stadler with Mozart, these players drew from Weber and Spohr idiomatic writing exploiting the instrument's new possibilities.

In addition to those few who are immortalized through their influence on great composers,

innumerable virtuoso clarinetists travelled through Europe: Kroll (D1965, Eng. trans., enlarged, 1968) lists over 50, with a large number of minor composers producing appropriate works for performance in varied circumstances in large and small towns. In addition to concertos (including double concertos such as that for two clarinets by Krommer), sets of variations and potpourris on popular operas were used to lighten the diet and give opportunity for additional virtuosity.

The clarinet was now a regular member of the orchestra, playing an important role in the wind section. Clarinets in C, B \flat and A were all frequently specified, the choice being determined primarily by the tonality of the piece. Although the virtuosos equipped themselves with instruments having additional keys, orchestral players probably played on five- or six-key clarinets for the symphonies of Beethoven and Schubert, and so preferred not to play in remote tonalities. However, the parts written now exploited the beauty of the clarinet as well as, or instead of, its brilliance. Whereas in Mannheim the clarinets had as often as not been silent in slow movements, now they stood an equal chance with the other woodwind when it came to a lyrical passage: a significant commentary on the instrument's development. Neat articulation, long elegant phrases, wide-ranging arpeggios and Alberti bass passages were required of them. Indeed the clarinet, together with the horns, became associated with a particularly romantic kind of expressive writing.

Although the selection of an A, B \flat or C clarinet was made largely on the basis of key signature, it was about 1800 that the tone-colour of each instrument began to take on well-defined characteristics, and in particular that the tone of the C clarinet became rather distinct from that of the B \flat . The warmth that the instrument now acquired, particularly but not exclusively in the chalumeau register, affected the C clarinet far less. To this extent, it is perhaps less valid to play C clarinet parts on the B \flat clarinet today than to play A clarinet parts on the B \flat instrument. The extent to which composers consciously exploited the distinction has not been seriously investigated, but a case in point is Schubert's use of a C clarinet in one movement of the Octet (1824), which cannot be justified solely in terms of key and must imply an intended change in timbre.

Until the time of Berlioz, higher-pitched clarinets than that in C did not reappear in the orchestra. The D clarinet had almost disappeared with the coming of clarinet specialists in the 1780s, although it had been the first instrument used both in the orchestra and in the military wind bands. By 1800 the expanded bands included clarinets in C and in high F; both Beethoven and Mendelssohn composed for the high F clarinet in their works for band, but not in orchestral music. Beethoven evidently imagined a highly competent player for the high F clarinet as the part rises to a''' and contains solo passages. In the orchestra he does not extend the clarinet's range beyond g''' , and only rarely as high as that (as in the trio of the minuet in Symphony no.8).

In military bands clarinets in F and C were gradually replaced by those in E \flat and B \flat between about 1815 and 1825, so that when Berlioz turned his imagination to the clarinet group the high-pitched member he chose for the *Symphonie fantastique* (1830) was the E \flat . In France, England and the USA the E \flat clarinet has since then been to a varying extent regarded as an available option to composers. East of France, clarinets in E \flat and D were specified with almost equal frequency; Strauss, Mahler, Stravinsky, Wagner and others expected the player to change from D to E \flat when his neighbour changed from A to B \flat , plainly for convenience of key.

The situation with regard to the clarinet in C is also complicated by geographical factors. In England, few players seem to have retained C clarinets when the time came in the early 20th century to replace the old 'high-pitch' clarinets built to $a' = 452$ by a set built to $a' = 440$. Just about this time in Germany, Richard Strauss was exploiting the tonal difference between members of the clarinet family more meticulously than had anyone before; he used the C clarinet as a distinct sound to be contrasted with, alternately, the E or D clarinets a little higher in pitch, and with the A or B clarinets a little lower. Smetana and Dvořák are among the other composers whose use of the C clarinet is directed towards a different timbre, while it is quite clear from an examination of Dvořák's work that he alternated the instruments in A and B for key convenience only, regarding them as identical in timbre.

Relatively few composers followed Mozart's lead in writing chamber music for the clarinet,

although it continued to be used in Harmoniemusik. Beethoven supplied a Trio op.11 for clarinet, cello and piano, and used the instrument effectively in his Quintet op.16 for piano and wind instruments as well as in other works. Brahms made two major contributions to the repertory in his Trio op.114 for clarinet, cello and piano and his Quintet op.115 for clarinet and strings.

