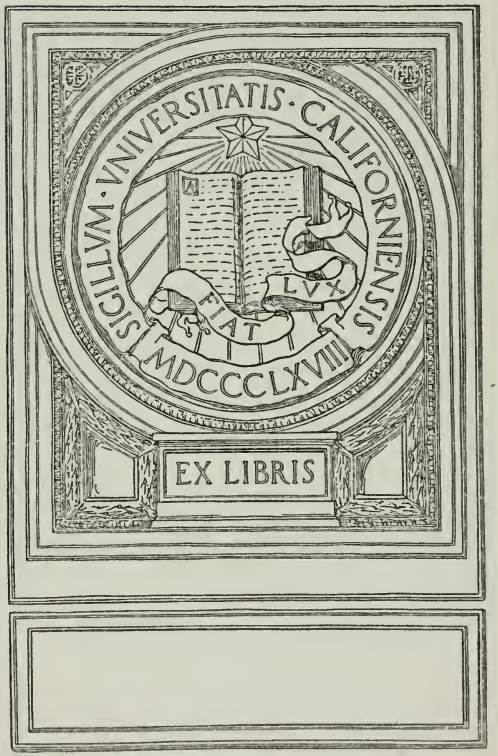
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CATECHISM

OF

MUSICAL INSTRUMENTS

(GUIDE TO INSTRUMENTATION)

BY

Dr H. RIEMANN.

TRANSLATED FROM THE GERMAN.

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PREFACE.

The compilation of the Musical Catechisms has been carried out on the same plan as the author adopted in his Musical Lexicon; viz to present concisely, in a manner readily intelligible, and especially synoptical, everything relating to musical knowledge which it is chiefly important to know, and thus in place of the widely circulated little works, outwardly of similar aspect, but as to their actual contents, occupying much too low a level, to create small pocket manuals, from which, in every moment of doubt, speedy enlightenment is to be obtained. *Not what every musician knows, but what every musician ought to know, should be found in a Musical Catechism.*

When, however, Lobe's "Catechism of Music" p. 3, speaks of the introduction of "smaller" notes between the seven principal notes, or when it explains embellishments incorrectly (confuses ≈ and ≈ in the Hummel-Spohr manner, but without comment concerning its use, calls ≈ a Short Shake (Pralltriller) with the lower note as embellishment, ≈ a Mordent with the

upper note!!); this is not to be excused, even on the plea that a thoroughly popular conception was aimed at; and certainly no musician can be expected to seek enlightenment in such works. Even the not altogether ignorant amateur would be puzzled by such primitive errors.

The Author thought he could not withhold these introductory remarks as some justification of his latest productions; they have to make the gap that they are designed to fill. Let the public compare and choose!

Hamburg, Spring 1888.

Dr H. Riemann.

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LIST OF THE ENGRAVINGS

in the Catechism of Musical Instruments

by Dr. H. Riemann.

INTRODUCTION.

GENERAL REVIEW OF INSTRUMENTS.

1. How are musical sounds produced?

By rapid, periodic vibrations of elastic bodies, which are communicated to the air and transmitted by it in so-called sound-waves.

2. Cannot sound waves be also generated without such vibrations of elastic bodies first originating them?

Only in appearance; for in all cases where waves of sound are produced by a single shock, or any explosion (lightning, shooting), the air itself is the vibrating elastic body. Similarly, the syren, a physical apparatus with condensed air, which is emitted at computable and rapidly succeeding intervals, is not itself the vibrating body, but the wind, forced through it at regular intervals, causes vibrations (alternating condensation and rarefaction) of the surrounding air.

3. Can any other bodies than the air transmit sound waves?

Certainly; hard bodies such as stone, wood, metal, conduct sound much more rapidly than the air; for while the rapidity with which sound can be carried by the air only amounts to about 1040 feet in a second, it is carried by hard substances with lightning rapidity beyond computation.

4. Could we not now, give a more precise answer to our first question?

Yes; from the transmission of sound through the air, we might learn to regard the rapid, periodic vibrations of elastic bodies, as the only condition of the production of musical sounds.

5. At what rate must these vibrations follow each other so as to produce on the ear the effect of a tone?

The slowest rate of vibration capable of producing a sound is that which lasts about $^1/_{10}$ of a second; but this scarcely gives a continuous tone, but rather a dull jarring and trembling.

6. Is there a limit also to the rapidity of the vibrations, relative to their audibility?

Yes; but this is not exactly fixed. It has been calculated that very high tones, produced by steel bars, make 48,000, and even 96,000 vibrations in a second: but it is not every ear that is able distinctly to perceive them.

7. What relationship does the pitch of sound hold to the rapidity of the vibrations?

More rapid vibrations give higher tones, slower vibrations give lower tones.

8. On what does the rapidity of the vibration depend?

On the size (weight), and on the stiffness or elasticity of the vibrating body; the greater the weight the deeper the tone, the greater the elasticity the higher the tone.

9. On what does the strength of the tone depend?

On the force of the vibrations, i. e., on the width or amplitude of their deviation from the position of repose, or equilibrium of the parts.

10. What is the difference between sound and tone?

Tone is the name given to a sound of fixed pitch, which implies a uniform period of vibration, or, what is the same thing, equal mass and tension, of the tone-giving body. Music has to do with such sounds only.

11. What kind of elastic bodies does music employ for the production of tones?

Tight stretched strings of catgut, silk or metal; skins; tubes enclosing columns of air; plates; bars; straight or bent slabs of metal, wood, and more rarely, of stone.

12. How are the strings set in vibration?

Either by plucking, or twitching them, striking them with the hand, a pin, rod, or little hammer; or by friction of a resined bow.

13. A string held tightly stretched by the hand gives only a thin, faint sound; how is it that the strings of our pianofortes, harps, violins, etc., give such loud tones?

Their sound is intensified by the so-called sound-board, a thin plate of wood across which the strings run, firmly

lying on a bridge, in contact with the sound-board, to which it transfers the vibrations.

14. Does the sound-board throw out the same tone that it would do if set vibrating independently, e. g. by the stroke of a small hammer?

No; such independent vibrations of the sound-board are prevented by small pieces of wood glued underneath it, the cross way of the grain, as well as by the artificial construction of the sound-board itself. The sound-board acts rather as a conductor of sound in the sense of our third question, i. e. it is only intended to throw out vibrations of a larger superficies into the air, instead of the narrow line of the string alone causing vibration.

15. How are the columns of air enclosed in pipes or tubes, set in vibration?

By the intermittent (rapidly and regularly interrupted) introduction of air, causing alternate condensation and rarefaction of the enclosed air-columns; the waves of sound thus excited communicate themselves to the air, and are thereby transmitted further.

16. After what we know of the syren, would not the intermittent air stream alone suffice to produce a tone, and the pipes, therefore, be unnecessary?

Yes; but in many instruments the pipes must themselves assist in interrupting the afflux of wind, and above all regulate the rapidity with which the blasts succeed each other, and consequently therefore determine the pitch of the notes; they must also in every case act the part of a sound-board, i. e. they must give the waves of sound greater breadth.

17. Is the intermittent afflux of wind in musical instruments caused, as in the syren, by revolving plates, provided with holes which alternately open and shut?

No; yet there are instruments in which the action is not very different from it; such, for example, are the so-called reed pipes of the organ, harmonium, and kindred instruments. In these a strong metal plate—the reed—bars the passage of wind, is bent out by it, but being elastic, it springs back, to be again forced out as before, etc. Thus the exit of air is interrupted at quickly succeeding intervals, the length of which depends on the size, form and elasticity of the reed. The pitch of the tone produced depends, as in the syren, on the number of con-

cussions given by the outflowing current, to the outer air. The pipes or bells, into which the reeds discharge the wind, have only to act the part of sound-boards—to strengthen the sound; they are therefore in a measure to be dispensed with, and, indeed, are entirely wanting in the harmonium, accordion, and mouth harmonica.

18. Are not certain orchestral instruments just such reed pipes?

Reed pipes, no doubt, but not exactly such. The reeds of the oboe, clarinet, and horns, are not strong enough to vibrate and interrupt the passage of air with regularity. With these, therefore, the columns of air enclosed in the pipes render assistance. Thus, as soon as the bending of the reed by the wind, affords access to the pipe there arises condensation of the air, which exerts a backward pressure, and, owing to the equipoise established between the air flowing from the player's mouth and the condensed air in the pipe, allows the reed to return to the place of repose, i. e. to interrupt momentarily the entrance of air. And now the air at the other end of the pipe comes into position to equalize itself with the surrounding air, i. e. to give it a shock, whilst the air at the mouth end, being now less compressed, draws down the reed. The periods, at which the entrance of air is interrupted, depend, in all instruments of this kind, entirely on the length of the pipe, i. e. on the distance the in-coming air must travel to reach its maximum condensation (at the middle of the pipe).

19. Is not the production of tone similar in the orchestral flute, and in the flue, or flute pipes of the organ?

Not quite. Flutes and flute pipes have for instance, neither so hard a reed as the reed pipes of the organ, nor a supple reed like the oboe and clarinet, but as it would almost appear, no reed at all. On closer consideration, however, we perceive that they have an *air reed;* the matter stands thus:—from the mouth of the player or from the 'language' ('Kernspalte' or 'Frosch') of the organ pipe, there rushes a fine ribbonlike stream of air against the edge of a lateral hole, near one end of the pipe, in such a manner that the stream is divided, and driven half into the instrument, whilst half flows into the outer air. The condensation arising from the influx of air (as in the oboe, etc.), creating an opposing force drives out the whole stream. But now this outrush of air

carries with it the air contained in the pipe, rarefaction ensues and again draws in the reed. The final result of this is that quickly succeeding concussions are constantly given to the surrounding air, which is thus set in vibration.

20. And how is it with horns, trumpets, and similar instruments, which have neither reeds, nor yet an incision (blow-hole) like the flute, but rather a cup-shaped mouth-piece into which the player presses his lips?

With these the edge of the lips acts as a reed. The lips are forced apart by the breath stream, and, after condensation of the air within the instrument, closed again by the equipoise of the two portions of air; they are, however, continually re-opened by the breath, as the air-column has through the bell equalized itself with the outer air.

21. How are stretched skins set in vibration?

By a stroke from a drumstick, etc., or from the hand.

22. How are steel bars, steel plates, bells, and other bodies consisting of solid, and from its natural rigidity, elastic material, set in vibration?

By a stroke from some other hard body.

23. Are there any other ways of producing tone?

Yes; for instance the friction of glass cylinders, glass bells (harmonica), the burning of gas flames in glass pipes (pyrophone); but these, in artistic music at least, have obtained no importance.

24. How can we consequently divide the musical instruments in general use?

First of all into three principal classes.

I. *Stringed instruments.*
II. *Wind instruments.*
III. *Percussion instruments.*

25. How may stringed instruments be subdivided?

Into two groups:

1. *Stringed instruments* on which the notes can be sustained at will of the player.
2. *Instruments of the harp kind* (with but little power of sustaining notes).

26. How may wind instruments be divided?

Into four groups:

1. Instruments with *an air reed* (flute).
2. Instruments with *a reed pipe* (oboes, &c.).
3. Instruments with *membranous reeds* (tubas).
4. Instruments with *metal reeds.*

27. How are instruments of percussion to be divided?
Into two groups:

1. Instruments with stretched skins (kettle-drums and drums).
2. Resonant hard bodies (bars, plates, bells).

CHAPTER I.
STRINGED INSTRUMENTS.

28. What names are given to the different combinations of instruments used in simultaneous performance?

Violin.

The combination of all the instruments in use, or at least of a greater number of each of the various kinds, is called "full orchestra"; the union of only wind instruments, is called a wind-band; of wood and brass wind instruments, with the addition of drums, a military band; a combination of brass instruments only a brass band (Fr. fanfare). A collection of a few of the same, or of different classes of instruments, has no special name. The restriction of the orchestra to the stringed instruments only (with each part played by several instruments,) the so-

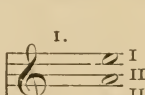
called stringed orchestra (Streichorchester), supplies not only a musical corps of value in itself, but constitutes the ground-work and nucleus of the full orchestra round which all else is disposed. This important distinction of the stringed instruments is due to the facility with which they accommodate themselves to every form that musical idea can assume, as well in regard to the utmost velocity of execution on the one hand, as to the sustaining of notes at will, on the other. Wind instruments, on the contrary, by the limitation of breath, and brass instruments still further by their sluggishness in the production of tone, are of more restricted use.

29. What kind of stringed instruments are used in the modern orchestra?

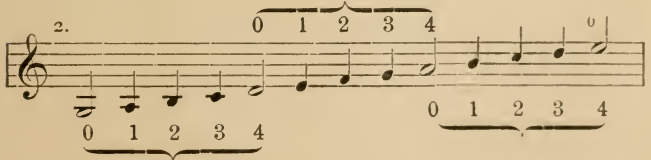
Only four, of almost similar construction, but of different size: the violin, viola, violoncello, and double-bass. With regard to pitch, the violin includes the compass of the soprano and of the notes above it; the viola commands the alto; the violoncello (or cello) the tenor and bass; the double-bass the bass and contra-bass. Each of these instruments is strung with four strings, whereas those formerly in use (viols, viola da gamba) had six.

