



STUDIES IN CORNET AND TRUMPET
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Allan C. Knoll

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THESIS

STUDIES IN CORNET AND TRUMPET PEDAGOGY

BY

ALLAN CLEMENT KNOLL

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THESIS

PREFACE

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The writing of this thesis was inspired by the need for an instructor's manual in regard to cornet and trumpet pedagogy. Embodied herewithin are studies and reports of experiments, supplementing pedagogical material. Preference has been given, in the choice of material, to ascertained facts; though sometimes the author's conclusions are stated, or the argument of others given, in order that the subject may be fully treated.

The author is greatly indebted to Professor Leonard Falcone for many valuable suggestions and material, to Mr. Carrol King for conducting the oil tests, and to Dr. Robert W. Young and the C. G. Conn Ltd. for suggestions in the problems of acoustics.

This manual is offered as a contribution to the continued growth and development of the cornet and trumpet as a solo, band, and orchestral instrument.

Allan Clement Knoll

East Lansing, Michigan
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I. HISTORY OF THE CORNET AND TRUMPET

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✓ The prehistory and early history of horns and trumpets is wrapt in mystery. Their beginning is identified with that of human history. Among primitive races of men, convenience both in war and the chase demanded a means of signalling more powerful than that afforded by the human voice. This must have led to the adaptation of some rude instrument fashioned from shell, horn, or tusk according to locality.¹ The interior form of all these objects is approximately conical, and such a tube, when blown with the lips at the small end, gives a succession of notes approximating the overtone series, the exact agreement between the notes obtained and this series depending upon the precise internal form of the horn. The gradual evolution of the best signalling instrument is, therefore, closely connected with music itself.²

✓ Instruments made from shells and horns have been found in all parts of the world, not only in

1. Wallaschek, Primitive Music, 99.

2. Stone, "Horn", Grove's Dictionary.

India, but in Persia, Afghanistan, Tibet, Annam, Burmah, Borneo, and the Pacific Islands.¹ Horns were also made of ivory, bamboo, and wood with little variation in pitch, the tones produced being powerful and often harsh. Lartet and Christy² found prehistoric instruments made from the first digital phalange of the hind foot of a reindeer in the Cavern of Laugerie Basse, in the Dordogne District, France. A hole had been bored in its lower surface near the expanded upper articulation. On application of the lips to the hollow of this articulation, and by blowing obliquely into the hole, a sharp and penetrating sound is produced.

There is definite information regarding the wind instruments of the Egyptians, Hebrews, and Assyrians; the general features and character of the music and instruments of these peoples were essentially the same. One instrument, a species of trumpet, called the shophar, was in use in early Hebrew days. This instrument has retained its position in the Synagogue up to the present day.³ During the latter part of the

1. Galpin, The Music of the Sumerians, 24.

2. Wilson, Prehistoric Art, Report of the U.S. National Museum, 1896, 524.

3. Idelsohn, Jewish Music, 10.

period of the Second Temple, two types were in use: the curved (male) ram's-horn and the straight (female) mountain-goat's horn. The latter form with a gold mouthpiece was used in the Temple on New Years, whereas the former, with a silver-covered mouthpiece, was used on fast-days. The shophar could produce but few tones, probably not more than three, and these were in the relation of tonic, fifth, and octave, as now used in the Synagogues, which are claimed to be the same as in olden Hebrew times.¹ These instruments played an important part in Hebrew history as related in the Old Testament. They figured in the Siege of Jericho², and in the procession of David when he moved the ark to Jerusalem.³ The Assyrian horns, likewise, were only suited for producing three or four notes.⁴

The earliest metal trumpets were constructed on the same principle as the shophar, and in most cases the form of the instrument was plainly a copy of some natural horn. A trumpet for signalling, known as the Chatzotzera, was made of silver and known to Egyptians, Hebrews, and Assyrians. According to Galpin,

1. Idelson, Jewish Music, 9.

2. Book of Joshua, VI:20.

3. Second Book of Samuel, VI:15, see also the First Book of the Chronicles, XV:28.

4. Engel, The Music of the Most Ancient Nations, 217.

the trumpet first appeared in Egypt under Thothmes IV¹ of which two specimens have been recently discovered. One, made of silver, is 22 7/8 inches in length; the other, made of bronze, has a total length of 19 7/8 inches. Both of these instruments have bell diameters measuring 3 1/2 inches.² There are no cup mouthpieces, but the tubes terminate in a thick metal ring through which sounds may be produced with difficulty. It is possible that other mouthpieces for the instruments may be missing. The silver trumpets of the Assyrians were very similar in design to those used by the Egyptians.

There were two forms of trumpet used by the Roman armies. The buccina was an instrument with a cup mouthpiece used by the infantry. Many pictures show this instrument used as accompaniment in gladiatorial combat.³ Its bore was cylindrical, gradually expanding into a bell; the tube being curved to nearly a circle, with the bell resting upon the shoulder of the player.⁴ The lituus was also an instrument with cup mouthpiece, but used by the cavalry.

1.c. 1415 B.C.

2.Galpin, The Music of the Sumerians, 21.

3.Kinsky, A History of Music in Pictures, 20.

4.The American History and Encyclopedia of Music, IV, 100.

It was similar in shape to the Hebrew shophar, the cylindrical tube being bent upward like a crook at the lower end, where it expanded into a small bell. The lituus was pitched an octave above the buccina.¹

The La-pa of ancient China was also a military trumpet similar in shape to the Roman lituus with the addition of a telescope slide. They were constructed of wood, covered with copper, or of copper alone. The peculiar feature of all trumpets throughout China, India, Burmah, Siam, and the entire Asian regions, is the extremely shallow disc-like mouthpiece, with only the faintest indication of a cup. The effect of a shallow cup is easier production of high shrill notes; made such because the lip muscles of these races are thin and tense. The expanse of the disc exercises pressure, leaving only the small portion of the lips, equal to the diameter of the narrow aperture entered by the stream of breath, free for vibration.² These trumpets were made in various sizes, but not more than three or four notes were possible by ordinary players.

1. The American History and Encyclopedia of Music, IV, 156.
2. Smith, The World's Earliest Music, 269.

Numerous trumpets have also been found in Scandinavia from five to eight feet in length, with bell mouths six, eight, and ten inches in diameter.¹ These instruments were known as luhrs and were used around 1500 B.C. The majority of these are of bronze, cast in short sections with joints which were riveted together. Others have been found recently which were made of iron with gold trimmings. The middle portion consists of an ox horn. The mountings are elaborate and are attached at either end in such a way as to lengthen the horn and increase its power as a musical instrument.

The earliest known example of mechanical means for controlling a number of finger-holes is a Greek or Roman tibia, one of four discovered in 1876 at Pompeii and now in the museum at Naples. This instrument is of cylindrical bore, and is pierced with eleven lateral holes. Fitting over these holes, are eleven sliding sockets or shutters, any one or more of which can be closed. By means of these slides, the sequence of tones and semitones could be varied.² These instruments

1. Wilson, Prehistoric Art, 527.

2. Blaikley, "Valve", Grove's Dictionary.

received no further development, or were lost at an early time.

In medieval times, the Canterbury, Dover, Folkestone, Ripon, and Ipswich Horns were used by huntsmen, foresters, and watchmen employed by the Guilds and Corporations to sound the note of assembly.¹ The oliphant was also a recognized medieval instrument made from an elephant's tusk, to the smaller end of which a cup-shaped mouthpiece was fixed. This was brought to the West from Byzantium in the tenth century and, with the sword, was among the most valuable items of a knight's equipment.²

The straight horn of medieval times grew into two distinct types: the trumpet in which the bore was cylindrical, and the bugle in which the bore was tapered or conical. After the 14th century, more frequent mention of these instruments begins to appear in contemporaneous writings. In that century it seems that trumpets built in round curls similar to the modern French Horn were well known in Italy and France. Some famous Italian paintings of the 15th century show angels playing straight trumpets, and it is probable that

1. Forsyth, Orchestration, 69.

2. Kinsky, A History of Music in Pictures, 43.

instruments of this construction as well as those of a zigzag form were in use in years previous to 1400.¹

Open-standing keys or hinged valves worked by the little finger, extending the compass downward, are found on the bombardt and flute à bec in Virdung.² The Cornett (Cornetta, cornet à bouquin, Zinke) became prominent at this time. It consists of a wooden tube, slightly conical and covered with leather, having six holes for the fingers and one hole for the thumb on the under side. The mouthpiece was similar to that of the straight trumpet. Its compass consisted of a chromatic scale of a few notes more than two octaves. Curved Cornetts were grouped into three principal sizes, and were in use from the 10th to the 18th century.³ Earlier improvements

1. Kinsky, A Hist. of Music in Pictures, 68.

2. Musica getutscht (1511).

3. I. The small treble Cornett (Cornettino), with a compass of about two octaves from alto D.
II. The ordinary Cornett (Cornetto), with a similar compass from tenor A, a fourth below the small Cornett.
III. The great Cornett (Corno Torto), curved in an S form, with a compass from tenor C, an octave below the small Cornett. (Galpin, "Cornett", Grove's Dictionary).

had obviated the clumsy length of brass instruments by bending and rebending their tubes. Then followed the application to the brass of the finger-hole system of the wooden Zinke.¹

Another instrument, the serpent, was an outgrowth of the Cornett and Zinke. It was made of wood, covered with leather, and used a mouthpiece. These instruments played with a mouthpiece (not a reed) lost their characteristic brilliance and nobility of tone when the note was not emitted through the bell but through a side hole, and passed out of use with the perfection of the brass instruments.

In 1753, a horn player, A. J. Hampl of the Royal Orchestra in Dresden, conceived the idea of inserting crooks in the middle of the tubing by which the pitch could be altered.² This resulted in the slide trumpet. However, this developed into the trombone as we know it today, but proved impracticable on small instruments.³

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1. Coerne, The Evolution of Modern Orchestration, 13.
 2. "Hampl", Riemann Dictionnaire de Musique.
 3. Colles, "Symphony and Drama", Oxford History of Music, VII, 142.

Muting and changing the pitch by placing the hand in the bell may have been introduced by Michael Wöggel in 1780¹. His instrument was called the "invention horn", but was really a hand-stopped trumpet bent to a curve. As hand-stopped tones are foreign to true trumpet tone, the instrument received little acknowledgement. This was followed by the Ophicleide which was invented in 1790 by Fricot, a Frenchman living in London. The peculiar quality of its tone did not blend with the other instruments of the orchestra and was not used to any great extent.² Kolbel of St. Petersburg built a keyed bugle in 1770, and Weidinger of Vienna completed one in 1801.