Among the earliest compositions for clarinet and piano were sonatas by Vanhal, Franz Danzi, Hoffmeister and Xavier Lefèvre. The first well-known piece in this genre was Weber's Grand Duo Concertant of 1815–16. Later in the century, Schumann composed three Phantasiestücke (op.73) and Brahms two substantial sonatas (op.120). Early in the 20th century came Reger's three sonatas op.49 nos.1 and 2 and op.107, Saint-Saëns's Sonata op.167 and Debussy's *Première rhapsodie* for clarinet and piano or orchestra.

During the 19th century gypsy musicians abetted the diffusion of various forms of the Western clarinet throughout eastern Europe, the Balkans and the Middle East. In Turkey, for example, E \flat , B \flat and A clarinets were introduced into the palace band of Mahmud II (1808–39) and the low G instrument was particularly favoured for Turkish tunes (see Picken, E1975, p.511). The military band and the jazz band have since continued to carry the clarinet throughout the non-Western world.

(iii) The 20th century.

As with other wind instruments, technical demands on the player increased considerably in the 20th century, first in orchestral parts, then in concertos and other solo and chamber works. The talents of specific players continued to encourage composers to extend the technique of the instrument. Notable in this connection are the clarinetists Aage Oxenvad (for whom Nielsen wrote his concerto), Benny Goodman (Bartók's *Contrasts* and concertos by Hindemith and Copland), Frederick Thurston (Bliss's quintet and various English concertos), Gervase de Peyer (Musgrave's concerto) and Alan Hacker (Peter Maxwell Davies's *Hymnos*). Some outstanding 20th-century chamber works, such as Schoenberg's *Pierrot lunaire* and Stravinsky's *The Soldier's Tale*, exploit the instrument's versatility and distinctive sound.

The B \flat clarinet once played a primary role in ragtime and jazz ensembles, although its significance waned greatly after about 1945, except in so-called traditional or Dixieland jazz. It is generally played with a wide vibrato and with distinctive glissandos and portamentos. The virtuoso achievements of early jazz clarinetists were considerable: Sidney Bechet drew high praise from Ansermet, and Benny Goodman, as mentioned above, was sought out by several composers. Other important jazz clarinetists include Jimmie Noone, PeeWee Russell, Artie Shaw, Barney Bigard, Woody Herman and Jimmy Giuffrè. Extended 20th-century compositions using the clarinet in imitation of jazz include Gershwin's *Rhapsody in Blue*, Stravinsky's *Ebony Concerto* and Bernstein's *Prelude, Fugue and Riffs*. Music by such composers as Holst and Persichetti for the military or symphonic band (in which there are more clarinets than any other instrument) is also worthy of mention.

New attitudes to wind writing in general and the clarinet in particular were fostered by an increasing interest in sounds outside the instrument's normal spectrum and upward range. Flutter-tonguing (e.g. in Berg's *Four Pieces* op.5), glissandos (often used in jazz) and quarter-tones were used early in the trend, which came to include a full range of fingered microtones, many new variations of tone-colour (both of these using aspects of cross-fingering), and a hitherto unused phenomenon, **MULTIPHONICS** (Bartolozzi, B1967, and Heiss, B1968–9, represent first attempts to catalogue and classify the new techniques). The pioneering in multiphonics was done by a number of players but particularly important was the contribution of the clarinetist

Detalmo Corneti, working with Bartolozzi (using a clarinet extended to e \flat). They exploited the fact that by employing certain complex fingerings, usually involving the opening of holes in the tube at unorthodox places, it is possible to produce a number of different sounds simultaneously. It is often essential for the player to adopt an unusual embouchure. The resulting 'chords' consist of a number of upper partials, some out of tune, in groupings that are normally only discovered empirically. Because of the difficulty of fingering and blowing these chords, and their inherent instability and unreliability, players have been somewhat reluctant to use them to any great extent, and most composers lack the necessary technical knowledge to specify them. However, players

such as Alan Hacker have done much towards making such techniques an important part of modern clarinet playing.

Historical clarinets began to receive attention from performers in the early 1970s, somewhat later than other instruments: before this time the use of period instruments had been focussed on the Baroque and earlier periods. In 1970 Alan Hacker founded The Music Party in order to explore the use of early clarinets in chamber music. Both he and Hans Rudolf Stalder recorded the concerto by Johann Stamitz using 18th-century clarinets, and since then many other players including Hans Deinzer, Eric Hoeprich, Colin Lawson, Charles Neidlich, Antony Pay and Keith Puddy have performed and recorded using 18th- and 19th-century clarinets. In 1990 Keith Puddy recorded Brahms's two sonatas on the clarinets on which Mühlfeld had first performed them, and by the late 1990s clarinetists were enriching their range of sound by using instruments from the 1920s and 30s in a historically informed manner.

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Nicholas Shackleton