30. What may be remarked respecting the compass and capacity of the violin?

The violin (Ital. violino. Fr. violon) is strung with four strings which are thus tuned:

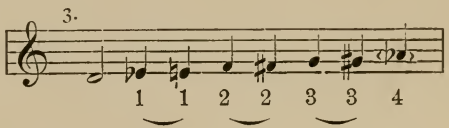


The gaps between these natural notes of the open strings are filled by pressing the finger on the string and thus shortening it (O = open string, 1 index finger, 2 middle finger etc.)



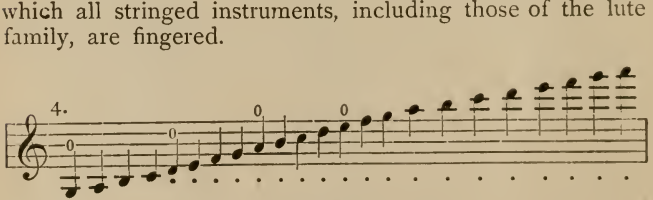
and similarly the upper string is also shortened by pressure of the finger (4th or little finger, on b^2). But the fingering of stringed instruments is not confined to this so-called

'first position', in which the first finger takes the next degree above the open string, etc. But rather, the compass is considerably extended in that the hand of the player glides up the neck of the instrument, giving the first finger at once, a higher position. The intermediate chromatic notes are played with the same finger as the notes from which they are deduced.



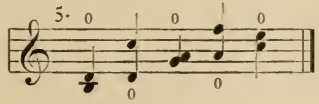
In orchestral use, nowadays, the violins constantly go up to the seventh position, i. e. the finger is pressed down six degrees higher than in the first position, so that it produces the octave of the open string; in this way the upper boundary of the instrument is raised to a^3, which, meantime, the latest composers (since Beethoven) often overstep, as they go up to e^4 (eleventh position). Playing in the higher positions, however, is by no means limited to the first (highest E) string, but is extended equally to the lower strings, either from technical necessity, e. g. when passages are to be continued smoothly, or in double-stopping; or for the purpose of making the most of the peculiar tone-colour, or *timbre*, of the individual string.

The following synopsis will explain the principle upon which all stringed instruments, including those of the lute family, are fingered.

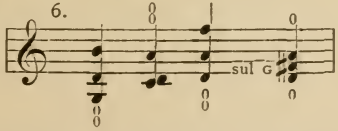


1. Pos.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·	·	·	·	·	·
2. „	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·	·	·	·	·
3. „	·	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·	·	·	·
4. „	·	·	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·	·	·
5. „	·	·	·	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·	·
6. „	·	·	·	·	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·	·
7. „	·	·	·	·	·	·	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	·	·

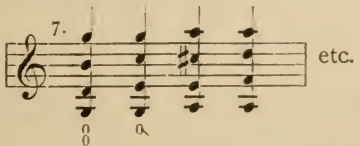
As far as the *timbre* of the four strings is concerned, the E string sounds clear and sharp, the A string softer, the D string particularly mellow, the G string (probably because it is covered) sounds harder again, without being powerful; with this string the contrast between the smallness of the instrument and the depth of its tones comes out conspicuously. The genuine tone, the chest voice of the violin, is not in the G, but in the D string. Although in its inmost nature an instrument for melody and designed for music in one part only, the violin is nevertheless capable of playing in several parts. In order to acquire confidence in writing passages with double-stopping, or perhaps even entire compositions in several parts, it is necessary to be thoroughly versed in the art of fingering. Here are a few remarks for general guidance. All double stopping which makes use of an open string together with a shortened one is easy: as



all fifths, sixths and thirds are also easy; but on the contrary, octaves and seconds, where no open string is available, are difficult. Of chords of three notes, the easiest are naturally those with two open strings:

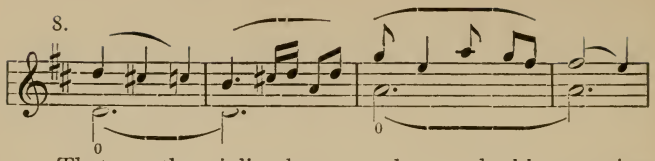


also, chords of three or four notes consisting of fifths and sixths are especially easy: such as,



In using an open string to sustain a note it is, of course, easy to play a running melody on a neighbouring string:

8.



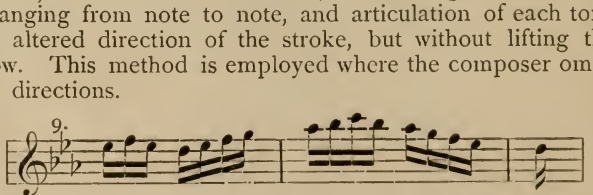
That on the violin there can be no double stopping the upper note of which is lower than d^1, is easy to understand.

31. What various shades of tone are brought out by the different methods of handling the instrument, in respect of attack, mode of bowing, etc.?

Firstly it is to be remarked, that every touch of the string by the bow, as well as every change in the direction of the stroke, gives the sound a sort of consonantal articulation, which might perhaps be compared to the attack of the voice in singing with closed glottis (the ℵ of the Hebrews). This articulation interrupts the quiet flow of the tone, and puts an end to the pure legato effect. Composers therefore indicate, by a slur over the notes, how far they wish the legato continued, by avoiding a change in the bowing, that is, by keeping the stroke in the same direction. In instruction books it is always expressly indicated where the down-bow (⊔, ⊓ form of the nut end of the bow), and where the up-bow (∧, ∨ form of the point of the bow) should be used. It is generally preferred to let the down-bow begin the accented beats; chords, on all the four strings, are always played with the down-bow. Besides the sustained legato, easily articulated by merely changing the direction of the bow, there are the following special methods of bowing.

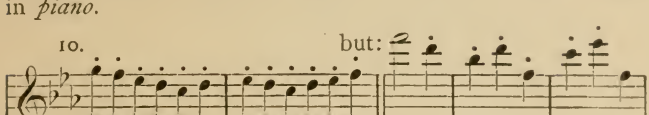
1) The common staccato, or *non legato*, with bow changing from note to note, and articulation of each tone by altered direction of the stroke, but without lifting the bow. This method is employed where the composer omits all directions.

9.

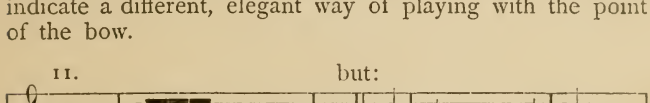


2) The real staccato (Fr. grand detaché, Ital. sciolto) with somewhat prolonged stroke of the bow, is indicated by dots over the notes, which however also indicate a

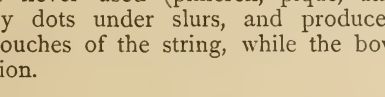
skipping (saltato, Fr. sautillé) movement of the bow; but they have the former meaning in *forte*, and the latter in *piano*.



3) The crisp, short staccato (détaché sec, martellato) with vibration of the string, from a quickly interrupted short stroke; indicated by dashes, which however in *piano* indicate a different, elegant way of playing with the point of the bow.

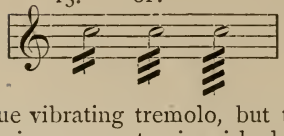


4) The genuine virtuoso staccato, which in the orchestra is never used (pikieren, piqué, Ital. spiccato), indicated by dots under slurs, and produced by quick successive touches of the string, while the bow keeps the same direction.



If the strings of the violin are played on, near the bridge, the tone is harder, louder (indicated by *sul ponticello*, *sur le chevalet*); the style of playing which gives the tone a soft almost flute-like sound, more in the middle of the string (over the fingerboard), is indicated by *sul tasto (sur la touche)*. Also the touch of the string with the nut end of the bow, makes the tone harder, more energetic (especially in *forte* indicated by *au talon*) while touching with the point (*a punta d'arco*) gives a fine delicate tone. Of the special graces of stringed instruments the tremolo is also to be particularly noticed —the quick vibrating repetition of the same note, with constantly changing bow, written, according to *tempo*:

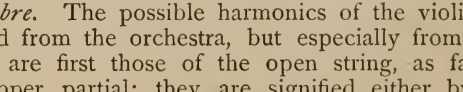
13. or:



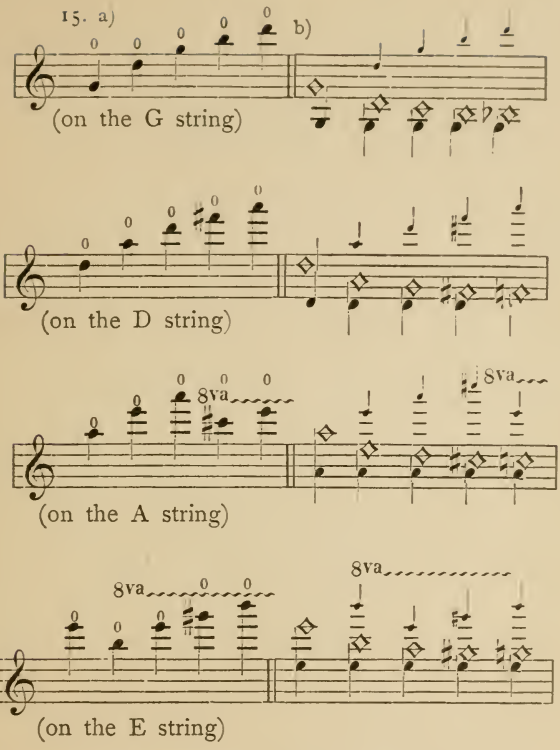
When not the true vibrating tremolo, but the exactly equal division into semiquavers, etc. is wished, it is well to indicate this expressly, by *non tremolo*. Shakes are throughout the compass of the instrument, both possible and easy.

A damping of the tones of violins, as of other stringed instruments, results from placing the mute, a sort of little wooden comb, on the bridge. The mute helps less to prevent the vibrations of the strings than it does to prevent their being conveyed by the bridge to the resonance box, and it gives the tone a muffled, subdued sound, which, not only in *piano*, but also in *mezzo forte*, is of penetrating effect (indicated by *con sordino)*. If the strings are not to be played with the bow, but plucked with the fingers, so that the violin for a time sounds like a lute, or guitar,—though the tone, of course, is dry, short, and without echo (the resonance box being differently constructed), the passage is marked *pizzicato*. The resumption of the bow is then indicated by *coll' arco*, or briefly *arco*. In conclusion, we must remember the *harmonics*, i. e. those higher tones which a string gives, when, instead of vibrating as a whole, it vibrates in parts. If, for instance, we touch a point forming the boundary of half, $^1/_3$, $^1/_4$, $^1/_5$, etc., of the length of the string, we cause rest, i. e. a node, at this point, and the string divides itself into corresponding parts:

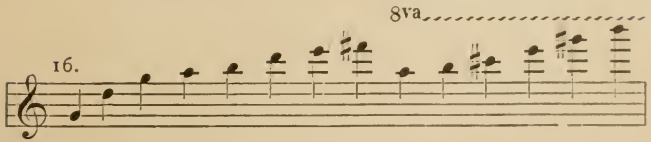
14.



i. e. it gives, not its own sound, but the 5th upper partial of this tone fivefold, the third of the double octave. Tones thus produced, have a much finer, more ethereal, flute-like *timbre*. The possible harmonics of the violin, to be expected from the orchestra, but especially from a string quartet, are first those of the open string, as far as the sixth upper partial; they are signified either by simply placing a cipher (o) over the note, or else by indicating the note to be touched (b):

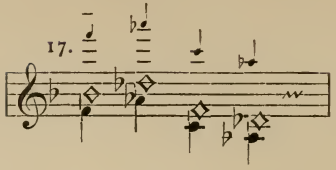


If, besides the harmonics hereby produced: viz.,



it is wished to bring out some other high harmonic, let its second lower octave be stopped firmly with the first finger, while the little finger lightly touches the string at the interval of a fourth.

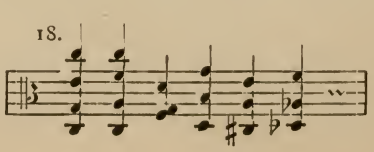
17.



32. What is to be remarked concerning the viola in addition, and what in contrast, to that said about the violin?

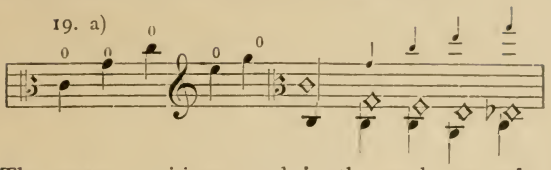
The viola (Ital. viola, Fr. alto) is rather larger than the violin, although not as much as might be expected, considering that the instrument goes the interval of a fifth lower, according to which, the proportionate dimensions of the two should be 3 : 2, whereas, in reality the viola is $1^1/_2$ in. instead of $6^1/_2$ in. longer, and the depth of the sides is only insignificantly greater. This explains the somewhat suppressed tone of the viola, especially on its two lowest strings. Of late years attempts have been made to ennoble the tone of the viola by enlarging its proportions—to some extent satisfactorily (by Hermann Ritter of Würzburg; but his *viola alta* has not yet obtained general acceptance). The method of playing the viola is entirely analogous to that of the violin, only that in playing the viola (and especially the *viola alta*) a larger grasp is necessary than for the violin, and therefore double stopped octaves and seconds are more difficult on the viola than on the violin. All that has been said in reference to the method of bowing, tremolo, shakes, pizzicato, etc. for the violin, applies equally to the viola. The only difference is the absence of the e^2 string, in place of which the viola has a c string. Music for the viola is always written in the alto clef, because then its best, most convenient compass falls within the staff; but the highest tones are occasionally written in the violin clef. Among additional double stops in the lower compass are:

18.