In 1788, a significant invention took place when Charles Clagget, an Irishman, invented a method of uniting two trumpets or horns. He joined two trumpets, one pitched in D and the other in E^b, so that with a piston a single mouthpiece might be applied to either instantaneously, thereby getting the advantage of a complete chromatic scale.³

The modern piston was invented in 1813 by

1. Gatty, "Trumpet", Grove's Dictionary.

2. Forsyth, Orchestration, -174.

3. "Clagget", Riemann Dictionnaire de Musique.

Blümel, an oboe player who sold his invention to the German instrument maker Stölzel, who in turn perfected the mechanism. Périnet is also given credit for this invention.¹ Riedl contributed to its improvement, but Stölzel carried it still further by adding a second valve.² Müller of Mayence added a third valve which was capable of adding three semitones to any open position. This is the modern arrangement of valves and completes the chromatic scale above and below the second partial of the fundamental tone of the instrument.

Charles Joseph Sax, a maker of wind instruments in Brussels, investigated and formulated laws concerning the bore of wind instruments. In 1822 he began to make all kinds of wind instruments, brass and wood. In 1824 he invented an "omnitonic horn", which he continued to perfect till 1846. This instrument could be adjusted to any key by means of a piston sliding backwards or forwards on a graduated scale, which set the body of the instrument in communication with tubes of different lengths corresponding to all the

1. Heinitz, Instrumentenkunde, 78.

2. John shaw took out patents in 1824 and again in 1838, but his ideas were concerned with rotary valves rather than pistons. What Shaw actually introduced was a four-way stop-cock turning in a cylindrical case in the instrument which altered the air-column when rotated. This device was too delicate and did not find use in the trumpet, but was adopted for use in the French Horn. (Blaikley, "Valve", Grove's Dictionary.).

major keys.

His eldest son, Antoine Joseph, known as Adolphe Sax, continued in his father's footsteps. In 1845, he took out a patent for the saxhorn, a new brass valve instrument of the bugle type. He introduced various improvements, among which was the substitute of a single ascending piston for the group of descending ones.¹ He did not aim at designing or improving instruments of the trumpet and horn qualities only, but rather at adapting improved valves to brass instruments of the bugle type ranging in pitch from soprano to contrabass, the lower pitched members of the family being substitutes for the imperfect serpents, ophicleides, and other bass horns then in use.

Many European manufacturers of brass and woodwind instruments began to operate. In woodwinds especially, several European manufacturers bear reputations today for quality which are well deserved. Such manufacturers as Selmer, Buffet, Heckel, and Robert do not permit their products to bear stenciled names. In

1. Chouquet, "Sax", Grove's Dictionary.

brass instruments Schmidt, Alexander, and Besson are outstanding manufacturers.

Charles G. Conn, who was born in Manchester, New York in 1844, provided the impetus for American manufacture of instruments. He came to Elkhart, Indiana with his parents in 1850. After many experimental years, he created a number of new manufacturing devices which made it possible for him to produce instruments of uniform excellence. Soon others followed in his work, continuing in research. The following list is the names of American manufacturers of band and orchestra instruments:

- Buescher Band Instrument Co.
- C. G. Conn Ltd.
- Elkhart Band Instrument Co.
- Frank Holton and Co.
- Imperial Band Instrument Co.
- Brua C. Keefer Manufacturing Co.
- Martin Band Instrument Co.
- Pan-American Band Instrument Co.
- H. N. White Company.
- York Band Instrument Co.

There are also a number of manufacturers who do not make complete lines of band and orchestral instruments, but who make specialties of various instruments. These are as follows:

- J. C. Deagan Co.
- Leedy Manufacturing Co.
- Ludwig and Ludwig.
- Nuss Manufacturing Co.
- Harry Pedler and Company
- R. E. Olds.
- Slingerland Manufacturing Co.
- Vega Company.

II. ACOUSTICS IN RELATION TO THE CORNET AND TRUMPET

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Sound has been a basis for scientific study and research ever since Pythagoras demonstrated the laws of vibrating strings during the sixth century B.C., and it is very probable that his studies were influenced by data derived from the Egyptians.¹ This was further developed by Aristotle and Plato, the former formulating laws concerning stopped pipes.²

The physical basis of sound consists of vibratory motion in some form. If the vibration is irregular, the resulting sound generally falls under the definition of noise; but if it is regular and periodic, the sound is a musical sound.³

When a vibrating body is in motion it communicates its vibrations to the air, which, in turn, conducts them to the listener. It is then said that

1. Mills, A Fugue in Cycles and Bels, 4-6.

2. Aristotle, Problemata, Prob. XIX.

3. Helmholtz, Sensations of Tone, 8.

the vibrations have been "transmitted" through the air from the vibrating body to the ear of the listener.¹ Air, which is the most common medium through which sound travels, has a power of expansion and contraction possessed by few other substances. Buck² has an illustration of expansion and contraction. He states:

If we pour half a pint of water into a pint-pot, the pot is only half filled. But if we make a vacuum in the pot and let in half a pint of air, the air fills the pot; though in expanding itself to twice its normal volume it halves its density. In the same way a pint of air can be compressed into a half-pint receptacle, in which case the density of the air will be doubled. When the density is diminished we say the air is in a state of rarefaction, and when it is increased, in a state of condensation.

When any given particle of air is displaced from its position of rest, the particle next to the one displaced has its equilibrium of elasticity disturbed on each side, and moves on to reestablish equilibrium due to the alternate states of rarefaction and condensation. In Figure 1.:

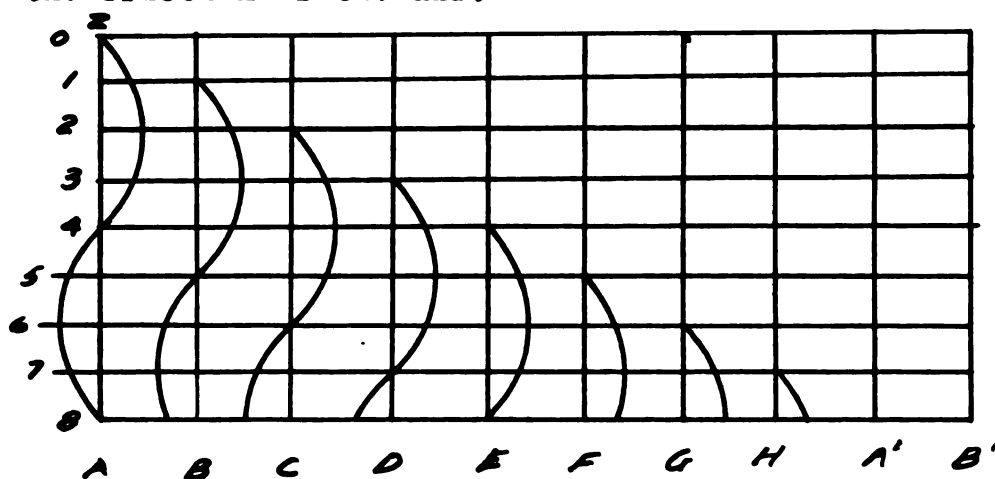
Let the curve A Z represent one complete vibration, and the row of dots on the line O represent particles of air at rest, and let the state of things in each succeeding eighth part of a vibration be represented by the position of the dots on the lines

1. Pole, The Philosophy of Music, 22.

2. Buck, Acoustics for Musicians, 122.

1 to 8. As A moves toward B the pressure about B is unequal on its two sides, and B moves towards C in consequence: C in turn behaves in the same way with respect to B and D, and so on throughout the series.¹

The whole diagram comprises one complete wave-length. This action repeats itself until the energy of the original particle has worn itself completely out due to the friction of the air.



(Figure 1. Wave-length and its vibrations.)

Sonorous vibrations may be of two classes, namely transverse and longitudinal. The vibration of strings is an example of transverse vibrations. In wind instruments the vibration is longitudinal, the only type concerned with in the acoustics of the cornet and trumpet.

1. Blaikley, Acoustics in Relation to Wind Instruments, 6.

Periodic pulsations of the atmosphere which constitute musical tone must be set in motion by an energetic force. They are produced by what Newton called a "tremulous body". Newton further states:

Every tremulous body in an elastic medium propagates the motion of pulses straight forward in every direction. The parts of the tremulous body alternately advancing and returning do, in advancing, urge and drive before them those parts of the medium that lie nearest and, by that impulse, compress and condense them; but, in returning, they allow the condensed parts to recede again and expand themselves. In consequence, the parts of the medium that lie nearest to the tremulous body move to and fro by turns in like manner as do the parts of the tremulous body itself; and, for the same cause that the parts of this body agitate these parts of the medium, these parts being agitated by like tremors will in their turn agitate others next to themselves, and these others agitated in like manner will agitate those that lie beyond them, and so on infinitum. And, in the same manner as the first parts of the medium were condensed in advancing, and relaxed in returning, so will the other parts be condensed every time they advance and expand themselves every time they return. It follows that they will not all be advancing or all returning at the same instant, else they would always preserve determined distances from each other and there could be no alternate condensation and rarefaction; but since in the places where they are condensed they approach to each other, and the places where they are rarefied they recede from each other, therefore some of them will be advancing while others are returning; and so on infinitum. The parts so advancing and condensed are pulses, by reason of the progressive

motion with which they press upon obstacles in their way; and the successive pulses produced by the tremulous body will be propagated in rectilinear directions, and at nearly equal distances from each other, because of the equal intervals of time in which the body by its several tremors produces the several pulses. And though the parts of the tremulous body advance and return in some certain and determinate direction, yet the pulses propagated from thence through the medium will spread themselves in all directions from the tremulous body, as from a common center, in surfaces nearly spherical and concentric.¹

In the cornet or trumpet the tongue, lips, and breath are the materials out of which this tremulous body is produced. The breath from the lungs is excited by the vibratory motion of the lips and forced into the instrument where it is amplified by means of resonance. The tones may be produced by blowing upon the mouth-piece alone, detached from the rest of the instrument. The tube comprising the rest of the instrument serves not only to build up the weak sound of the vibrating source, and reinforce it until it sounds louder, but also to refine the sound and make it more musical.

Zahm states:

.....resonance or consonance is the remarkable property that one sonorous body has of

1. Newton, Isaac, The Mathematical Principles of Natural Philosophy. (1686) Book II, Prop. XLIII, Th. XXXIV.

impressing its vibratory motion on another sonorous body.¹

He illustrates by holding a tuning-fork over a glass jar, pouring water slowly into the jar. As the water is poured into the jar, the sound is gradually augmented until at a certain height the note of the fork has attained its maximum intensity. If more water is poured into the jar, the sound rapidly dies away, until it becomes quite inaudible. Pouring out some of the water, and thereby lengthening the air-column, the sound is again reinforced. The same is true in the cornet, but there the tube picks out and amplifies only one wave whose length is proportional to that frequency. The waves both of condensation and rarefaction are so timed that their upward and downward motion are in perfect unison.

Musical tone or sound is made up of two distinct classes - pure and composite. The voice and musical instruments produce composite tones (or Klänge) composed of a number of partial tones each in itself pure, derived from the overtone series.² The number of

1. Zahm, Sound and Music, 266.

2. Seashore, The Psychology of Musical Talent, 129; see also the same author's The Psychology of Music, 96.

partials present in a tone depends upon the intensity of the tone, location of the tone within the compass of the instrument, and the instrument producing the tone.¹ Schwartz states:

In a wind instrument there operates a physical law which stands guard over the sound and sorts out and obliterates those vibrations which are unmusical, amplifying only those which are pleasing and which are desirable for the pitch note. The tubing is a sort of resonance filter which lets only the proper vibrations pass. The others are dampened out. In this way a clear and beautiful note is produced out of the mixture of vibrations which originates at the vibrating source.²

Although the lowest note on the instrument is that which has a wave-length twice the instrument's length, it is not easy to play this note because the performer's lips are not equal to the task. The upper octave of the fundamental is more easily played. When the lips are tightened and the instrument is blown harder, the vibration rate is increased until the one complete wave divides into two waves, each half as long. The resulting note is an octave higher than the former. By holding the lips tighter and blowing still harder, three waves result, each one-third as long as the first. If the performer were

1. Pole, The Philosophy of Music, 45.

2. Schwartz, The Story of Musical Instruments, 324.

equal to the task he could go on, compelling the wave to divide into seven, eight, and up to twenty or more separate waves. These notes would all be partials of the fundamental. There are wide gaps between the lower partials, but as the higher partials are reached the notes are closer together until, when at the thirteenth partial, the notes are a half-step apart.

All brass instruments are capable of producing these tones of the overtone series, even though some are very impractical. The depression of a valve or valves open airways with additional tubing which virtually lengthen the instrument so that the gaps may be filled with notes from other series of tones. The first valve opens a length of tubing which enables the performer to play a whole tone lower than the open tone. The second valve lowers any open tone one-half tone, and the third valve opens up three half tones, or a tone and a half. The combination of the second and third adds two full tones; the first and third combine to make two and one-half tones; and by combining all three valves, three whole tones are added. These combined lengths of tubing enable the performer to reach six half tones

below any open tone and are sufficient to bridge all the gaps in the overtone series excepting in the first octave above the fundamental in which only six of the twelve half tones are available.

When the air-column of a cylindrical tube is blown by the lips, only the odd partials are obtainable. If an open tube could be used, all the partials would be possible, but the closed pipe must be considered because the mouthpiece seals one end.

Blaikley states:

In short, we require a tube which although closed at one end, shall have for its proper or resonating tones all the notes of the harmonic scale. Such a form exists in the cone; a cone, open at its base, and complete to its apex, where it is of course closed, gives a fundamental note of the same pitch as an open tube of equal length, and the overtones in the same order of succession.¹

The theoretic cone, complete to its apex, is an impossibility; as a wind instrument must of necessity have a considerable diameter where the lips are placed. This aperture at the mouthpiece alters the ratios required in the sounding of the partials. The only way to prevent

1. Blaikley, Acoustics in relation to Wind Instruments, 18.

such irregularities is to replace the straight lines of the cone by curved lines which gradually decrease in curvature until they run out in the straight lines of the cylindrical tubing. At the top is an antinode, where the molecules are in violent movement but where the pressure is slight. In the center is a node, where the movement of the molecules is at a minimum, but where the pressure is greatest.¹ At the bottom end is another antinode. The nodes in the cone are at increasing distances apart, reckoning from the open end, and at the apex of the cone is a node common to all notes. An inaccurate fitting of pistons, dents in the instrument, or collection of foreign material will alter these nodes and antinodes to such a degree that the tones will be destroyed or intonation impaired.

The three important characteristics of a vibration in music are; frequency, amplitude, and form.² Pitch depends solely on the length of time in which each single vibration is executed, or the number of vibrations completed in a given time. Amplitude is the amount of disturbance or the height of a vibration. Loudness depends

1. Jeans, Science and Music, 111.

2. Pole, The Philosophy of Music, 21.

on this, and is independent of frequency. In music, for example, a crescendo or diminuendo without change of pitch would be impossible if this were not true. The distinctiveness of tone quality or timbre depends upon the form of the vibration.¹ That overtones account for quality of tone, has been demonstrated in various ways. Helmholtz invented a complete set of resonators, so made that each would vibrate in sympathy with a certain pitched tone, shutting out all others. When one end was inserted in the ear, the resonator's mechanism would pick out its particular note from a complex and rich tone and would vibrate violently, causing its note to sound loudly in the ear. By the use of these resonators, rich tones were analyzed into the fundamental and all the overtones that were present.

Quality of wind instruments are divided into three distinct classes - brass, reed, and flute. The flute is characterized by very few and weak upper partial tones, whereas, reeds are characterized by very strong odd numbered partials. The quality of the brass family is made by many partial tones. The method of vibration is totally different from the reed of the oboe

1. Helmholtz, Sensations of Tone, 11.

or clarinet; for whereas in these the lower harmonics are dampened by the appended tube, and one of the higher and sweeter partials is reinforced, in the cupped instruments every successive harmonic from the very lowest is practicable, and all but the extreme bass sounds are actually used successively in producing the scale.¹ Instruments have been invented which reveal the presence of overtones. These machines, called oscillographs, picture sound by means of curved lines. Each musical instrument produce curves of characteristic shape, the intricacy of pattern indicating the presence of the overtones.

Timbre is not only caused by the overtones which accompany the fundamental note in different degrees, but also by the more or less distinct noises which are caused by the special method through which the sounds are produced. In wind instruments where the tones are maintained by a stream of air, one generally hears more or less whizzing and hissing from the instrument and from the air which breaks against the sharp edges of the mouthpiece.² Mutes tend to alter the partials in

1. Stone, Elementary Lessons on Sound, 176.

2. Blaserna, The Theory of Sound in its Relation to Music, 166.

brass instruments and effect the tone so that it is more characteristic of another instrument. A muted trumpet or cornet is very similar to the tone of an oboe. Two different players may play upon the same instrument, yet entirely different tone characteristics are brought out. The reason for this is the technical playing ability of the performers. Some players do not have the trained lip control, or embouchure, which enables them to play a note so that the tone wave vibrates as a whole and in many smaller sections at the same time. Often the instrument is defective, certain places in it serving to kill the overtones where they should appear. Each instrument may possess the same number of overtones, but in the large-bore horns the low overtones are produced while the high overtones are dropped out, and in the small-bore instruments the high overtones are favored. Not only the width of bore influences the tone quality, but the taper in the bore is equally influential. The wider or more tapered the bore, the fewer overtones; the more nearly cylindrical the bore, the more overtones there will be. Selection of mouthpieces is very important also. The lower the compass of the instrument, the lower and deeper the cup; the

higher the compass of the instrument, the ^{MORE} shallow the cup should be. The quality of a tone is strengthened if the brass player will play with great intensity as the upper partials will be brought into use.

There is a definite correlation between tone quality and intonation, so the selection of an instrument is an all important factor. In regard to this, Blaikley comments:¹

As a general law, it will be found that there is a close connection between intonation and quality, that is to say, that an instrument which is well in tune is also of good quality; the exact tone-quality which is the best for any particular class of instrument is, of course, a matter of individual taste to some extent, but, whatever the exact quality, it should be tolerably uniform throughout the compass of the instrument or it cannot be called good.

Alternate fingerings for various tones may effect a slight difference in pitch. In the construction of an instrument, the valve slides are not proportional in length. One difference is that the sum of the lengths of the first and second valves is less than that of the third valve, if each valve has

1. Blaikley, Acoustics in relation to Wind Instruments, 28.

been adjusted to lower the tone by its appropriate number of semitones. The first valve increases the speaking length in the ratio 15:16, and the second in the ratio 8:9, and thus the two together lengthen it by $\frac{23}{120}$ which is less than the increase necessary, $\frac{24}{120}$, for three semitones.¹ Since the additional length is inserted in slightly different positions when alternate fingerings are used, some peculiar formation in the bore may be situated at an antinode in one case and not in another. Consequently, all tones played with the first and second valves may not be the same degree sharper than the corresponding tones played with the third valve.

The generally accepted definition that the trumpet is two-thirds cylindrical and one-third conical, while the cornet is one-third cylindrical and two-thirds conical is not altogether true. Actually the only parts of the trumpet tubing which are cylindrical are the valve and tuning slides, but likewise constitute the only cylindrical tubing in the cornet. The mouthpiece of the trumpet formerly was mostly

1. Richardson, The Acoustics of Orchestral Instruments and of the Organ, 82.

cylindrical, but today it is generally tapered. The actual sliding part of the tuning slide is cylindrical, but on most trumpets the side joining the mouthpiece is smaller than the slide leading to the valves, thereby giving it a gradual taper. It is true, however, that the degree of taper differs between the two instruments. There is less taper in the trumpet, and more in the cornet. The mouthpiece receiver on the trumpet is larger than the receiver on the cornet, while the bell is usually smaller, thereby allowing more taper between mouthpiece and bell in the cornet than in the trumpet, both having the same bore through the valves. This difference between them is effectual and still defines their tonal qualities.

III. CARE OF THE INSTRUMENT

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The first few lessons are the foundation of a musician's career, and the instructor should devote time to explaining the essential parts of the instrument in addition to its proper care and usage.

In order to keep an instrument in perfect working condition, constant care and attention is necessary. Through continued blowing, the inside of the tubing becomes covered with a coating of saliva, which if allowed to stand, turns hard and forms deposits of verdigris. An unsanitary instrument is not only a source of constant danger to the player, but intonation may become impaired. Warm water should be run through the instrument frequently in order to prevent the incrustations of oil and dirt. In order to clean an instrument, the valves should be removed and the instrument submerged in warm water for a short

time. Hot soap suds may then be poured into the bell and slides. A soft brush on a flexible wire will aid in the loosening process. A thorough rinse with warm water is necessary to remove all deposits. The process should be repeated in severe cases, or sent to a reliable repair shop for steam cleaning. The accumulated water should be removed from all parts of the instrument by blowing immediately after playing to prevent the collection of sediment.

An application of vaseline to the threads of valve caps and to all slides will keep them in good working order and will also prevent rusting. Slides should be moved in and out daily to prevent them from sticking. The application of vaseline will aid in keeping the slides air-tight and easily movable.