The harmonics of the open C-string are:

19. a)

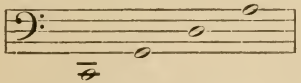


The seven positions used in the orchestra take the viola, in the high notes, to (the interval of) a fifth below the highest note of the seventh position on the violin, therefore up to d^3; nevertheless, composers seldom go as far, because between the violin and viola, the second violin is interposed as medium. The viola, therefore, mostly goes only to g^2. Although there is no imperative reason for this, yet the viola is for the most part condemned to the rôle of a quiet, sustained middle voice, to which are assigned long notes, tremolo, double stopping, etc. It is, however, at all times in a position to compete with the violin and cello, not only in passages, but in the execution of melody of every kind, especially in the middle register (above c^1), where, owing to its special fitness, on account of its size, its song possesses both strength and passionate expression.

33. What compass has the violoncello, and what are its peculiarities as to sound, and to the art of handling it?

The violoncello is just an octave lower than the viola:

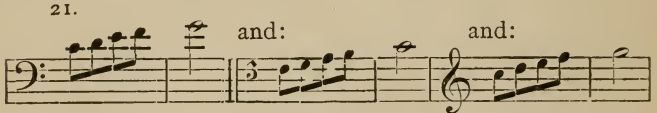
20.

Tuning: 

it is, therefore, much larger than the latter; in playing it cannot be held against the chin or shoulder, but is placed upon the floor (for which reason it has a foot), between the knees of the player, who is seated. The dimensions too, of the fingerboard are so much enlarged that the fingering is quite different, and much more complicated than on the violin, the aid of the thumb being brought into requisition for fingering the scales in the higher positions of the cello, and especially for its particularly good harmonics; for these the thumb stops the note requiring

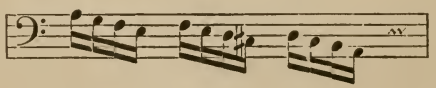
firm holding, whilst the other fingers touch the nodal points. In double stopping, when the open string is not used, only fifths, sixths, and sevenths are easy; but chords of three, and four notes, composed of sixths and fifths, can also be written. The *pizzicato* is of very pleasing sound. The cello is the tenor of stringed instruments, and possesses, particularly in the tones of its A string, a voice of penetrating vigour and passionate brilliancy. Music for the cello is written, according to need, in the bass, or tenor clef, also in the violin clef; but in the latter it was formerly written an octave higher than it really sounded. Of like signification, therefore, are:

21.



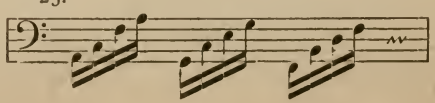
Nowadays, when the violin clef is used, the notes are written as they really sound. The compass upwards reaches easily to d^2; but solos, especially with harmonics, go more than an octave higher. The harmonics correspond with those of the viola, but an octave lower. Further, there is nothing to add to what has been said on bowing and *technique* in reference to the violin and viola. Only, it must be borne in mind that, with the large stringed instruments, even more than with the small ones, care must be taken that passages which are to come out quickly and fluently, are conceived with constant regard to the natural *technique* of the instrument; progressions such as:

22.



are more convenient than, for instance, arpeggios which are better suited to keyed instruments:

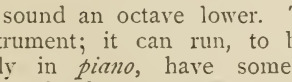
23.



34. What is to be said of the character and technique of the double-bass?

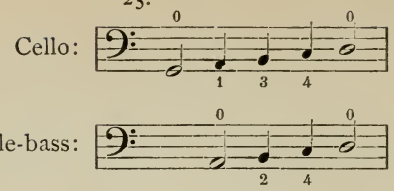
The double-bass (It. violone) was formerly tuned an octave lower than the cello, i. e. it reached to contra C, as is shown by many passages of our classical composers from Bach to Beethoven. But as the tuning of the four strings in fifths, because of the great distances on the fingerboard, makes a fingering to be relied on impossible, a different course has been taken since the beginning of the present century, and the instrument is now tuned in fourths instead of fifths; the lowest string, therefore, being contra E. Music for the double-bass is written an octave higher than it sounds, that is to say, it is treated as a 16ft instrument. Therefore, in the notation, the open strings are tuned thus:

24.



but they really sound an octave lower. The double-bass is a clumsy instrument; it can run, to be sure, and its tones, especially in *piano*, have something ghostlike, shadowy; still such deep running tones have always something of the grotesque, which in *forte* may assume overwhelming, gigantic proportions. Moreover, the lowest octave in the double-bass is seldom of any value save in doubling a higher part (cello, bassoon, trombone); similarly also the violins rarely take the highest notes, except when doubled by the second violins. Yet it may happen that full harmony takes a very high, or a very low position. In writing for the double-bass, even greater attention must be paid to the difficulty of its *technique* than in the case of the cello. If, for the cello, there are various methods of fingering, because none offers itself that is perfectly natural and sufficient, with the double-bass it is still worse. Most contrabassists in the orchestra have no regular method of fingering, but glide up and down with the whole hand, a proceeding which is certainly not to be approved of. A comparison of the principles of fingering for cello and double-bass:

25.

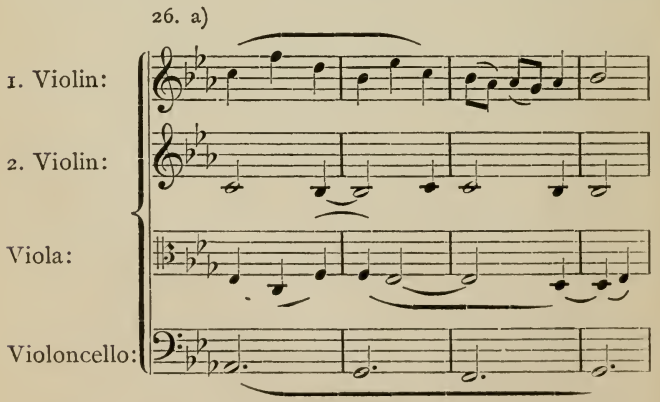


shows that it is better to keep passages within smaller compass, and shorter, when they are to be given to the double-bass, than when they are intended for the cello. The *pizzicato* of the double-bass is rich and full in tone; and in *piano*, can take the place of the kettle drum. The harmonics, too, are pleasant but are scarcely ever used. Double stopping for the double-bass, can at most come into consideration in case one note is an open string, and, indeed, then only when the interval is either an octave or a fifth; even the latter in the lowest position, sounds too thick.

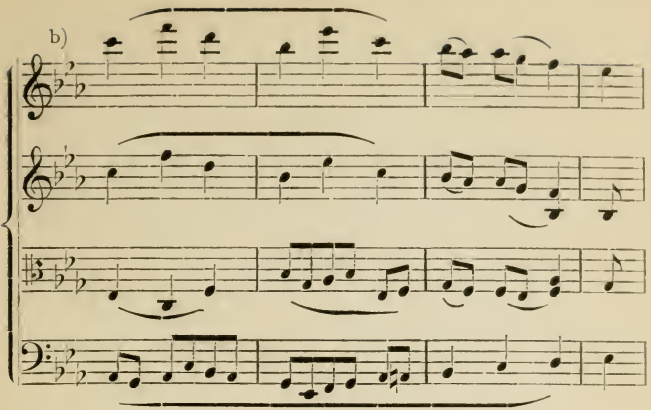
35. How do later composers group the above considered kinds of stringed instruments in ensemble playing?

In chamber music two violins, a viola and a cello are united to form a quartet (quatuor) (Beethoven, op. 127):

26. a)

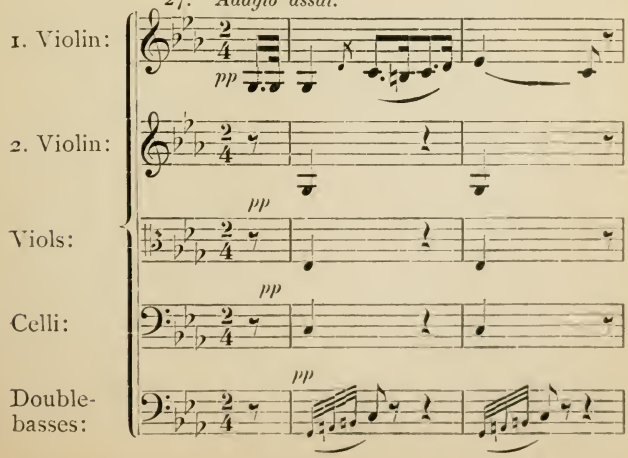


more rarely, as at (b), two parts are in octaves, which converts the movement from four, into three part harmony. In orchestral writing, besides these four parts, the double-



bass is added; it moves however, mostly with the cello, and occasionally also, only doubles the principal notes of the latter, either in unison, or in octave.

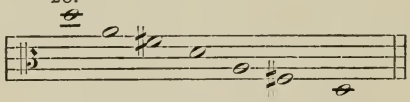
Only under special circumstances will the composer think of making the double-bass part fuller than that of the cello, like Beethoven, for example, when in the funeral march of the Eroica, he assigns to the basses the rôle of portraying the heavy tread of the corpse bearers:



36. What kind of instrument is the viola d' amore?

It is of the size of the viola, and belongs, for the rest, to a species of stringed instruments now quite obsolete. Its peculiarity was, that besides the upper strings of catgut, it had under the fingerboard a number of wire strings, tuned in unison with the upper ones. As soon as the upper strings were played on, the lower ones were set in vibration by sympathy. The effect of such simultaneous sounds, is a gentle trembling (as in Gottfried Silbermann's *Cembal d' amour*), as, of course, the tones are never quite in tune. The seven upper strings of the *viola d' amore* were variously tuned. Meyerbeer, who sought to revive them, in *Les Huguenots*, though without finding imitators, tunes them in the chord of D major:

28.

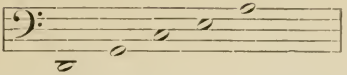


and, apart from the open string, uses only few passing notes, or even harmonics of the open string. The *viola di bardone*, belonging to the same category, was the favourite instrument of Prince Esterhazy, for which reason Haydn wrote numerous works for it (mostly not preserved); it was an instrument of the size of the cello, and tuned, after the manner of viols and lutes, in fourths and thirds: $_1$B E A d g b e^1. All these many-stringed instruments had low bridges, and were intentionally constructed so that three or four notes might be sounded simultaneously.

37. How was the old viola da gamba distinguished from the cello?

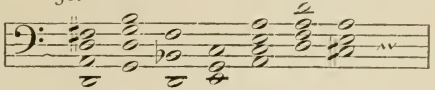
The *viola da gamba* had six strings, and a low bridge; the back and belly were not arched, the sides were low, the sound holes were sickle-shaped, and indeed the form of the instrument was marked by semicircular, rather than by freely curved lines. The *viola da gamba* differed from the *viola di bardone* and *viola d' amore*, in having no wire strings under the fingerboard; like them, however, it favoured the playing of chords, and was consequently, for a time, a favourite accompanying instrument. The tuning of the *viola da gamba* was:

29.



Chords such as the following were, therefore, easy to play on it (as they make use of the open strings):

30.



and, from the lowness of the bridge, could be kept sounding a long time. The somewhat nasal tone of this rather weak instrument, was supplanted by the vigorous tone of the violoncello, and attempts at reviving the *gamba*, will hardly be crowned with success.

CHAPTER II.

INSTRUMENTS OF THE HARP FAMILY.

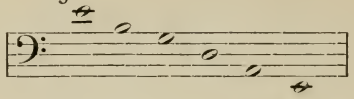
---

38. What instruments, the strings of which are plucked, are used in the modern orchestra?

This class of instrument, which prevailed so extensively from the 15th to the 17th century, is to-day but poorly represented. One family, that of the lutes, is almost extinct. These instruments had necks, and fretted fingerboards; they were handled similarly to the bowed instruments (Streichinstrumente), except that instead of being played with a bow, the strings were plucked with a plectrum. The last survivors of the family are the mandoline and guitar. The mandoline has the pear-shaped resonance-box and back-turned neck of the old lute; it has eight strings, strung in pairs which are tuned in unison, their pitch corresponding with that of the violin-strings (g d′ a′ e″, Neapolitan mandoline); or else it has five or six pairs of strings, tuned like lutes in fourths and thirds (g b e′ a′ d″ e″, Milanese mandoline). The guitar is distinguished by a

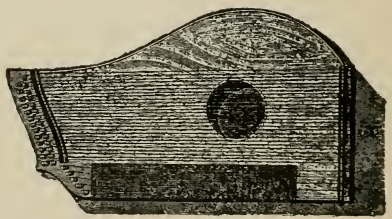
flat resonance box; it is also considerably larger than the mandoline, and is strung with six single strings, which are tuned to:

31.



The notation is, however, when written in the violin-clef, an octave higher than it sounds. On all these instruments, as well as on the obsolete lute, *theorbe*, *chitarrone*, chords of three and four notes were easily obtained for voice accompaniment. For the chief fundamental basses there were, especially in the deeper lutes (theorbo, chitarrone), lying beside the finger-board a larger number of bass strings, which were neither stopped, nor used in playing chords. The possibility of replacing the ensemble of lutes of the 17th century, by the *pizzicato* of the bowed instruments, has gradually led to its almost complete disappearance.

Mandoline.



Cither.

39. Is not the cither an instrument fit for admission into our orchestra?

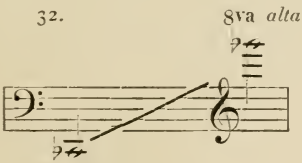
No; the principal effect of the cither, the weakly vibrato of the melody (produced by balancing the finger on the string), does not blend with the decided *tone-colouring*

of the orchestra. The cither stands halfway between the lute and the harp proper, since it has some (5) of its strings stretched over a fretted fingerboard, and some (bass) strings (30 to 35) strung beside them. The cither lies flat upon the table, and has no neck. Only one particular variety of the instrument, an odd mixture of the violin and cither, has a neck, and is alternately played with the bow, and plucked. It is made as treble, alto, and bass instrument. In this form the old lyres (Catm of Mus. Hist. 72) still maintain a modest existence. A larger sized variety of the common cither of percussion, is the elegy cither.

40. The harp is therefore, nowadays, the only orchestral instrument of which the strings are plucked: how is the harp of the present day constructed?

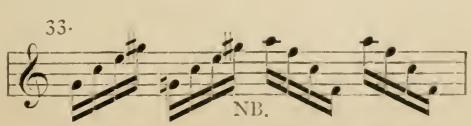
The only harp of any account nowadays, for artistic music, is the double-action pedal harp (Système Érard à double mouvement). It has 46 catgut strings, tuned in the C flat major scale, from contra C flat to G'''' flat.

32.

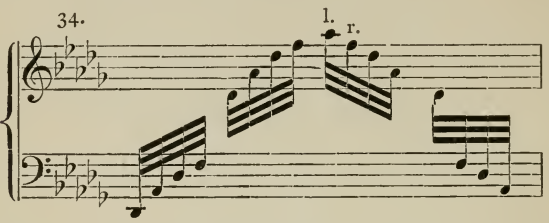


By an ingenious mechanism each string can be raised either a semitone, or a tone; but the pedal which re-tunes C flat to C, performs this operation simultaneously on all the C flats of the instrument. Real chromatic progression is therefore practically entirely denied to the instrument, and certain harmonies which introduce two forms of the same degree of the scale (e. g. G c e g♭) can only be performed when recourse can be had to notes of the same pitch; they cannot however eventually be correctly continued, e. g. the following:

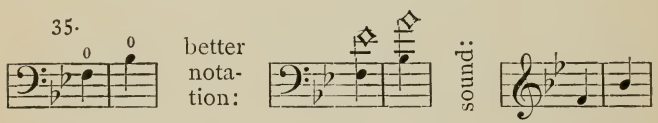
33.



are not practicable, because G♯ must be taken on the A-string (=A flat), which cannot quickly enough be tuned up again to A, for G♯—A to be played in close succession. The strength of the instrument lies in the *arpeggio* of full harmony, played through several octaves:



in which it must always be remembered that keys with a moderate number of flats, favour the instrument most, while its brilliancy fades in proportion to the number of sharps indicated, because then the strings are shortened by the action of the pedals. The particular effects of the harp are: the harmonics, produced by merely touching the middle of the string with the thumb, e. g. *(La Dame Blanche):*



further, the *glissando* produced by tuning the harp beforehand to a single chord. As each string can be tuned two semitones higher, it is possible to produce a number of well-sounding four part harmonies, so that the instrument no longer contains a foreign tone, and the player can glide up and down the instrument at pleasure, without bringing out a wrong note. The possible methods of tuning are:

a) all the chords of the diminished seventh (c♯ e g b♭, d f a♭ c♭, d♯ f♯ a c, and their enharmonic synonyms.

b) the major chords with major sixths, and chords of the dominant seventh on e, b, f♯, c♯, g♯, (e g♯ b c♯, e g♯ b d; b d♯ f♯ g♯, b d♯ f♯ a; f♯ a♯ c♯ d♯, f♯ a♯ c♯ e; c♯ e♯ g♯ a♯, c♯ e♯ g♯ b; g♯ b♯ d♯ e♯, g♯ b♯ d♯ f♯).

c) the minor chord of the seventh below a♭, e♭, b♭, f and c (b♭ d♭ f♭ a♭, f a♭ c♭ e♭, c e♭ g♭ b♭, g b♭ d♭ f, d f a♭ c).

41. Do not the piano and cembalo belong to the instruments whose strings are plucked?

Certainly; for the difference between striking with a plectrum or ring (cither) and with a *hammer*, is scarcely to be called one of principle; in any case they both agree in this, that the tone produced decreases very quickly in strength, and unlike that of the stringed instruments cannot be continued loud or soft, nor swelled, at will.

It is impossible, even generally, to treat of piano-playing here, we refer therefore to special works (v. our Cat[m] of Pianoforte Playing), as we presume that all music students have some knowledge of the piano. Respecting the *cembalo* of the Gipsies, developed from the old dulcimer, the predecessor of the piano, it may be remarked that it extends over four octaves chromatically from E to e^3, and is played with two hammers. Its shape is rather like that of a grand piano without the key-board, cover, and legs.

CHAPTER III.

WOOD WIND INSTRUMENTS.

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42. Is the difference in the designation of wood wind instruments and brass wind instruments a reasonable and distinctive one?

It is so far inexact, that instruments generally reckoned among wood wind instruments, as flutes and clarinets, are also occasionally made of metal (silver, brass); a flute, however, still remains a flute even if made of silver; and nobody would reckon the clarinet with brass instruments although it were made of brass. Since, however, for certain classes of instruments, wood has been generally adopted

as the usual material, the distinction between wood and brass wind instruments is practically useful, although the class of wood wind instruments includes types of nearly all kinds of wind instruments, whereas the class of brass wind instruments comprises only those with cup-shaped mouth-piece. Wood wind instruments are divisible into:

a) Instruments with an air reed (flute).
b) Instruments with a double reed (oboe, bassoon, sarrusophone).
c) Instruments with a single reed (clarinet, saxophone).
d) Instruments with cup-shaped mouth-piece (Zink or *cornetto*, serpent).

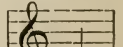
Of these the saxophone and sarrusophone are always, and the higher clarinets frequently, made of brass.

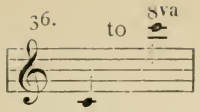

Flute.

43. Are there different kinds of flutes now in use?

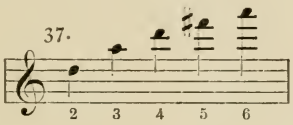
Yes, first of all, the large and the small flute (Ital. flauto grande and flauto piccolo, Fr. grande flute and petite flute), and then flutes of these two kinds differently tuned. But all flutes stand so high, that they command only the upper registers; the flutes of alto, tenor, and bass compass, used in former centuries, require too much wind, and have therefore become obsolete. Yet, in the organ where, as is known, the wind is artificially produced, flute pipes to the length of 4oft, are in use.

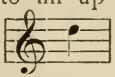
44. What may be remarked concerning the large flute?

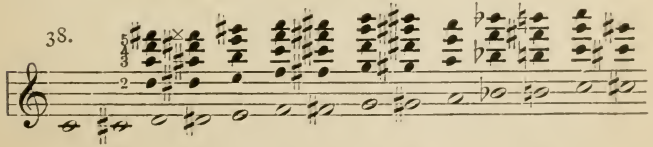
The air-reed is not produced as in toy-flutes and in the flute-pipes of the organ by means of a reed in the mouth-piece, but direct from the player's lips, the air being forced against the sharp edge of the blow-hole. The ordinary large flute used in the orchestra is in C, i. e. the music for it is written as it sounds. But its original key was not C major, but D major, i. e.  was its lowest tone, and the holes in it corresponding to the D major scale lie particularly handy. This flute, now almost the only one in use, was therefore called the D-flute, a name now meaningless, as flutes reach two semitones lower. The full compass is, consequently, from



chromatically. This stately row of notes is partly produced by a particular manipulation, partly by altering the method of blowing (overblowing). In the same way as strings with nodes vibrate, causing harmonics, so also columns of air enclosed in pipes, instead of vibrating in their whole length, will vibrate in parts ($^1/_2$, $^1/_3$, $^1/_4$, $^1/_5$), and give then, not the fundamental tone, but the harmonic corresponding to the division of the column. The original tonic of the flute (d′) gives therefore, in overblowing, the harmonics—



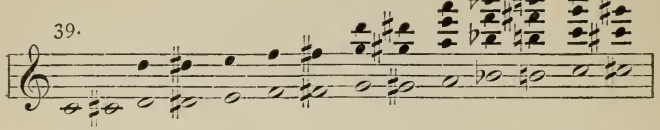
The finger-holes and keys serve merely, by shortening the air column, to fill up the gaps in the natural scale. All notes below  are produced, not by overblowing, but by touch. There are several possible ways of producing the higher notes, meanwhile that method is always preferred which brings the note out as the lowest harmonic: e. g. $f\sharp^3$ not as the fifth harmonic of d^1, but rather as the fourth of $f\sharp^1$, or the third of b^1. The following example may serve as a guide:



i. e., not taking account of the lowest notes, which are only used as fundamental tones, every note in the lower octave can be overblown in several ways. Flutists, however, use chiefly overblown notes in the octave, twelfth, and double octave, avoiding as much as possible the

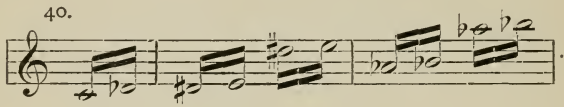
seventeenth (5th harmonic) as this differs too greatly from the *tempered* notes:

39.



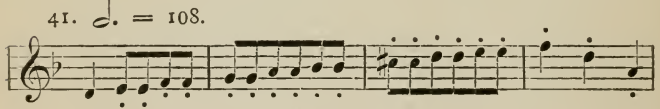
The following shakes or tremolos, on the flute, are difficult:

40.



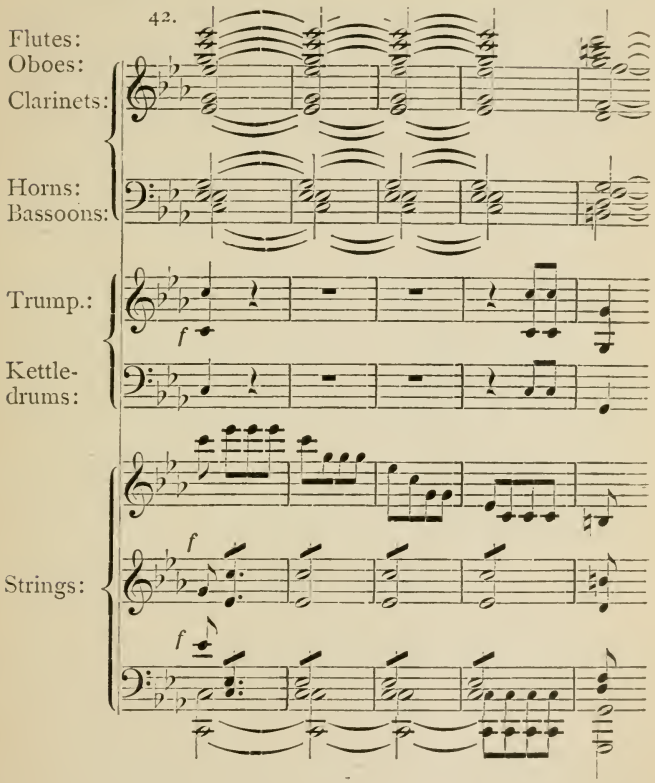
The flute is by far the most dexterous of all orchestral instruments, and makes the greatest leaps with ease. A special peculiarity of its *technique* is the double tonguing, the repetition of every note in quick passages, produced by the utterance of consonants (t) into the instrument in blowing:

41. ♩. = 108.

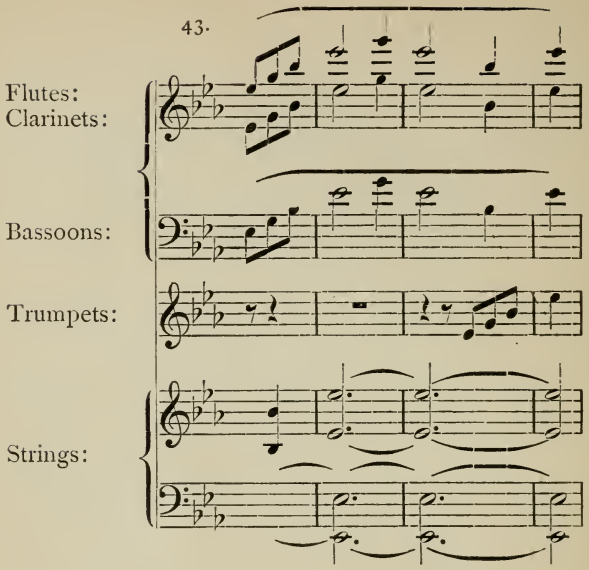


The *timbre* of the flute is of all the wind instruments the most shadowy, bodiless; nevertheless, the higher tones, and particularly the third and fourth harmonics, have clearer brilliancy. It is only with a softly played accompaniment that the middle and lower registers of the flute are suited to execute melody. Sustained low notes of the flute sound threatening, dismal. The usual part taken in the orchestra by the flute, is the doubling of the first violin either in unison or octave. Generally there are two large flutes, which, when not playing together in unison, combine with the first and second violins. Although the flutes are agile enough to play passages with the violins (to which in that case they lend greater brilliancy) yet they

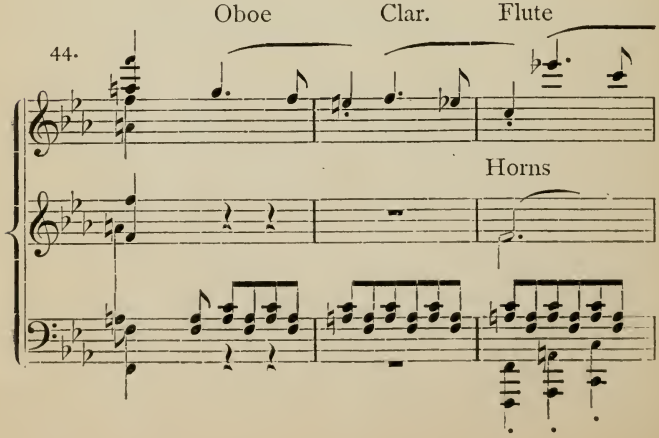
often take part in sustaining the long notes so well suited, not only to the brass instruments, but also to the wood wind instruments. (Beethoven, Symphony in C minor.)