The valves, or pistons must be kept immaculately clean to work freely. They should be removed frequently and wiped with a piece of soft cloth. The openings in the pistons also should be kept clean. The bottom caps should be removed and the inner valve casings cleaned thoroughly. Noisy valves are sometimes caused by the spring rubbing against the stem which it surrounds, or by its coming in contact with the chamber

in which it is encased. This noise may be stopped by setting the spring properly, or by putting a drop of oil at the point of friction. Worn-out pads or corks are also likely to cause noise and should be replaced. Valve oil rather than saliva should be used at all times. The oil not only lessens the friction but preserves the pistons against the ill effects of acid in the saliva. It also absorbs corrosion and small particles of food that may be blown into the instrument.

In order to conclusively determine the relative merits of oil and saliva for valve lubrication, a number of comparative tests were performed upon five leading brands of valve oil. All the liquids were individually tested for density, surface tension, and acidity. Figure II. is a table showing the numerical results of the tests related to a similar test of saliva, and are very significant in the selection of a lubricant for cornet and trumpet valves. The tests show conclusively that saliva is much heavier than the oils and water. In order to reduce the friction in close fitting valves, as thin a lubricant as possible is necessary. The measurements

of the surface tension tests also support those of density and further prove that saliva is a much heavier lubricant than the oils. The corrosion of valves is caused by the acid contained in saliva and

Liquid Tested	Density (grams per C.C. at 24)	Surface Tension (Dynes per Cm.)	Acidity
Saliva ¹	1.007(ave.)	57.7(ave.)	90-190 C.C .02N HCl per 100 C.C.
Oil No. 1.	0.8073	27.9	0.0
Oil No. 2.	0.7950	27.5	0.0
Oil No. 3.	0.8010	27.4	0.0
Oil No. 4.	0.7943	27.5	0.0
Oil No. 5.	0.8137		0.0

Figure II. Oil and Saliva Tests.

in the water which is formed by condensation of the breath. The oils are not only free from such acid content, but also aid in the preservation of the pistons.

1. Hawk and Bergeim, Practical Physiological Chemistry, 268-269. The values as found here were substantiated with tests of specimens from 20 members of the Michigan State College Band.

Saliva furthermore contains a considerable amount of mucus which is detrimental to proper valve action; whereas the oils are free from damaging impurities.

The exterior parts of the instrument should be kept clean and bright. If the instrument is not badly tarnished it may be washed with soap and water; afterwards polished with a soft cloth or chamois. There are numerous preparations and polishing cloths for cleaning brass and silver effectively, which may be used in cases where the tarnish cannot be removed by ordinary methods.

The cork on the water-key must be replaced as soon as it wears out and the spring should be oiled frequently. Dents should be removed as soon as possible; and worn valves, slides, or other fittings which tend to mar the tone should be plated and reground.

The instructor should not fail to emphasize that more instruments are ruined by neglect than by ordinary wear received in playing.

IV. TONE PRODUCTION

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A. Position of the Instrument.

The initial step in cornet and trumpet pedagogy is the correct position of the instrument in preparation for the actual playing. The cornet is held firmly with the left hand, the thumb being slightly bent around the first valve, and the fingers placed together back of the third valve. The right hand takes a position with the thumb against the casing of the first valve allowing the first three fingers to curve over the valves. The fingers of the right hand must not be extended across the valves, nor should the extreme finger tips be used to press the valves down. The fingers must be in the form of an arch, thus enabling the valves to function freely with the fleshy part of the finger tips. The correct curvature may be found by allowing the student's right arm to fall along side the body in a very relaxed manner. The student should then notice the natural curvature of the fingers, assuming

this same position above and over the valves.

The small finger-hook frequently found on cornets is for the purpose of playing with one hand while turning pages with the other. It should not be used while playing with both hands. Action of the third and little finger are so closely allied that any restrictions placed on the little finger may also tend to restrain the third finger. It may be used if the position of the little finger in the hook does not inhibit the freedom of the other fingers.

The valves should be pushed straight down with the fleshy part of the finger tips in a definite and precise manner. Any sidewise thrust is apt to cause the valves to bind, thus retarding the action. The lifting of the fingers is as important as the downward motion, and should be accomplished quickly in order to effect the change of tones cleanly. The lowering and raising of two or more valves must be done simultaneously. Valuable finger practice for strengthening may be assigned by the instructor without the use of the instrument. This may be accomplished by placing the finger tips on the edge of a table or any other flat surface, manipulating them in all possible combin-

ations with sufficient force in audible rhythmic patterns.

The cornet should be held in a horizontal position, squarely in front of the player. The cornet may be tipped slightly to the right in order to prevent the left hand from becoming cramped in any way. The arms should then assume a natural position away from the body. In practicing, it is best to stand erect with the feet spread about a foot apart so that the body has balance and solidity, and the student may breathe deeply.

B. The Embouchure:¹

The placing of the embouchure is one of the most important as well as the most difficult phases of cornet playing. A good embouchure depends upon the physical characteristics of each individual player. Crooked and irregular teeth cannot be expected to form

1. The embouchure is the part of a musical instrument applied to the mouth; hence the formation and disposition of the lips, tongue, and other organs necessary for producing a musical tone are denoted by this term.

the base of an embouchure that will respond to natural playing. A peaked lip or underslung jaw are other common irregularities that tend to prevent correct embouchure placement. Players with exceedingly thick lips present another problem to the cornet instructor. The physical prerequisites for a cornetist should consist of regular and even teeth,¹ lips that are not overly thick, and a determined jaw. This should not be used as a hard and fast rule, but may be applied in the majority of cases. Many players have attained high recognition in the professional field with physical handicaps, overcoming them by means of conscientious practice and determination.

Care should be taken in the selection of a suitable mouthpiece. If the formation of the jaw and teeth are close to normal, any one of the accepted standard mouthpieces may be used with satisfactory results in the majority of cases. A mouthpiece with a reasonably broad rim and fairly deep cup should be used by the average player. If the jaw and teeth have distinct

1. Lamp and Epley, "Relation of Tooth Evenness to Performance on the brass and woodwind Musical Instruments", The Journal of the American Dental Association, July, 1935. Lamp and Epley take exception to the need for regular teeth, but do not quote definite enough statistics and measurements to substantiate their contention.

peculiarities, then a specially constructed mouthpiece may be used in order to compensate for the specific handicap.

The embouchure is difficult to set, as the important part, where the lips are set in vibration, cannot be seen either by the player or by the instructor. The mouthpiece cannot be placed by a definite set of rules, but only through guidance on the part of the teacher and based on a few experimental principles. Some instructors and players advocate two-thirds of the mouthpiece on the upper lip, one-third on the lower lip; others say one-third on the upper lip, two-thirds on the lower lip; and still others recommend one-half on the upper lip, one-half on the lower lip. No one of these opinions is universally accepted, nor has any one been supported by scientific investigation. Embouchure depends upon the formation of the individual mouth, teeth structure, and skin texture. In other words, there can be no single norm into which all pupils should be placed. It is advisable, however, to start with one-half on the upper lip and one-half on the lower lip, gradually raising or lowering the mouthpiece if this position is unsatisfactory. Care should be exercised that the mouthpiece is placed in the exact center of the mouth.

The smile is an excellent basis for the placement of the mouthpiece against the lips. The smile draws the corners of the mouth back and inward, thus forming a firm base for the mouthpiece to rest upon. In some cases, the lower jaw should be brought out slightly in order to have the lower teeth in line with the uppers. The lips should be against the teeth and gums in a solid fashion, rather than in a stretched manner. If the lips are stretched tautly across the teeth, the tone will respond only by means of excessive force and strain. Generally speaking, the so-called "buzz system"¹ is not very satisfactory, and should only be used in cases where the player has a physical make-up appropriate for this kind of embouchure. It should not be recommended to the beginning pupil, but may be held in reserve for exceptional cases. Keeping the lips tightly closed thus forcing the lips to vibrate might produce a fuzzy tone and may prevent the student from advancing beyond a certain degree of skill. The lips must be held parallel, and the upper lip must not overlap the lower while playing. After the player has assumed a correct position, the center of the lips should

1. The buzz system consists of forcing tightly closed lips to vibrate.

be pursed slightly, leaving an opening between. As stated above, the foregoing may not be applicable to everyone, but represents a point of departure.

The one criterion of a good embouchure is the ability to play with as much ease and as natural as possible. The only exception to this rule is in the playing of extremely high tones, where the lips must be stretched tighter in order to facilitate rapid vibration.

As soon as the mouthpiece is placed on the lips, the student should then experiment as to a comfortable position, tightening around the mouthpiece so as to prohibit the escape of air. Once a satisfactory position has been attained, it must not be moved either for ascending or descending passages. For the higher tones the lips should be drawn tighter by the muscles, the muscular tension to become more relaxed for the lower tones. The instructor should encourage the use of a mirror for individual practice. By practicing before a mirror, a beginner can avoid falling into many undesirable habits.

C. The Attack:¹

When the instructor has succeeded in helping the pupil to find a comfortable and logical embouchure, the student should be advised as to the proper beginning of any tone. In preparing for the attack, the tongue should be placed against the center of the lips; then for the actual attack the tongue is retracted from this position. The tongue must be pointed, leaving the base of the tongue as relaxed as possible. The tongue acts in the capacity of a valve in stopping and allowing the breath to enter the mouth-piece and instrument. The action of the tongue is much the same as if a foreign substance, such as a thread, occupied its tip, and the person wished to eject it.

The attack not only involves the action of the tongue, but also involves controlled exhalation of the breath. When the tongue has assumed its position in preparation for the attack, the muscles of the diaphragm should be tightened. This tension is increased the same instant the tongue is retracted from its

1. The attack is a technical expression for decision and spirit in beginning a phrase or passage.

position against the lips. The tongue, breath, and diaphragm must work simultaneously in order to perform the attack properly.

Many instructors advise tonguing in back of the upper teeth, but observation shows that a breath sound often precedes the actual tone. The only way this breathiness may be overcome and a clean attack obtained is by controlled direction of the breath with execution of the tongue against the center of the lips. The exact placement and means of retraction varies for each tone in the instrument; only by continued experimentation on the part of the individual pupil can all tones receive the attack with definite assurance. The lips are the generators of the vibratory motion of the breath, and only with the tongue against the lips may the vibrations be set in motion cleanly without disturbance. For the lower tones, the tongue should be slower in action and pointed downward. Tones of the middle range (those located on the staff) may be obtained by pointing the tongue straight ahead. For the higher register, the student should point the tongue upward and slightly back from

the aperture of the lips.¹

The cheeks must not be puffed, nor should air escape on either side of the mouthpiece. The entire face should remain motionless; only the tongue should move. In attempting to produce the first tone on the instrument, the student should not press any valves down, thus producing an open position tone. No attempt should be made to produce any definite pitch. The player will eventually produce some pitch; whichever pitch this is, it should be played over and over again until the student has gained control of it and can reproduce it at will.