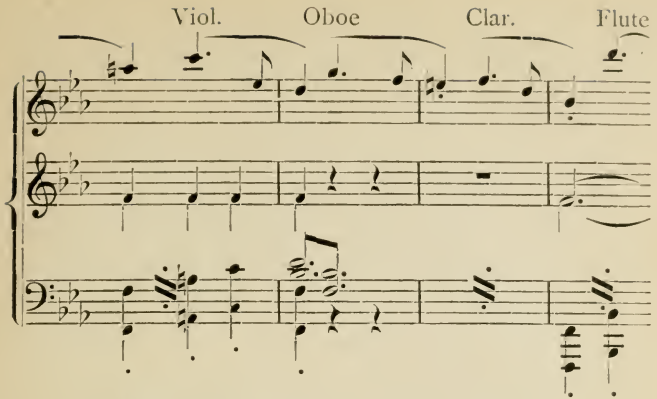


If the flute plays in octaves with the other wood wind instruments, it always has the highest part, although its highest notes are not much higher than those of the clarinet and oboe. The clarinet or oboe is then generally treated as representing the middle register, between the flute and bassoon, e. g. Beethoven, Symphony in E flat major (Eroica):



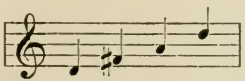
When playing alternately with other wood wind instruments the flute likewise takes the highest part:



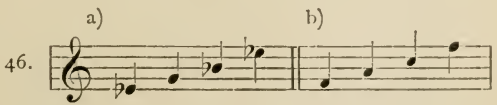


45. What other kinds of flutes are used besides the large C flute?

Formerly, for wood and brass wind bands, flutes were in favour, which stood a semitone, and some which stood a minor third, higher than the ordinary large flute. As the favourite key of the former kind, instead of being D major, was E flat major, they were called flutes in E flat, while the latter were called third-flutes. For both however, the music was written as if their principal scale were D major, i. e. the notes:

45. 

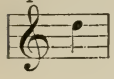
sound on the E flat flute (more correctly D flat flute) as at (a) and on the third-flute as at (b):



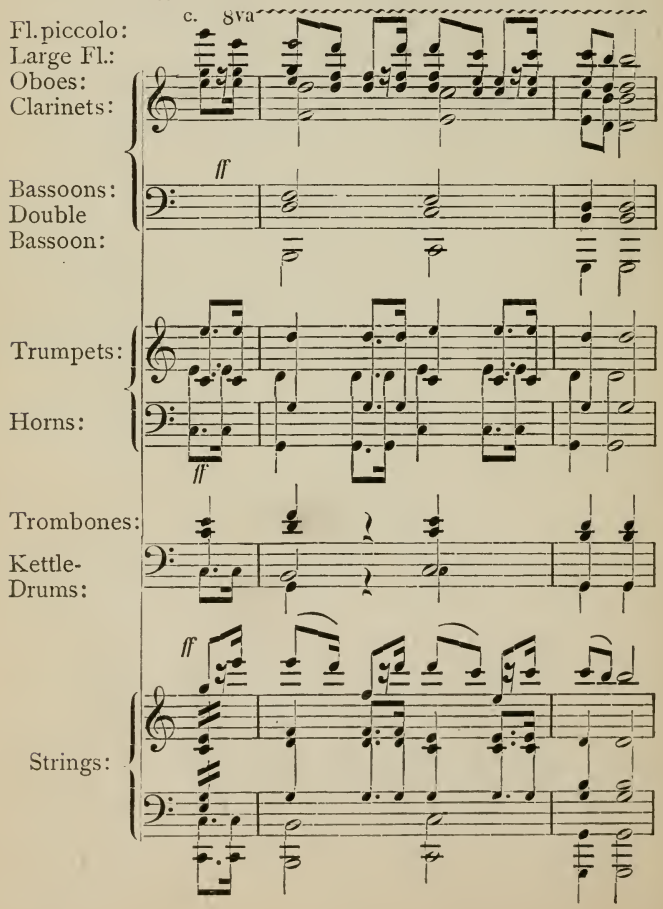
The compass of these high flutes, now as good as obsolete, corresponded with that of the large C flute, without this latter's lowest notes.

46. How is the small (octave, piccolo) flute distinguished from the large one?

Only by its inferior size and higher register, and by the absence of the two lowest notes, (c′, c♯′). The *flauto*

piccolo is in every sense the octave instrument of the large flute, having, the two lowest notes excepted, an equal compass but raised an octave higher, therefore from  , as its lowest note, to a^4, even to b^4 and c^5.

47.

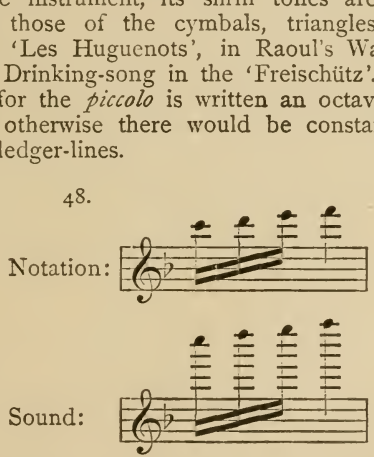


The sound of the *piccolo*, especially in the higher register of overblown notes, is sharp and shrill; but in that of the fundamental ones it is soft and weak. Great caution is needed in introducing the small flute into the orchestra. It is most in place above a strong band of brass instruments, to which it gives the greatest brilliancy, without being perceptible itself. Likewise, when it doubles the violins and wood wind instruments in octaves, in high passages where the large flute cannot follow, the piercing sharpness of its extremely high notes becomes less perceptible (Beethoven, C minor Symphony: vide p. 32, ex. 47).

When the *piccolo* appears without such covering, as a characteristic instrument, its shrill tones are of exciting effect, like those of the cymbals, triangles, etc. as in Meyerbeer's 'Les Huguenots', in Raoul's War-song; also in Caspar's Drinking-song in the 'Freischütz'.

Music for the *piccolo* is written an octave lower than the sound; otherwise there would be constant need of a number of ledger-lines.

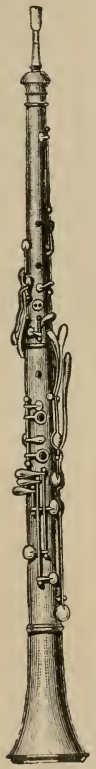
48.



47. Are there any other differently tuned piccolo flutes in use besides the ordinary one (in C, i. e. the notation being according to the sound)?

Nowadays, scarcely any exist; but formerly, the flutes in D flat (E flat), and in E flat (F, third flute) were also made of smaller size, as octave-flutes. Midway between the large and small flutes there was a kind in A flat (according to the previously explained custom of derivation, named after the D flute—the B flat flute) which was larger than the small one, and smaller than the large one. It is only in English military music that such old fashioned methods of tuning are still to be met with. The flageolet too, the

last descendant of the once widely used beak-flutes (flûtes à bec, flûtes douces), a species of flute with plugged mouthpiece, in G, sounding a twelfth higher than the music for it was written, is rapidly disappearing.

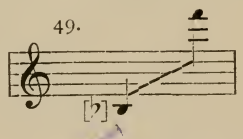


Oboe.

48. What kind of instrument is the ordinary oboe?

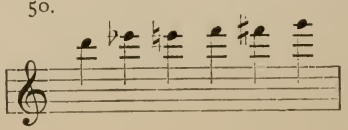
The oboe (Fr. hautbois, It. oboè) is an instrument with a double reed and conical sound-tube, having like the flute, only the soprano register. The foundation of the fingering—the real foundation scale of the oboe (that given by the most conveniently placed sound-holes) is, as in the flute, the scale of D major; but the notation of the oboe is not, any more than that of the flute, one which transposes, on the contrary every note is written as it sounds. In the lower notes the oboe reaches a semitone (some instruments two semitones) lower than the flute; in the higher notes the compass is more limited, the instrument speaking easily and agreeably only up to e^3, but it can be used up to f^3, and even to g^3.

49.



The notes up to, and including, c^2, are produced simply by gradually shortening the tube (opening the soundholes); those of the following octave, by *overblowing* in the octave, as in the flute. The notes blown as third or fourth harmonics (ex. 50) are very acute; the lowest

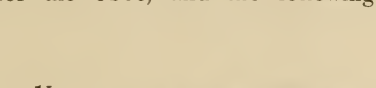
50.



sound rough, and are in *piano* somewhat akin to those of the trumpet, but seem caricatured. In its best notes (from a^1 to d^3) the oboe is an instrument of inestimable value for the execution of melody. It is the oboe that is called on to personify maidenliness, *naïveté*, when it is a question of portraying human character. In the deliniation of nature, it is the characteristic representative of rural scenes, perhaps because it has according to history been developed from the herdsman's shawm. Although not very loud, the sound of the oboe is remarkably keen, and it is necessary therefore to guard well against assigning it a subordinate part the prominence of which is not desired. The *articulation* of the oboe must be distinctly indicated, as it is very noticeable. The staccato of the oboe sounds exceedingly graceful.

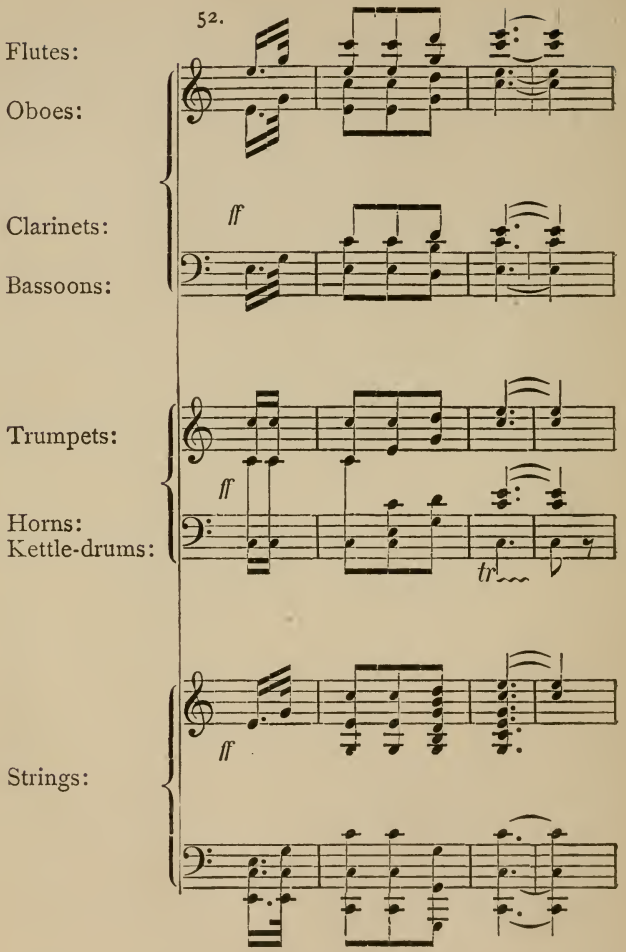
Shakes and tremolos below d^1, and above c^3, are inconvenient for the oboe, and the following are better avoided:

51. NB.

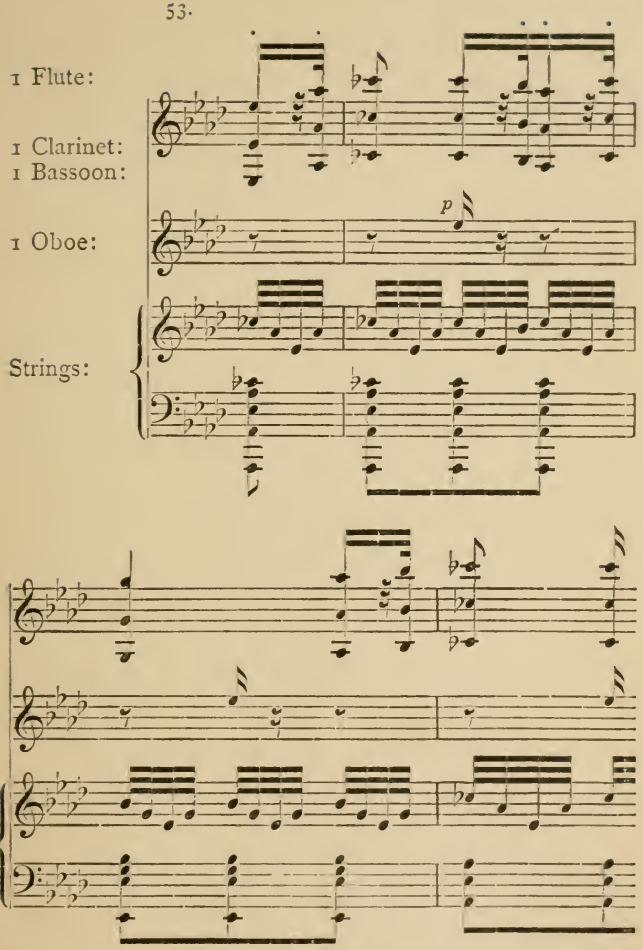


(impossible in quick *tempo*)

The oboe is preferable as a solo instrument, and although there are always two in the orchestra, they are mostly employed singly; yet in *tutti* the two can of course at all times be used together. They also occasionally come in advantageously with the other wood wind instruments, or with the horns, in harmony. The instrument most nearly related to the oboe is the bassoon, with the *timbre* of which its own blends most fully. In a combination of oboes, flutes and clarinets, the dominating melody is given to the first oboe; or if this be taken in octaves by the clarinet and flute, the oboe has an important counter-voice assigned to it. Further, long notes suit the oboe well, but not the ordinary *filling-up* notes. Music for the oboe is generally written lower than for the flute, and higher than for the clarinet, e. g. Beethoven, C minor Symphony):



As a proof of the manner in which the oboe, even in the most insignificant, hidden, delicate tones, pierces through the other instruments, we point to the following extract from the exquisitely beautiful passage in the C minor symphony:



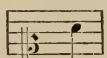
49. Are there oboes differently tuned in use in the present orchestra?