D. Breathing:

Breath is the body of the cornet tone because the sounds produced by this instrument, as well as all the brass and woodwind instruments, are the result of columns of air in vibration. For this

1. A few cases have been found where the tongue works in exactly the opposite manner. However, they are rare, and the instructor should be certain before advising this altered procedure.

reason, the instructor should not fail to emphasize correct breathing and breath control. Breath must be taken in through the corners of the mouth after the mouthpiece has assumed its position on the lips, rather than by means of the nose or through the instrument. This insures speed of inhalation providing air with sufficient oxygen content for the body and instrument. This is very important in cornet performance as an ejection of wind from the stomach will cause a pitch to flatten almost a semitone.

The ordinary breathing of everyday life brings oxygen into contact with the blood in the lungs carrying carbonic acid away.¹ Elevation of the ribs expands the chest and increases its circumference, and the contraction of the diaphragm lowers its floor and enlarges its capacity in a downward direction.² The two actions go together and draw a sufficient volume of fresh air into the lungs with a slow, easy movement. The used air is more quickly emitted, principally by the elastic recoil of the lungs and chest; thereafter

1. Bayliss, Principles of General Physiology, 600.

2. Curtis, Voice Building and Tone Placing, 49.

there is a slight pause. This occurs about every four seconds or fifteen times a minute.

Breathing for cornet is quite different. Its whole object is to maintain a sustained and well-regulated air-pressure for the production of sound. A full breath must be taken rapidly, and then kept in a state of controlled compression as long as thirty seconds. Thus the number of respirations possible in a minute may be reduced to a minimum. This necessitates a much larger volume of breath than is ordinarily needed, not only for the length of time the sound may have to continue, but also for the supply of oxygen to the blood. The first point is, therefore, to secure the power of taking in a large volume of air as quickly as possible; the second point is to give it out with carefully regulated force, for upon this the controlled production of sound entirely depends.

The amount of breath to be inhaled should be regulated by the length of passage to be played. If the breath is not regulated the player will experience a feeling of fatigue and suffocation due to excessive strain on the lungs. The breath must be held back so that a continuous, intense, and concentrated column of

air is propelled through the instrument. The lower tones require less intensity of air, the higher ones a great deal more. As soon as the tongue has actuated the attack, the breath must remain constant and level throughout the duration of the tone. Any fluctuation or waver of the breath will result in a change of pitch or a complete loss of the tone. If the player does not have use for all the breath he has taken into his lungs and diaphragm, he must not allow it to escape through the instrument, but exhale freely through the nose. He is then ready to take another breath as previously described. The student should avoid taking in too much breath where it is not needed.

After the beginner has acquired good control of his breath, he should practice quick breathing which is very essential to good cornet playing. Usually a breath should be taken during a rest, after a phrase, and after tones of long duration. Breathing places are sometimes marked by the breath sign ('), and new music should be scanned and so marked where the breathing possibilities are difficult.

E. Tone Placement:

Tone placement is the foundation to true intonation and tone production. Each tone has a definite place in the instrument, and the skilled cornetist must have an accurate conception as to the relative position of each tone and what he must do in order to obtain it.

The player should conceive of a cornet tone as round, clear, and solid; rather than angular, irregular, and spacious. Also, the student should consider the entire range as a ladder of these tones, some larger, some smaller according to the intuition of each individual player. Each step in this ladder has its own characteristics, and the distances between tones are not always the same. The open tones are the most direct in the instrument, and thus produce the most perfect conception of complete roundness. The most imperfect are those tones using all three valves simultaneously, and those involving the combination of the second and third valves because of the decided addition to the air column. Half way between these two extremes are situated the other valve positions, namely: the first valve, the second valve, the first and second

valves, and the first and third valves. The reason for these differences is an acoustical problem involving the additional length of tubing of the three valve slides, which, in each case, will change the location of the nodes and antinodes in the instrument.

Tone production and tone placement can be illustrated as in Figure III. where (a) shows the beginner's conception of an open tone, (b) shows improvement in tone, and (c) represents the perfect conception of the same tone.¹

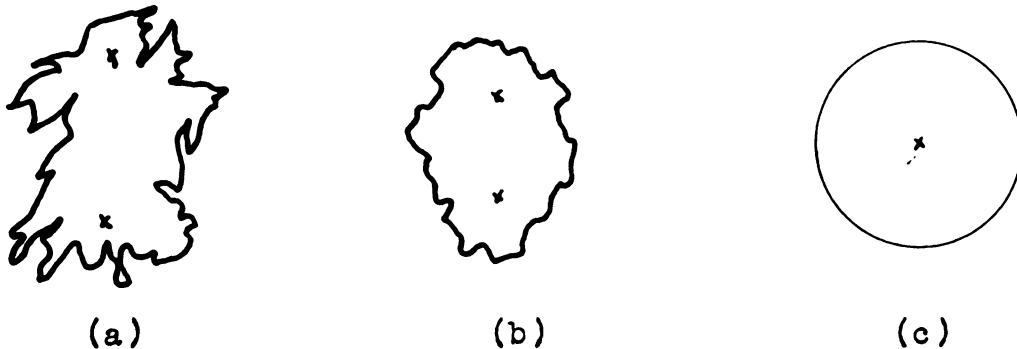


Figure III. Tone Placement.

The clearest and purest tone is a well-centered tone, and is only possible if the attack and duration are effected at the center. The first two illustrations in Figure III. show that the center is not adhered to, but is produced either by blowing too high or too low. If the tone is blown high, a forced

1. Cf. chapter II above.

tone will be the result; if blown too low, a depressed tone will be the outcome. This center may be located by changing the direction of the breath upward and downward until the clearest tone is produced. The breath may be sent upward or downward by lifting or lowering the diaphragm. In some cases the action of the breath may be accompanied with a slight protrusion or retraction of the jaw in locating the exact center. The action of the tongue and the amount of breath are other factors which must be considered by each player. Adjustments must be made in tone placement if the player changes from one instrument to another.

After the student has become proficient in tone placement, he may shift his attention to tone production entirely. The latter is accomplished by complete breath control. Tones of long duration should be played with as much volume as possible without overblowing the instrument. When an ideal tone has been produced, the student should match the others with this one. By comparing the poorer tones with the better ones, the beginner will soon experience a uniformity of tone throughout the entire compass of his instrument, the goal of every cornetist.

F. The Sustained Tone, and the Release:

The study of sustained tones in cornet playing serves the same purpose as do warming-up exercises for athletes before participating in a strenuous contest. The beginning cornetist will invariably try to play rapid passages and high tones as soon as his instrument is removed from its case. This procedure must be discouraged by the instructor. The playing of sustained tones should occupy the first few minutes of the practice or playing period. They will not only place the lips in proper playing condition, but also will aid in the development of a strong embouchure and tone of good quality.

The sustained tone should be started with the common attack and held as long as breath permits, diminishing toward its close. The lips, jaw, and breath must remain absolutely steady during the course of the tone. Quivering and spasmodic twists of the lips and unsteady breath will probably be experienced at first, but by persistent practice these may be overcome.

In order to bring the tone to its proper

close, the breath must be diminished in volume as the tongue resumes its position of attack against the lips. If the tone falls off toward its close, the diaphragm should be lifted in order to give it the necessary support. If the tone becomes higher at the end it is a result of pinched lips, and should be avoided. By lifting the diaphragm, the volume of air is reduced but the intensity remains the same, thus keeping the pitch constant until the tone is inaudible. The release may be practiced by playing a tone for the duration of four slow beats, closing the tone at the count of four, diminishing for one-half beat.

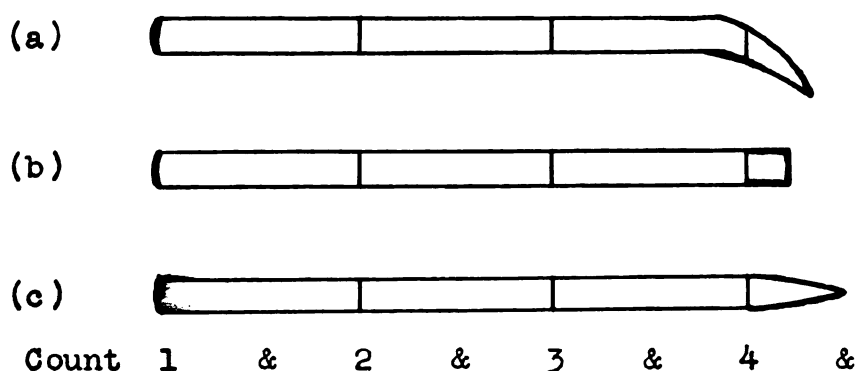
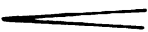
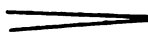


Figure IV. The Release.

Illustration (a) in Figure IV. is an example of the undesirable release. In (b) the tone is cut off too abruptly giving the release a choking effect. The true

expression of the proper production and release may be seen in (c), secured by means of a clean but not too sharp attack, a level tone, and concluded with a diminished release. The length of the sustained tone may vary among different players, but the average length should be in the neighborhood of fifteen seconds.

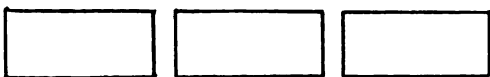
As soon as the student has mastered the sustained tone to a certain degree of proficiency, he should then strive for a softer attack, increasing (crescendo ) the tone during half the breath, and then diminishing (decrescendo ) the tone during the remainder of the breath. Care should be taken that the player does not produce a harsh tone while making the crescendo. Also, the tone should not become sharper when the volume is increased, nor flatter when it is diminished. The player should always strive for a full and clear tone at all times, abstaining from the use of vibrato. This practice should be transmitted to the entire range with perfect ease and without heavy pressure; thus by systematic training the lips will be strengthened. Sustained tones should be studied at the beginning of every practice period or playing engagement whether the cornetist is a beginner or an advanced player.

V. TECHNIQUE

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A. Tonguing:

Tonguing is repetition of attack, and can be phonetically represented by a succession of the linguo-dental syllable tu. There are four distinct classifications of tonguing, namely: the sforzando, the common, the staccato, and the soft or legato. The sforzando tongue is an explosive attack produced by means of a very strong breath and a vigorous stroke of the tongue. The tone is not diminished and is ended abruptly. This is very unpleasant and undesirable, and is used only for special effects. In Figure V., (a) is an illustration of sforzando tonguing.



(a)



(b)

Figure V. Sforzando and Common Tonguing.

The common tongue is, as its name implies,

used frequently in all types of playing. The attack is definite and must be supported by a full breath, the volume being diminished toward the close of each tone. It is advisable, in order to obtain clean playing, to leave a very short pause between tones. This gap must not be too long or the playing will become choppy and unmusical. Example (b) in Figure V. pictures the common tongue.

The staccato is another type of tonguing frequently used. This is produced by a quick action of the tongue, the tone being released as soon as it is sounded. The staccato or rapid tonguing is much more fatiguing than the others, and must be practiced regularly to approach perfection. In order to perform a clear staccato, it is absolutely necessary that the instrument have perfect valve action and fairly stiff valve springs. A staccato tongue cannot be produced if the pistons are partly down as the note will tend to crack. If the valve has a slight rebound, the springs are not stiff enough for exacting work.

In playing staccato, the tongue should not be out against the lips as in ordinary attacks, but rather against the lower portion of the upper teeth. The

movement will not be as great from this position, thus permitting more speed. Only the tip of the tongue should be used, and the retraction must be done quickly. Perfect tone placement is essential in producing a good staccato, inasmuch as the tone is released as soon as it has been sounded. It is advisable to practice the staccato on one tone at first, gradually increasing the intervals until octave jumps can be produced cleanly. In Figure VI, (a) represents staccato tonguing.

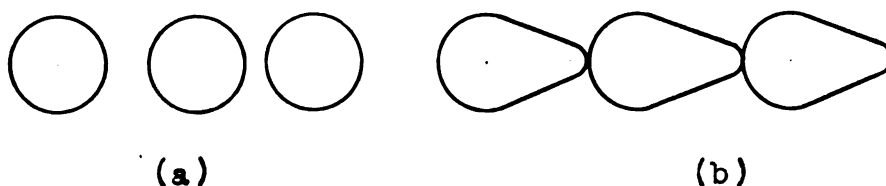


Figure VI. Staccato and Legato Tonguing.

The fourth and last type of tonguing is the soft or legato tongue. This differs from the other three inasmuch as the tongue does not resume its normal position against the lips, but back of the upper teeth or possibly between them. It is similar to the common tongue in body, but the gap between tones is done away with, thus effecting a continuous

tone with slight punctuations of the breath. The soft tongue may be phonetically represented by a succession of the thu syllable. The breath should be continuous and is only partially stopped by the slight action of the tongue. The most effective use for the legato tongue is in song playing and in passages of melodic character. Example (b) in Figure VI. shows this type of tonguing.

As a general rule, the beginning pupil should use the common tongue on quarter notes and notes of longer duration in exercises of moderate tempo. The staccato tonguing should be reserved for eighth and sixteenth notes.

B. Slurring:

The cornet instructor should not introduce the slur to the beginning player until his lips are sufficiently strong, lest they suffer permanent injury. There are two ways by which the slur may be produced: with the breath and lips, or with the tongue, breath and lips. The former should be taught first, using small intervals preferably

those involving a change of fingering. It is also advisable to present the downward slur first, in order to prevent the excessive use of pressure and strain.

The breath and lip slur is accomplished by means of a synchronization of the breath, the fingers, and the lips. When slurring from one tone to another, the direction of the breath must be changed in the direction of the new tone as discussed in chapter IV. The lifting support of the breath should become more intense on upward slurs, and less intense on downward slurs. In slurring from a lower to a higher tone, the lips must be stretched somewhat by tightening and drawing back the corners of the mouth. This should be accompanied by a slightly increased pressure of the mouthpiece against the lips. When slurring from a higher to a lower tone, the lip muscles must be relaxed to the position of the lower tone. The lower tone must also have the support of the diaphragm during this operation or there is the possibility of too great an impact on the lower tone or losing the tone altogether. If the slur necessitates the change of fingers, the lifting and placing of them must be done with precision and not lazily.

When first attempting the slur in fairly wide intervals, the diaphragm should be tightened quickly, thus forcing the slur with the breath. After the player has succeeded in obtaining the slur in this manner, the action of the lips, the mouthpiece pressure, and the strength of the breath may be minimized until a smooth and effortless slur is produced. The teacher should impress upon the mind of the cornet student that this is possible only if the action of the breath, the fingers, and the lips are simultaneous.

As soon as the student has reached a plateau, his ability to handle the breath slur, the tongue slur may be introduced for extremely wide and awkward intervals. It is done in exactly the same manner as the breath slur with the addition of the soft or legato tongue. The tongue is but an aid in locating the distant tone, and should be treated as such. The student should be cautioned that this is to remain a slur and that the tongue should not be heard.

The beginner should not attempt high slurs until the lip muscles are strong, and he has acquired flexibility in the middle register.

C. Articulation:¹

Articulation sums up all phases of trumpet and cornet playing previously acquired, and gives the instructor an excellent opportunity to test and review everything that has been taught up to this time. If the student is weak in any of the fundamentals, they will appear in articulated exercises. The instructor should analyze the faults carefully, making minor changes adapted to the individual need before proceeding to more advanced work.

Trumpet music frequently employs the use of the slur in combination with staccato notes in the same group. When this is the case the second of two slurred notes should be weaker and shorter than the first in order to enable the tongue to resume its position of attack in preparation for the staccato notes which are to follow. This necessitates the stopping of the breath at the conclusion of the slurred notes.

It is advisable in most cases for the

1. Articulation is the distinct production of correct tone, whether slurred or tongued, by proper adjustment of lips, breath, and fingers to an instrument.

instructor to emphasize the value of accentuation and stress in conjunction with articulation, if not previously demonstrated. For the sake of clarity, the first beat of every bar should receive a strong stress or accent. In quick common or triple time there is but one accent in a bar, on the first beat; but in slower time, whether common or triple, there are two - a stronger accent on the first beat of the bar, and a weaker one on the second or third. It is often necessary to introduce more accents than the ordinary rhythm requires and the omission of others according to the rhythmic pattern and character of the music.

Similar groups of notes should receive stress on the first tone of each group in order to insure a strict rhythm and to also add life and vitality to the music. In rapid passages of strong rhythmic nature containing combinations of slurred and staccato notes, a crisp tongue action should be used and the fingers should move the valves in a percussive manner to ensure distinction. A continuous flow of breath must be available for all types of articulated passages. Groups of slurred couplets or triplets, when occurring in music of smooth nature,

should be closely connected by means of the legato tongue in order to carry out the style of the music. In cases where there are groups of longer and shorter notes, the longer notes should receive their full value while those of shorter duration should be made somewhat shorter in order to remain separated from each other by brief intervals of silence. Articulation plays an important role in phrasing and should be observed in minute detail by the professional as well as the beginner.

D. Scales and Intonation:

The value of scales is frequently misunderstood by teacher and pupil alike. Many instructors omit scales entirely from their routine of trumpet pedagogy, and by so doing endanger the musical future of the student. True intonation in individual playing can only be approached by the use of scales in various forms. Scales are a valuable aid in the development of technique, and should be studied along with sustained tones during the warming-up period.

The competent teacher of cornet and trumpet

who has familiarized himself with the theory of music and the science of acoustics is aware of the fact that the musical scale of today is imperfect. For example, c[#]' and d^b' are two entirely different notes having different vibration rates, yet on keyboard instruments they are played on the same black key. The tuner alters this note so that it is, as nearly possible, half way between c[#]' and d^b'; in other words, this note is tempered. On a cornet or trumpet, the c[#]' and d^b' are always too sharp, and the manufacturer does not attempt to correct this deficiency fully, because in order to do so the third valve slide would have to be made so long that g^b, g, a^b, d', e^b', a^b', and a^b' would then be too flat.¹ This c[#]' or d^b' must somehow be lowered so that it will be in tune with other notes played adjacent or in harmony with it. This is done with the breath as previously described in chapter IV, E. This tone will not be lowered as much in the sharp keys as in those involving flats. Other tones of an instrument may be defective, and may be adjusted by similar means.²

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1. The player would then be confronted with the problem of trying to play all of these notes in tune.
 2. If the instrument has an adjustable slide, the pupil may use this device.

The most successful method of presenting the harmonic and melodic minor scales is to assign them in conjunction with their relative major scale. The whole tone scales should not be overlooked as they are being used more and more in modern compositions. The use of the third valve on a, e', a', and a'' are to be recommended when approached from a semitone below. The intonation will be impaired slightly, but finger difficulties will be minimized at these points, especially in rapid passages. This also tends to clarify playing, and makes for smoother progression in slurred passages.

Scale practice should not be restricted to tonguing alone, but should also employ slurring and articulation in as many rhythmic patterns as possible. This is conducive to creative work on the part of the student, and is a means of correcting faulty articulations that may have occurred in other parts of the lesson.

Each tone of a scale has a definite relationship to its tonic or keynote, of which the player should be conscious soon after undertaking the study of scales. The different kinds of scales mentioned above should be played slowly at first in a sustained manner in order to give the ear ample opportunity to hear and become critical of this relation-

ship of tones. The instructor should insist upon pupils playing in all keys rather than in a select few. Scales should be reviewed constantly, and those emphasized which occur in the solos and studies of the pupil's lesson. A valuable procedure is the playing of scales without the aid of music. This necessitates the visualization of staff notation as the tones are played. Finger memorizing, per se, has no value and should be stopped as soon as it is apparent in the pupil's work.

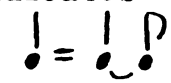
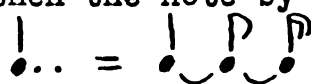
Intonation may be further developed if the cornetist will play his solos with piano accompaniment, and also engage with other players in small ensembles. Scales are not only a theoretical musical necessity, but are beneficial toward better intonation, finger precision, clarity of attack - in fact all fundamentals of technique; and should be played with these factors in mind.

VI. RHYTHMIC PROBLEMS

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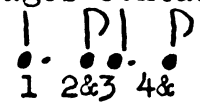
A. Dotted Notes:

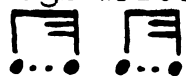
Incorrect articulation and unreliable rhythmic values in connection with the playing of dotted notes are very prevalent among instrumental players. These faults may be eliminated for the most part if the significance of the dot and its relationship to the preceding note is pointed out to the student before he has had a chance to play them incorrectly upon his instrument.¹

The dot placed after a note indicates that its length is to be increased one half (); the effect of a second dot is to lengthen the note by three-quarters the original value (). Attention should be called to the fact that dots following

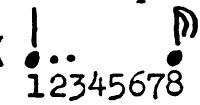
1. The physical basis of habit is the establishment of neural paths in the cortex of the brain. Repetition reduces the friction of neural energy and lies at the back of habit; thus making wrong-doing as easy as right-doing. Mental habits are formed in the same way as physical, and the right habit has to be started consciously in order to become automatically correct.

rests lengthen them to the same extent as those applied to notes. As soon as the student is familiar with the notation of dotted notes, the teacher should have him play the various patterns on but one tone of his instrument. This eliminates any finger difficulties that might arise, and gives the pupil a chance to center all his attention upon the correct values of the notes involved.