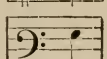
Certainly; for instance the English horn (*corno inglese*, *cor anglais*), which is nothing more than an alto-oboe, an oboe in F, an improvement of the old *oboè di caccia*.

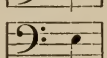
The sound of this instrument especially in the high notes, is certainly akin to that of the oboe, but in the lower notes it strongly resembles the horn, being somewhat bleating in sound. For rural description the English horn, like the oboe, can be used, but it sounds gloomier, more melancholy. In the orchestra, the English horn is always an exceptional instrument, and is generally played by the second oboist (there being a pause naturally for the second oboe). Let none write for this strange-toned instrument who have not by practice previously familiarized themselves with its peculiar *timbre*. The fingering of the English horn corresponds wholly with that of the oboe; but on account of its greater length, the instrument is bent as a knee. Its compass is equal to that of the oboe, but pitched a fifth lower (e—b♭²); the music for it is written, however, as if it were an ordinary oboe, i. e. the notes if played on an ordinary oboe would sound a fifth higher. Such a method of writing is called '*transposing*', more correctly *transposed* or *intended for transposition*, since not the notation, but the instrument transposes. Rightly therefore all such instruments, which give notes different from those indicated in the notation, are designated '*transposing*' instruments.

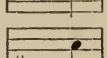
50. Are there no convenient means of representing the relation of the sound of a transposing instrument to its notation?

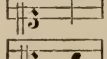
Certainly; it is a great help to read the notes in another clef, viz:

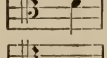
Mezzo-soprano-clef:  instead of violin-clef for instruments in F or F♯.

Baritone-clef:  instead of violin-clef for instruments in G.

Bass-clef:  instead of violin-clef for instruments in E or E♭.

Soprano-clef:  instead of violin-clef for instruments in A or A♭.

Alto-clef:  instead of violin-clef for instruments in D.

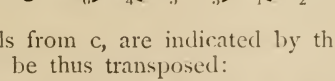
Tenor-clef:  instead of violin-clef for instruments in B♭ or B.

But this reading of clefs, which only removes the register (much lower or much higher) has its drawbacks. There is, however, another means which is not only more correct, but in the end simpler as well, as the result is in all cases the same. One has only to imagine, which in fact is true, that for a transposing instrument, that key is written as C which is its own natural key—the one whose name it bears. The notes for these instruments are in reality not *tone signs* but *finger signs*. If an instrument in F plays its c, this sounds like f; if it plays g, this sounds like c. One must therefore get accustomed to understanding all the notes for transposing instruments as *interval signs* (from c upwards), i. e.:

c♯ as augmented unison (1ˊ),
d♭ as minor second (2ˊ),
d as major second (2),
d♯ as augmented second (2ˊ),
e♭ as minor third (3ˊ),
e as major third (3),
f as perfect fourth (4) etc.

If, therefore, the English horn has to play the notes d♯ g♯, augmented second and augmented fifth are read, but not from c, but from f, therefore g♯—c♯. This method proves itself good; it is simpler than it seems, as one has only to think out the position of the first note, the after ones follow as ordinary transposition. An illustration may make the matter easier to deal with; the notation:

54.



whose intervals from c, are indicated by the underwritten figures, would be thus transposed:

Intsruments in B♭: 6ˊ = g♭,
„ „ A: „ = f,
„ „ D: „ = b♭,
„ „ E♭: „ = c♭,
„ „ E: „ = c,
„ „ F: „ = d♭,
„ „ G: „ = e♭.

Naturally one must always keep in mind what interval the instrument transposes (in B♭ a tone lower, in D a tone higher, etc.). Reading the notes thus, though at first a rather complicated operation, will become easy, sure, and effectual (cf. 56).

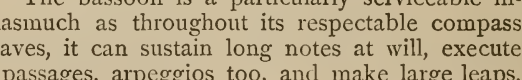
51. Are there not other kinds of oboes?

No, the *oboe d' amore*, for which Bach wrote extensively, is now quite obsolete. This was an oboe in A, i. e. one standing midway between the ordinary oboe (*oboè piccola*) and the *oboè da caccia* (English horn), and sounding a minor third lower than its notation. The fingering also corresponded with that of the ordinary oboe.

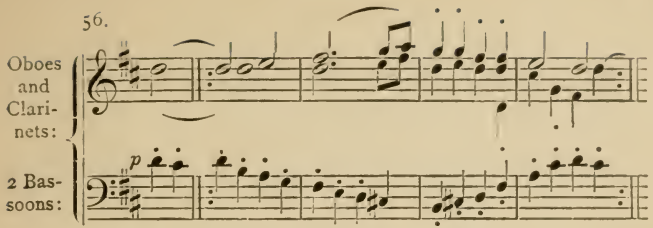
52. What sort of an instrument is the bassoon?

It is closely related to the oboe; both are developments of the shawm and bombard of the 16th century. The main distinction is that in the oboe and bassoon, the double reed is not placed in a sort of cup, but taken hold of immediately by the lips. The bassoon is still further distinguished from the bass bombard, by its sound-tube being bent and arranged in folds, so that the unwieldy length of the bombard is obviated (Bassbombard about 8 ft., double fifth bombard still longer); and again by its narrower tubes, and consequently less bleating, and more covered *timbre*. The compass of the bassoon reaches conveniently from Contra B♭ to b♭¹: some bassoons reach in the lower notes to Contra A. The fundamental notes to be produced only by touch, reach to (small) f; the next octave is obtained by *overblowing* in the octave (to f'); and only the highest notes require overblowing in the twelfth. The bassoon is a particularly serviceable instrument inasmuch as throughout its respectable compass of three octaves, it can sustain long notes at will, execute rapid scale passages, arpeggios too, and make large leaps. Its sound is somewhat akin to that of the horn and the *violoncello*, but not so clear and mellow, rather nasal, and in *staccato* and wide leaps, humorous, e. g. (Beethoven, 8th Symphony):

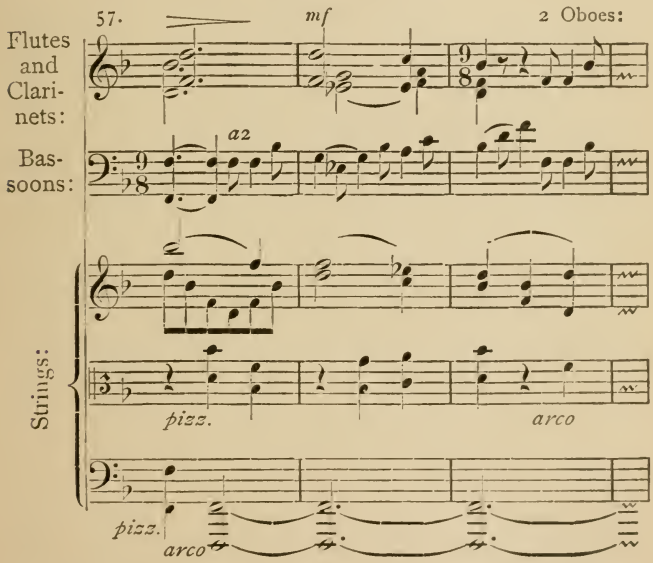
1 Bassoon and Kettle-drum. (Solo)



or (9th symphony):

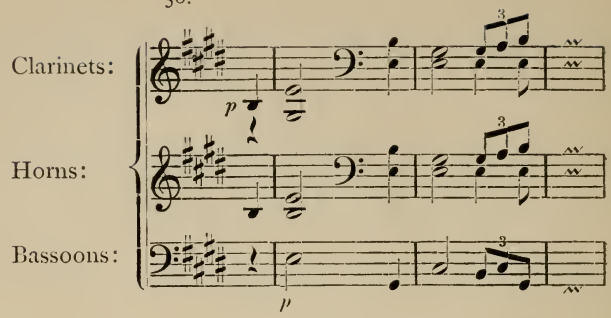


Like the oboe and English horn, the bassoon is capable of expressing the calm, happy contemplativeness of rural delight (J. Raff, Waldsymphonie):



It is better that the bassoon should not take sustained smooth melodies alone, but supported by the celli or violas, or as octave doubling to the other wood wind instruments (oboes and clarinets). The two bassoons of the orchestra are specially suited for combination with two horns, or with clarinets or oboes, in full harmony, e. g. (Overture to Tannhäuser)

58.



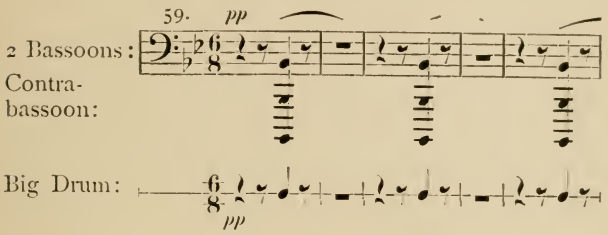
In *tutti* the bassoons are generally associated with the basses (celli and double-basses), playing readily with them all the runs; but when the three main divisions of the orchestra (strings, brass, and wood wind instruments) have each their own full combination of parts, the bassoon naturally allies itself with its nearest kin, the wood instruments. The danger of the bassoon attracting notice contrary to wish and aim, is not great, as its tone is on the whole much less penetrating than that of the oboe; moreover, it is rather like that of the stringed instruments.

53. Are there any other varieties of the bassoon in use?

In reality only the contra-bassoon; for the tenor or fifth-bassoon, which sounds a fifth higher than its notation (and is in G, therefore), has not generally obtained any importance in artistic music; its compass, corresponding to that of the ordinary bassoon, lies a fifth higher. The contra-bassoon, on the contrary, stands a full octave lower than the ordinary bassoon, and the notation, as for the double-bass, is written an octave higher than it sounds (it is treated as a 16ft instrument); but it customarily foregoes the use of its upper and lower extreme notes. Unfortunately the contra-bassoon, which is by no means to be dispensed with, becomes continually rarer; the deep brass instruments of double-bass register (contrabass tuba, helicon) are by no means suitable substitutes, as instead of a sound similar in *timbre* to the double-bass, their tone is explosive, broad, and rather rough. Call to mind the sublime passage in Beethoven's 9th Symphony, where Schiller's words:

"Froh wie seine Sonnen fliegen
Durch des Himmels prächt'gen Plan,"

after the sublime crescendo to the passage, "Und der Cherub steht vor Gott", are interpreted by him in an overpowering representation of eternity, by means of rests, which are rendered intelligible by *pp* strokes of the drum, bassoon and contrabassoon, on the lowest three B♭'s on the unaccented beat of the bar:

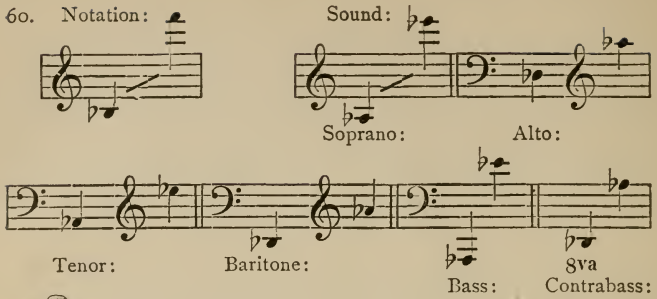


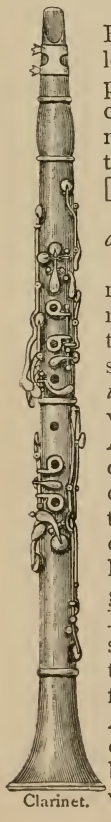
Here the mighty tread of the immeasurable, with a sublimity neither visible nor audible, but faintly appreciable to the mind alone, seems to enter palpably into our consciousness. To substitute for the contrabassoon in this passage, a brass instrument of larger size, would entirely destroy the shadowy, ghostly effect. Perhaps (as F. A. Gevaert hopes) the contrabass sarrusophone in C (vide below, No. 54) may by virtue of its kinship to the bassoon, and its more convenient fingering, supply the wanting substitute.