In passages containing alternate dotted quarters and eighths (

In the case of dotted eighths followed by sixteenths in strong rhythmic passages (

case than when playing dotted quarters followed by eighths; two rapid attacks must be effected so that they are distinctly heard. By pointing the tongue and executing the retractions quickly, the emission of two clear and pronounced tones will be the result. Brief intervals of silence should precede the playing of the sixteenth notes, and care should be taken that all notes of the same denomination have exactly the same value and treatment.

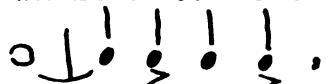
When a doubly-dotted quarter note is followed by a sixteenth note (), the first must be held seven times as long as the second. The only accurate method by which this may be accomplished is to practice this figure at a slow enough tempo to give the pupil time to divide each count into four equal parts mentally and physically, thus enabling each note to receive its exact value. After the figure has been repeated a few times, the student will become conscious of the relationship of the tones and may omit the subdivision of the beats.

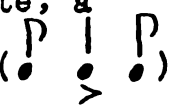
In trumpet playing, when a passage consists of alternate dotted notes and shorter notes, and both are marked staccato, the dot should be treated as

a rest; the longer notes are thus made briefer, and the short notes remain the same ().

B. Syncopation:

Definitions should be an integral part of the instructor's conversation with the pupil in order to avoid misconceptions. It is sufficient to state that syncopation is an alteration of regular rhythm, produced by placing emphasis on part or parts of the measure not usually accented.

The student, first attempting syncopation, should be encouraged to play consecutive quarter notes in 4/4 time, accenting the first and third beats of every bar, then shifting the accent to the second and fourth beats keeping strict time and using a subdued attack on the first and third beats. After this has been practiced sufficiently, the second beat should retain its accent as the first quarter note has been tied from a whole note of the preceding measure. This figure, , should also be practiced without any alteration of

time. Identical measures should then be played consisting of a quarter note, a half note, followed by another quarter note (), with the accent still remaining on the second beat. Playing the preceding example at a gradually faster tempo in four beats and keeping the respective tones at the same value or length and changing the rhythmic pulsation to two in a measure, is the ideal manner of introducing alla breve syncopation. Alla breve¹ constitutes the most common form of syncopation, and is identical in sound with measures made up of an eighth note, a quarter note, followed by another eighth note () in 2/4 time. The longer tone in this type of syncopation should always receive an accent and be held its full value; the other notes on either side should be played shorter with brief intervals of silence between. Care must be exercised that the accented tones are diminished immediately after the attack so that the regular accent will not receive any stress.

Continued syncopation should be articulated cleanly by means of a crisp tongue. It should be

1. Two beats to a measure, indicated .

played in as fluent and effortless a manner as possible without anticipation of the accented notes, rather than with a mechanical and laborious feeling of accentuation. Syncopation in $3/4$ time should be treated in precisely the same manner as that in $4/4$ and $2/4$ time. If the student has any capacity for rhythm, and has faithfully practiced the above exercises as described, he should be able to analyze and read complex syncopations at sight.

VII. ADVANCED TECHNIQUE AND EMBELLISHMENT

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A. Double and Triple Tonguing:

Double and triple tonguing are methods of articulation to be used in rapid passages where the speed demanded is impossible of accomplishment by single tonguing. Musical compositions use them effectively in the form of variations, and as a substitute for the tremolo of string instruments in transcriptions for band of orchestral music. The student should have single tonguing highly perfected before attempting either double or triple tonguing, and then only at the advice of the instructor.

The cornetist should learn the exact speed with which he can single tongue so that he may judge accurately whether to single, double, or triple tongue when he sees the staff notation. As was discussed in chapter V, single tonguing is phonetically represented by a succession of the lingual letter t,

or the syllable tu. Double tonguing aims at alternating the linguo-dental explosive tu with another explosive consonant produced differently, such as the linguo-palatal ku, thus relieving the muscles of the tongue by alternate instead of repeated action. This may be represented to the pupil by the syllables tu-ku. Isolated practice of the ku syllable has proven beneficial in the majority of cases.

There are two distinct practices in production of triple tonguing. One is to use the double tongue in triplet groupings such as tu-ku-tu, ku-tu-ku. This has been satisfactory for triplets built upon the same tone, but is not very practical for groupings that contain intervals. The other method in which triple tonguing is produced, and which is the method more extensively used by professional cornetists, is the articulation of two successive single tongues followed by a linguo-palatal ku syllable, tu-tu-ku, tu-tu-ku.

In order to produce this complex motion with perfect regularity, it is necessary to practice slowly at first without the use of the horn so that the tongue and throat may allow the same quantity of air to

escape at each syllable. Single groups of couplets and triplets should be practiced before attempting an indefinite number so that the ear and mind of the student have opportunity to orientate toward these new types of tonguing. The instrument may be used after a sufficient degree of rapidity has been obtained. All notes in double and triple tonguing must be equal in volume, length of tone, and distance apart. In order to impart more equality to the tonguing, it is necessary when beginning, to prolong each syllable a little. After a certain amount of precision has been obtained, the tonguing should then be shortened in order to obtain the true staccato which is desired.

An excellent exercise for the perfection of double and triple tonguing is to play consecutive staccato notes, increasing the speed gradually until single tonguing is no longer possible, then change to double or triple tonguing as desired. When making this change, care should be taken that the latter sounds as regular and even as the former.

B. The Vibrato:¹

As soon as the cornet student has attained a high degree of proficiency on his instrument, he should be encouraged to make use of the vibrato in playing legato passages and free-flowing melodies. The vibrato should never be used in band or orchestra unless when playing a solo melody and then very judiciously. When the vibrato is deliberately used to enhance the emotional feeling of the music it can be highly effective, but when it degenerates into a mannerism it is entirely opposed to good taste. The vibrato, if used properly, adds a richness, warmth, and flexibility to tone otherwise unobtainable. Seashore has conducted a number of studies in the vibrato with great results. He sums up the psychology of the vibrato as a source of beauty in the following statement:

The most general aspect of the sources of beauty in the vibrato is the expression of

1. A good vibrato is a pulsation of pitch, usually accompanied with synchronous pulsations of loudness and timbre, of such extent and rate as to give a pleasing flexibility, tenderness, and richness to the tone. (Seashore).

feeling by conveying the impression of instability as a symbol of emotion. In tense feeling we tremble. Whether it is intense love or hatred, intense attraction or intense repulsion, we tremble irresistibly; that is, we exhibit various aspects of instability in a pulsating way throughout the organism, affecting heart beat, breathing, voice, and all the organic processes. This is a universal and true indication of deep feeling or emotion. It occurs, however, proportionately in all degrees of genuine feeling, and finds a variety of means of expression through the organism. In music it takes the form of the vibrato.¹

Although the vibrato is a means for the expression of musical feeling, it does not differentiate among the feelings.

The player should be able to change from a straight tone to the vibrato at will, as well as from the vibrato to the straight tone. The vibrato should not start with the attack of a tone, but immediately after in order to insure cleanliness of attack. Tones of long duration should receive vibrato treatment, whereas it may be omitted on the shorter ones.

The vibrato may be produced on the cornet or trumpet in a number of ways. Care must be exercised in order to prevent the student from producing this

1. Seashore, "Psychology of the Vibrato in Voice and Instrument", Iowa Studies, III, 110.

ornament by shaking his head. The three best ways to produce the vibrato are by means of the breath and diaphragm, the hand, or the lips and jaw.

The breath, or throat and diaphragm, vibrato is best obtained by varying the amount and intensity of the breath through the action of the diaphragm and the throat cavities. This makes for a change in intensity of the tone, and only a slight variance in pitch. This is best produced by successive guttural sounds, preferably the syllable oo-oo without any break. This method is difficult to acquire, and unless the student has a natural inclination to produce the vibrato in this manner, it is advisable to teach either one of the other two forms.

The lip vibrato has a decided advantage over the hand vibrato inasmuch as it can be more readily controlled, and all notes will receive the same amount of pitch deviation. This vibrato should be attempted if the breath vibrato is too difficult, saving the hand vibrato as a last resort. In order to produce the lip vibrato, it is necessary that the student start with a sustained tone in the middle range of his instrument.

After the tone has been sounded the lower jaw should be raised and lowered periodically, thus slightly varying the size of the aperture between the lips, without going so far as to disturb the embouchure. This effects the intensity in such a way as to produce a sort of wave in the tone as well as a slight change in pitch. This must be practiced slowly at first until the pupil has acquired perfect control and identical oscillations. When this is effected rapidly the difference of intonation vanishes, and the ear only detects a plaintive throbbing.¹ The vibrato rate may vary from four to ten oscillations per second according to the type of music played, and the individual taste of the performer.

Another phase of the lip vibrato is accomplished by means of the hand rather than the jaw. The hand vibrato is done with the right hand on the tops of the keys. The art of pulsating a note by a to-and-fro movement of the hand and fingers should be done in a periodic manner. Only the thumb

1. Hattwick analyzed the vibrato in a number of cases by means of the tonoscope, and found that the average extent of the pitch in the vibrato was .4 of a tone, and the average cycle rate was 7 per second. ("The Vibrato in Wind Instruments", Iowa Studies, I, 279).

effects the vibrato in open tones and should be practiced regularly until it is uniform in intensity, rate, and pitch varyance throughout the entire compass of the instrument. Care should be taken that the hand movement is not excessive in appearance, nor is so violent as to disturb the embouchure.

In dramatic and emotional passages the rate should be made faster and more intense than in ordinary playing. In such cases, the muscles of the diaphragm must become more tense and the volume of air increased. Hard and fast lines in matters of expression in art are impossible to draw. Cultivation of taste, observance of good models, and especially the true and unbiased analysis of the human feelings, must be the guides as to how far this means of expression may be used.

C. High Tones:

It is the ambition of every cornetist to be able to play high tones, so the instructor is invariably confronted with this problem sooner or

later. The tones from g" to c'"' should not be attempted by the beginner until he has mastered all forms of playing technique in both the low and middle registers. The prerequisite for the playing of higher tones is the ability of attacking and controlling sustained tones from c" to g" without any strain whatsoever.

In this connection the teacher might do well to compare cornet-playing with pole-vaulting. The pole-vaulter does not confine his practice to making jumps at his maximum height, but rather perfects his form constantly on lower heights. It is the same with the cornetist; he must spend almost his entire practice period in developing his form, i. e., all his fundamentals. The practice of high tones should be reserved for a few minutes each day somewhere in the middle of the practice period when the lips have sufficient agility and are not too fatigued.

High tones are not well accomplished by attack, but rather by slurred chromatic scale practice. To learn to play high notes correctly, the student should start a chromatic scale from g' and slur up one octave to g", making as much gradual crescendo as

possible without marring the quality of the tone. After this has been accomplished, he should attempt the ascension and descension of the slurred chromatic scale in one breath. This practice should be continued on each ascending semitone¹ until the student's maximum range has been reached. The student should avoid pinching the lips or pressing the mouthpiece against the lips as much as possible, and strive to support the higher tones with concentrated breath by exerting more tension in the muscles of the diaphragm. These exercises should be played slowly at first with a certain degree of loudness, so that the entire range will be of uniform quality, and also to insure the player against possible pinching and pressing the lip muscles. A few minutes each day is sufficient for the practice of high tones as the lips are delicate, and punishment with a mouthpiece will tend to weaken rather than strengthen these muscles.

In order to obtain the extremely high tones from c''' to g''', it is necessary to stretch the lips somewhat in conjunction with the punctuation

1. g#' to g#'', a' to a'', b^b' to b^b'', etc.

of the breath. It is advisable to use the second valve for c[#]''' and the open position for d''' when these tones are first introduced, as the resistance will be lesser than that of the ordinary fingerings. Later, the regular fingers may be used.¹

After the player has extended his range by these means, the attack and sustained tone may be applied to the newly acquired tones.

D. Endurance:

Fatigue for a cornetist is usually experienced in the lips where the muscles are delicate and unable to take undue strain. Beginner's lips usually tire easily and quickly unless the instructor has taught the principles of endurance. The whole secret of endurance is to shift strain to other parts of the body, and to aid the muscles of the lip rather than to retard them.

1. c'''' - 0; c[#]''' - 2 or 1, 2; d'''' - 0 or 1; d[#]''' - 2;
e'''' - 0; f'''' - 1; f[#]''' - 2; g'''' - 0.

Improper breathing is the most common cause of fatigue in brass instrument playing. The cornetist should always breathe deeply, keeping the diaphragm muscles taut while playing to insure against securing the tones by pinching and squeezing the lips. The pressure of the mouthpiece against the lips should not be overdone. Pressure has many times been substituted for breathing by beginning players, with the result that they have maintained this habit to such a degree that they are unable to refrain from pressure in procuring tones from the instrument. The jaw should be set firmly to act as a foundation, and the mouthpiece placed upon the lips with a certain amount of tension, so that the escape of air is impossible, but, the mouthpiece must never be pushed against the jaw and lips, forcing the lips to vibrate. The less pressure a player is able to use in order to secure a desired tone, the more endurance will he realize.

The trumpeter must have all the tones of his playing range under absolute control so that he may be able to play them with the least possible exertion. Correct embouchure, good control and support of the

breath, as well as accurate articulation of the tongue, will relieve the lip strain to a great extent.

Relaxation must be adhered to during all types of playing. When the breath is inhaled through the corners of the mouth, the pressure of the mouthpiece against the lips should be released so that the natural circulation of blood may be resumed. During all intervals of silence, the mouthpiece should be taken entirely away from the lips. Protruding the lips at this time will relax them sufficiently, and thus enable them to remain fresh throughout the entire period of playing. Sore lips and fever blisters are caused by over-strain of the lip nerves or by disorders of the stomach. An application of zinc ointment will relieve pain and will dry fever blisters. Be sure to keep the lips thoroughly cleansed. Lip stick and other applications for cuts tend to soften the lips and should not be used if the student wishes to have his lips in the best playing condition.

The mouthpiece must be fully plated in order to prevent brass poisoning which may permanently injure the lips. Mouthpieces should be plated immediately after the brass begins to show through. Using a wet or dry lip is an individual matter depending

upon the nervous system of the person. A few minutes massage of the lips and jaw muscles before going to bed and immediately after playing will increase their strength and flexibility.

E. Transposition:¹

Ability to transpose is extremely valuable to the practical musician, and a necessity to the cornetist. Inasmuch as the cornet and trumpet of today are both pitched in B^b, almost all music demands transposition unless written specifically for these instruments.

Trumpet parts in orchestral music are frequently designated in C, A, E, E^b, D, etc. The performer must find the intervallic distance and direction from B^b, the pitch of the instrument, and the pitch indication as given on the parts. After the

1. Transposition is the act of changing the key mentally for performance into a different key from that in which it is written.

player has determined the number of steps between these keys and the direction in which he must go, he may then procede to transpose either by interval or by the use of clefs.

In transposing by interval, all tones must be read and played, above or below, as the case may be, from the original notation according to the intervalllic distance between the old key and the new key desired. If a cornetistwishes to make a C transposition, he must read all tones one whole step higher than actually written, observing the key signature of that key which is one whole step higher than the original key. For example, if the original key of the composition is F, the transposed key will be G. Accidentals occuring throughout the notation must be dealt with individually so that they will also sound one tone higher than written. In making this C transposition, all notes occupying a line will be read in the space above, and all notes occupying a space will be read on the line above. Transposition by the method described above becomes very tedious, and frequent chromatic alterations in a composition may tend to slow down the reading of such a work.

In order to transpose by the use of clefs, the cornetist must be familiar with all the clefs. The treble or G clef, with C located in the third space, is familiar. In the bass or F clef, C is located in the second space. In the C clefs, the soprano has C on the first line; the mezzo-soprano has it on the second line, the alto on the third line, the tenor clef the fourth line, and the baritone on the fifth line.

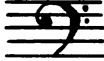
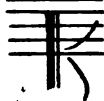
The selection of the clef is done by finding the intervalllic distance between the old key and new key, and using that clef which will effect such a distance. In making a C transposition, the cornetist will use the alto clef, thus automatically changing the letter names and respective sounds of the notes. However, the new key signature must be observed as in transposing by interval. Chromatic alterations may be observed by means of the following rules:

- I. Find the difference between the number of accidentals in the key to which you wish to transpose and the number in the original key.
- II. If the new key has a certain number of sharps more than the

original key, take this number in the order of sharps, and read 1/2 tone higher any accidental sign occurring in front of any one of these pitches. On the other tones, they must be read exactly as printed.

III. If the new key has a certain number of flats more than the original key, take this number in the order of flats, and read 1/2 tone lower any accidental sign occurring in front of any one of these pitches. On the other tones, they must be read exactly as printed.¹

The chart below shows the various clefs and the keys that they will automatically transpose. In order to

Key Designated	Clef To Be Used	
B, B ^b		Treble
A, A ^b		Tenor
C, C [#]		Alto
D, D ^b		Bass
E, E ^b		Mezzo-Soprano
F, F [#]		Baritone
G, G ^b		Soprano

VII. Transposition Chart.

1. Smith & Krone, Fundamentals of Musicianship, I, 187.

transpose fluently, the cornetist should set aside a few minutes each day for this practice, familiarizing himself with the clefs and the recognition of intervals. It is recommended that the instructor assign an exercise or short piece to be transposed into various keys. Transposition is not only an asset to the trumpet player for practical use, but is also a valuable aid in sight reading.

VIII. SUMMARY

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We have endeavored, in the foregoing chapters, to present a coherent background and comprehensive discussion of cornet and trumpet pedagogy. We have particularly tried to take advantage of modern tendencies in educational psychology and teaching practice. It is our hope that application of the material and ideas, as outlined above, will make for improved teaching and appreciation of many of the problems confronting both teacher and pupil.

Knowledge of the historical background of the instrument, its evolution from primitive horns, through various stages of development, to the uniform and excellent instruments of today, should inculcate in the pupil greater respect for his art, and with it, greater seriousness of purpose.

An adequate conception of the acoustical properties of the instrument should assist the instructor in meeting and solving many individual problems. The phases of musical tone, timbre, and acoustics involved in cornet and trumpet performance are so diverse and in many cases so individualized as to not permit further generalization. We have presented their known aspects. The individual instructor will be many times called upon to solve particular problems for which this can be but a mere foundation.

The same holds true for problems of technique. We have presented and discussed problems and methods of presentation which have arisen from our own experience and that of instructors with whom we have come in contact. It would be a physical impossibility to meet in advance all such problems. We can but encourage patient and thorough study of each new problem by the instructor.

No problem is too slight, no detail too insignificant to permit superficial skimming on the part of the instructor. The pupil should at all times be encouraged to make haste slowly from the moment the first tone is attempted until it is perfected, from the time that tone is acquired until several years later when the range is extended through the third octave.

In class teaching, a practice that has become increasingly common in public school music, care again must be taken that the need of the individual pupil is neither ignored nor casually treated.

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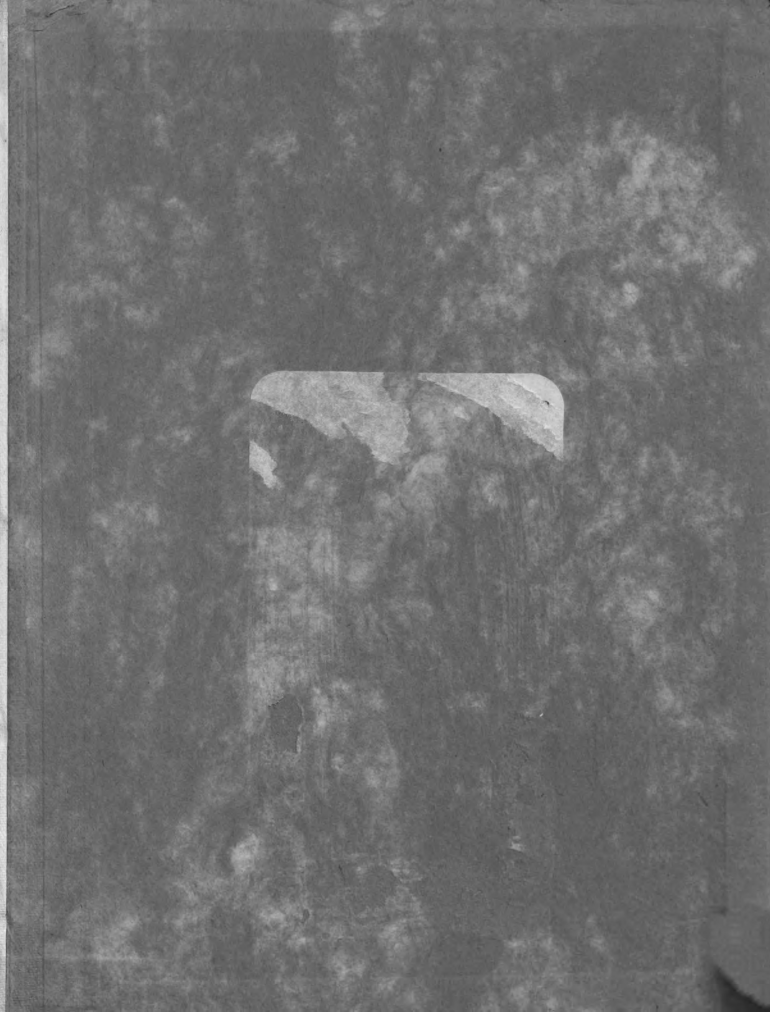
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