54. Are there any other wind instruments with double reeds, besides the oboe and bassoon?

None in general use. But an instrument called the *sarrusophone* has been constructed in Paris, since 1863 from a design of M. Sarrus, conductor of a military band. The body of this instrument is of brass; otherwise it is an exact copy of the oboe family, only on a larger scale, and therefore louder. In imitation of the saxophone, the sarrusophone is made of six sizes, as soprano, alto, tenor, baritone, bass and contrabass instruments. As the instrument is primarily intended only for military music, it is only made in E flat and B flat. The compass answers to that of the oboe, the notes extending from $b^{\flat}$ to f^{3}. The actual compass according to sound is as follows:

60. Notation: Sound:




Clarinet.

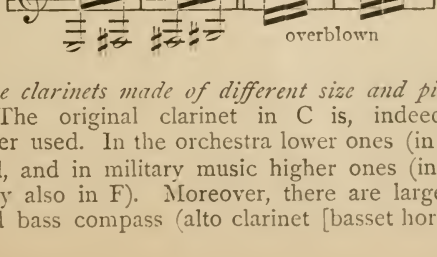
For symphony there has lately been made a still lower sarrusophone in C, which is suited for replacing the contrabassoon, being, in its method of tone-production, closely allied to that instrument. The music for it is written according to the sound, but an octave higher (compass $_2B\flat$ to [small] g).

55. What distinguishes the clarinet from the oboe and bassoon?

Above everything the reed, which is not a narrow double one, but a broad single beating reed, as in the ordinary reed pipes of the organ; then the cylindrical form of the sound tube, instead of the conical one of the oboe. The *timbre* of the clarinet and its relatives, is more voluptuous, more passionate than that of the oboe. A peculiarity of the clarinet arising from the cylindrical form of the tube, is the want of the even number harmonics (octaves), and thence the impossibility of leaping to the octave in overblowing. Therefore the clarinet, like all its kindred, instead of overblowing in the octave goes at once to the twelfth (third harmonic). But thence arises the necessity of extending the series of notes obtainable by touch (shortening the pipe) to the twelfth, which renders the fingering rather complicated (18 sound holes). According to its notation, the compass of the clarinet is from small e to g^3 (easily); with b^1, begins the series of overblown notes (twelfths) which extend to f^3. All notes above this must

be played as fifth, seventh or ninth harmonics; they however seldom appear except in solos. The clarinet is developed from a primitive French wind instrument called the *chalumeau* which had only a most insignificant compass (from f to a^1), and must be distinguished from the shawm (Schalmei) the ancestor of the oboe. To this descent the instrument owes the name of its lowest register (e to e^1), still called in German Schalmei. When in 1700 Christoph Denner of Nuremberg made overblowing in the twelfth easier, by aid of a small hole, the new register thus obtained, took the name of *clarino* as it promised, and was actually destined, to put the high solo trumpets (Klarinblasen) out of existence. And hence eventually the name *clarinetto* for the instrument itself. The register of the third harmonics (clarino) has the sensuous pleasantness of sound above described. The *schalmei* register sounds rather dull and makes considerable noise in blowing; it is in character akin to the viola, or to the stringed instruments played *con sordino*. The worst notes are the highest fundamental ones (g' to $b\flat'$), which are rather colourless and weak, and besides contrast, especially with their nearest higher neighbours, the first overblown notes; they are very difficult to play rapidly and *legato*. The extremely high notes are acute, and not much used, except at most in *tutti*. Formerly, to avoid the numerous ledger lines, the fundamental notes were sometimes written an octave higher, with the indication *chalumeau;* a return to the ordinary note value was indicaded by *clarino* or *loco*. The rapid repetition *legato*, of the following notes is impossible:

61.



56. Are clarinets made of different size and pitch?

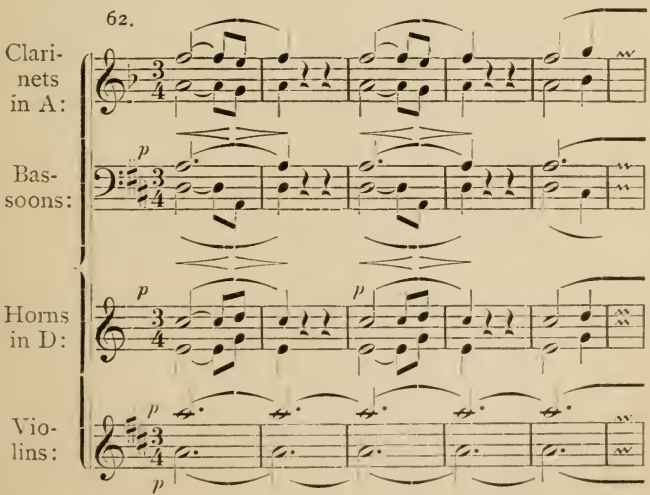
Yes. The original clarinet in C is, indeed, now scarcely ever used. In the orchestra lower ones (in B♭ and A) are used, and in military music higher ones (in D, E♭, A♭, formerly also in F). Moreover, there are larger ones of alto, and bass compass (alto clarinet [basset horn], and

bass clarinet). The C clarinet is scarcely ever chosen by classical composers, unless the piece is in the key of C; its sound is rather shrill and without mellowness. The real virtuoso instrument, that to which clarinet players by preference confine themselves, when the conductor does not insist on their taking the one required by the composer, is the B♭ clarinet. Its lowest note according to sound is d (at the close of last century, [with Mozart] B♭, i. e. the note c); in the upper notes it reaches easily to f³, even to b♭³ (note c⁴). Composers choose the B♭ clarinet for all pieces in keys with ♭s, while for the keys with ♯s the A clarinet is to be preferred. As supplement to what has been said above (50) on transposing instruments, a review may here follow of the shifting of keys in transposing instruments. It must be clearly understood, that the key in which the instrument is tuned must, in its music, always appear to be the key of C major, therefore that for the B♭ clarinet the two ♭'s must be disregarded, and equally for the A clarinet the three ♯'s in the key of A major:

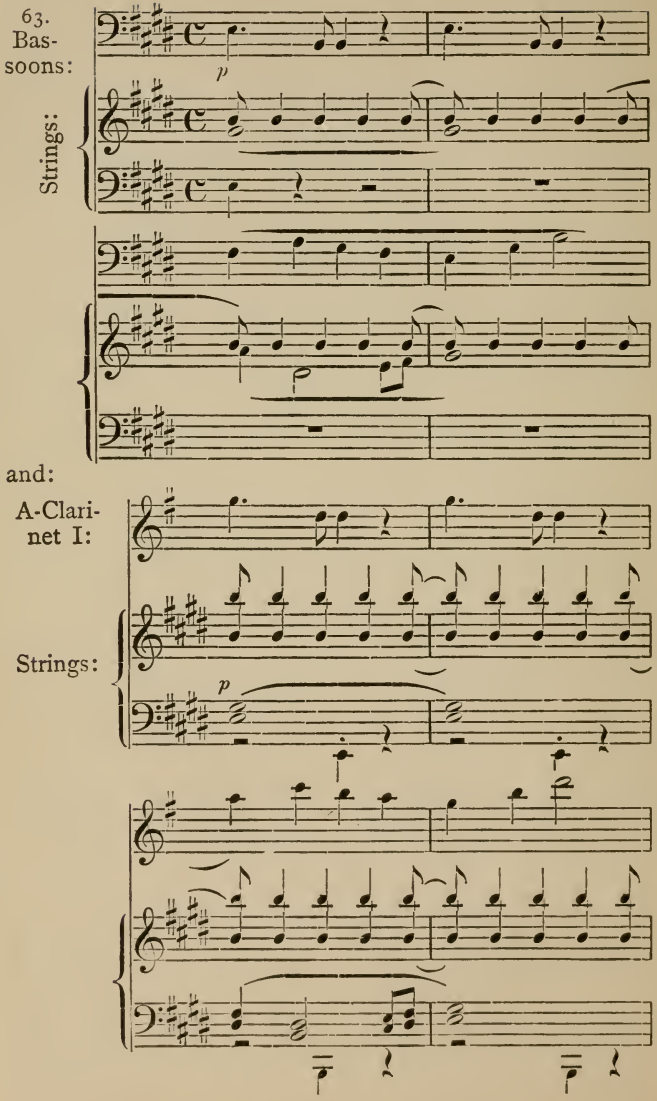
B♭ maj. (2♭'s) appears on the B♭ clarinet as C maj. (2♭—2♭ = no key-signature),
E♭ maj. (3♭'s) app. on the B♭ clar. as F maj. (3♭—2♭=1♭ key-sig.)
A♭ „ (4♭'s) „ „ „ „ „ B♭ „ (4♭—2♭=2♭ „)
D♭ „ (5♭'s) „ „ „ „ „ E♭ „ (5♭—2♭=3♭ „)
G♭ „ (6♭'s) „ „ „ „ „ A♭ „ (6♭—2♭=4♭ „)
F „ (1♭) „ „ „ „ „ G „ (1♭—2♭=1♯ NB.!)
C „ (nothing) „ „ „ „ „ D „ (noths—2♭=2♯ NB.!)
A „ (3♯'s) „ „ „ A clar. „ C „ (3♯—3♯=no key-sig.)
E „ (4♯'s) „ „ „ „ „ G „ (4♯—3♯=1♯ „)
B „ (5♯'s) „ „ „ „ „ D „ (5♯—3♯=2♯ „)
F♯ „ (6♯'s) „ „ „ „ „ A „ (6♯—3♯=3♯ „)
D „ (2♯'s) „ „ „ „ „ F „ (2♯—3♯=1♭ NB.!)
G „ (1♯) „ „ „ „ „ B♭ „ (1♯—3♯=2♭ NB.!)
C „ (nothing) „ „ „ „ „ E♭ „ (noths—3♯=3♭ NB.!)

As in the A and B♭ clarinets here, so in all the other transposing instruments, the signature of the key in which the instrument is tuned, is to be subtracted from the key-signature of the piece, so that superfluous sharps become flats, and superfluous flats become sharps (cf. above at NB.).

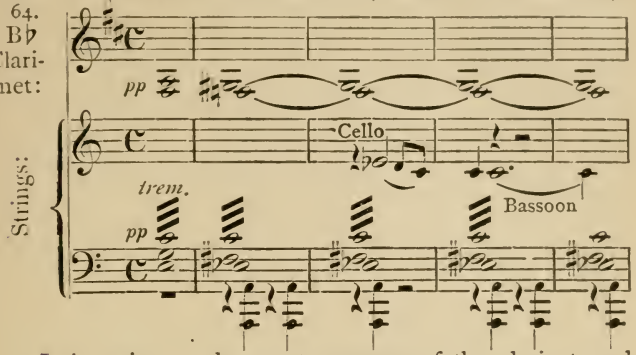
The tone of the A clarinet is neither so brilliant nor so voluptuous as that of the B♭ clarinet, but makes amends by being more soft and sorrowful. The choice of the clarinet in A, or of that in B♭, depends of course, generally, on the key of the piece; but in some circumstances, the particular character of the composition may necessitate the selection of the A clarinet, and with it the preference of a sharp key. The tone of the clarinet blends equally well with that of the other wood wind instruments, or with that of the horns. It it also better suited than the oboe for a melodious middle part not intended to be brought out with the prominence of a solo. But from the strings in the orchestra, it always remains characteristically distinct, and can therefore bring out a principal melody which descends below the other parts. In regard to pitch the clarinet is generally treated as being an octave (or fifth) higher than the bassoon and horn, and an octave lower than the flute, e.g. (Beethoven, Symphony in A major):



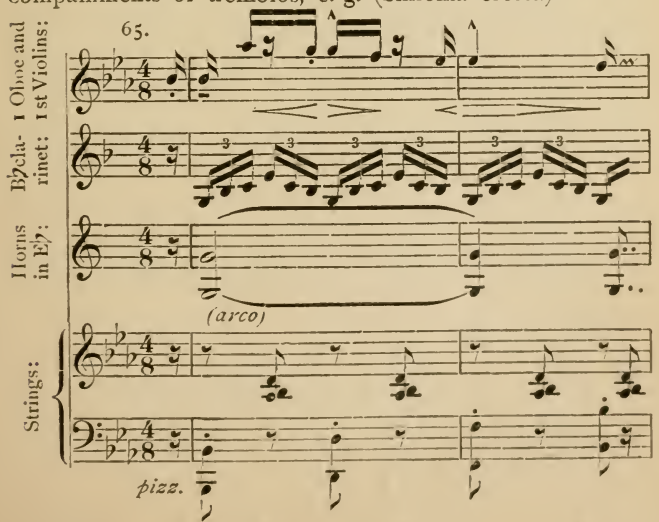
Nevertheless its enormous compass admits of its being treated as being two octaves from the bassoon, e. g. (Overture to Fidelio):


63.
Bassoons:
p
Strings:
and:
A-Clarinet I:
Strings:
p

on the other hand, it can descend with quite special effect, even to the best octave of the bassoon (Overture to Freischütz):

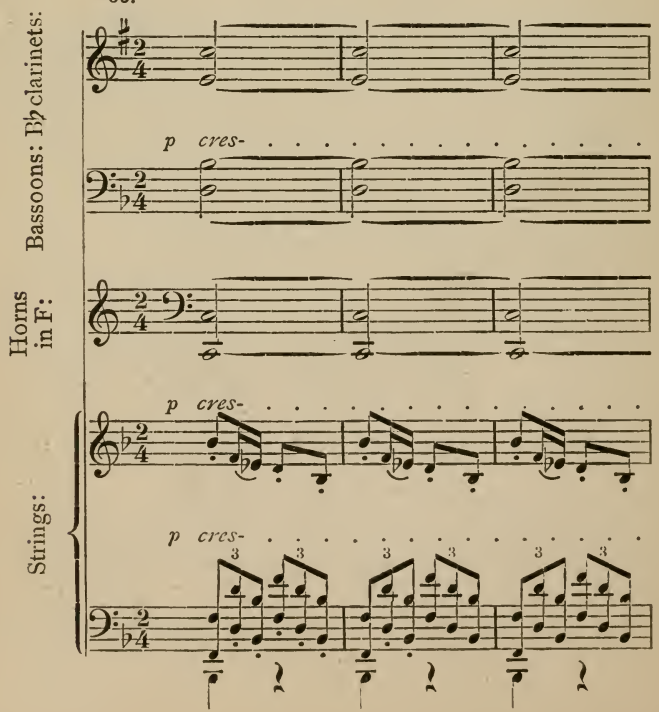


It is owing to the great compass of the clarinet and to its ability to play quick running passages, that in full military bands it represents the part of the violin, i. e. it plays passages of every kind. In such cases the number of clarinets is increased. But in symphony also, the rôle is sometimes given it of playing continuous arpeggio accompaniments or tremolos, e. g. (Sinfonia eroica):

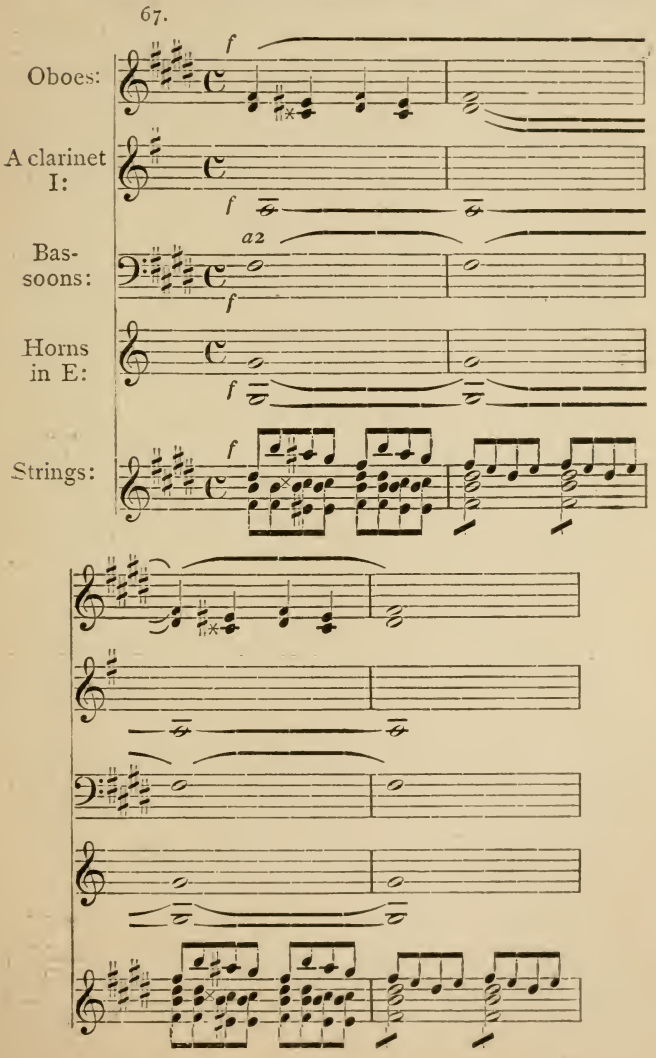


Yet, this method of proceeding is always exceptional; the part of the wind instruments, when they have no melody to play, is generally rather the sustaining of notes, and exposition of special harmonies which the stringed instruments ornament with figures. The student, therefore, will do well to thoroughly impress upon his memory examples of score such as the following. He must not forget that wind instruments are put in singly or in pairs, the stringed instruments on the other hand much more numerously, and that wind instruments prove of the greatest value when sustaining long notes, while the strings, with their figured passages, penetrate even through the *fortissimo* of the sustained notes of the wind *tutti* (Sinfonia pastorale):

66.



or (Mendelssohn, Overture to the Midsummer Night's Dream):

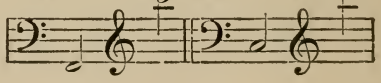


57. Are there not varieties of the clarinet which transpose its compass into that of the alto, tenor and bass?

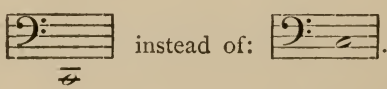
Certainly; there are alto clarinets and bass clarinets. Of the two sorts of alto clarinets constructed by instrument manufacturers, namely those in F and E♭, only the first is used in symphony, or opera. Its compass answers exactly to that of the ordinary clarinet, except that its highest notes are of course not taken into account, as they are to be had more easily on a higher kind of clarinet. When the alto clarinet reaches in its low notes to great F (note c, as the B♭ clarinet formerly), it is called a basset-horn. The tone of the basset-horn is akin in quality to that of the A clarinet, only more earnest and solemn. The voluptuousness of the clarinet tone vanishes more and more in the lower kinds, and in its place comes a more penetrating, suppressed tone, which, however, is mellower than that of the bassoon. The lowest kind of clarinet, the bass clarinet, is made in B♭ and in A, i. e. it is pitched an octave lower than the ordinary B♭ and A clarinets. The lowest notes (the bass clarinet is noted like the ordinary clarinets) speak well, even in *pianissimo*, down to the lowest note e. The usual pitch of bass clarinets is in B♭, but Wagner often indicates that in A. The compass according to sound of the various clarinets, is:

68.

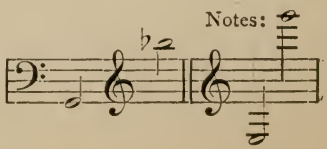
Basset-horn (Alto clarinet in F):



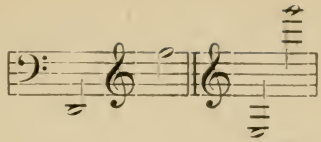
the notation of the deepest notes, when given in the bass clef, was formerly written an octave too low, therefore:



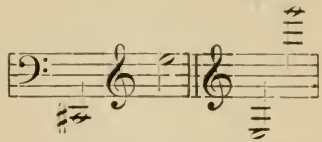
Alto clarinet in E♭:



Bass clarinet in B♭:



Bass clarinet in A:



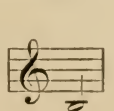
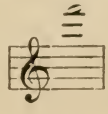
In all the varieties of the clarinet, the *technique* is the same; but the distance between the sound-holes is naturally greater in the deeper ones, and both the alto and bass clarinet are on that account bent so as to enable the player to reach the sound-holes. The shakes impossible to the ordinary clarinet (in C), may when transposed for those of different pitch be rendered with fluency, viz.:

in C:	e—f♯, f♯—g♯;	overblown:	b′—c♯″, c♯″—d♯″;
in B♭:	d—e, e—f♯;	„	a′—b′, b′—c♯″;
in A:	c♯—d♯, d♯—e♯;	„	g♯′—a♯′, a♯′—b♯′;
	d♭—e♭, e♭—f;	„	a♭′—b♭′, b♭′—c″
in F:	A—B, B—c♯;	„	e—f♯, f♯—g♯;

etc.

58. What kind of instrument is the saxophone?

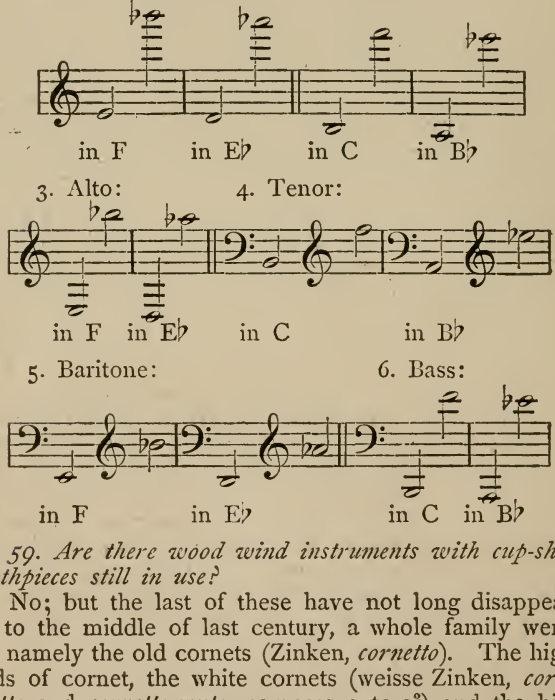
It is really distinguished from the clarinet only by the shape of the sound tube, which is not cylindrical as in the clarinet, but conical as in the oboe; it is played like the clarinet, by means of a single beating reed. But the altered shape of the bore causes the note in overblowing to go, not into the twelfth, but into the octave, by which means the fingering becomes as simple as in the oboe. And in fact the saxophones have the same notation, fingering and compass as the oboe, the

notation being:  to 

The inventor (A. Sax, 1840) however, makes the instrument of six sizes, viz.: high soprano, soprano, alto,

tenor, baritone, and bass; besides which each kind is of twofold pitch, one (in C, F) for use in symphony, the other (in B♭, E♭) for wind band. As only the Belgians and French have hitherto made use of the saxophone, it is only those in B♭ and E♭ that need be considered. Still it is doubtless possible that saxophones may in the future be adopted for symphony. The exact compass of the various kinds, according to sound, is:

69.



59. Are there wood wind instruments with cup-shaped mouthpieces still in use?

No; but the last of these have not long disappeared. Up to the middle of last century, a whole family were in use, namely the old cornets (Zinken, *cornetto*). The highest kinds of cornet, the white cornets (weisse Zinken, *cornetto diritto* and *cornetto muto*, compass a to a^2) and the higher Quartzink (*cornettino*, compass d^1 to g^3), were made of a single straight piece of hard wood; they had ivory cup-shaped mouthpieces with very narrow bores. In order to bring the sound-holes within reach, the larger kinds

were made with serpentine curves (*cornetto curvo*, and *cornetto torto*, *cornone*); they consisted of two pieces of wood cut into shape and glued together, and afterwards covered with leather (whence the name of black cornets, schwarze Zinken). The bass cornet (*cornone*, compass d to d^2) was played by means of an S. The largest kind of cornet was called a bass horn (*Basshorn*) or, from its snake-like windings, a serpent. It had about the compass of the bassoon, from contra A to b^1, but was pitched ni B♭, i. e. the music for it was written a tone higher ($_1$B to c′). The tone of this instrument, which lasted into the present century, was rough and coarse. All these instruments, like flutes, oboes, clarinets and bassoons, had sound-holes the opening of which shortened the vibrating column; they were therefore similar in their fingering to wood wind instruments; but they belonged to instruments with cup-shaped mouthpieces, i. e. they formed a natural transition to the so-called brass wind instruments, having in common with them, the manner of producing tones (membranous reeds).

CHAPTER IV.

BRASS WIND INSTRUMENTS.

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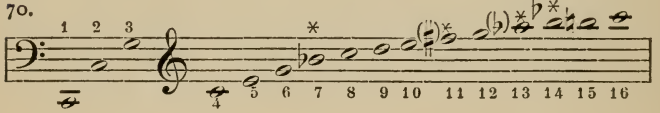
60. What general remarks may be made concerning the compass and capacity of brass wind instruments, in contradistinction to those of the wood wind instruments?

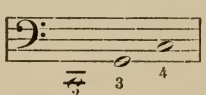
First, that the average compass is greater; next, however, that with few exceptions (trombone) the scale is deficient in tones. To obtain a thorough insight into the nature and construction of brass wind instruments, let us imagine them in the only, or almost the only, form in which horns and trumpets were once in use, as so-called *natural* instruments, without any mechanical contrivance by means of which the gaps in the natural overblown scale might be filled, and let us remember how we have

already become acquainted with one contrivance (sound-holes), and are now soon to become acquainted with two others (slides, valves). As we know, the pitch in instruments with membranous tongues, is also determined solely by the length of the tube; but with them overblowing plays a much more important part than in instruments with air, or proper reeds. Overblowing is with them, much easier; in some it is really very difficult to produce the fundamental note. So then, instruments in this category have at their disposal only a series of notes arising from a single note, the natural fundamental note of the instrument. For the majority of instruments belonging here, this natural fundamental note is written as C (or it should be; for unfortunately we find here also, the error of writing the lowest notes, which require the bass clef, an octave too low); the series of the first 16 natural notes, great C being supposed the first, is:

70.



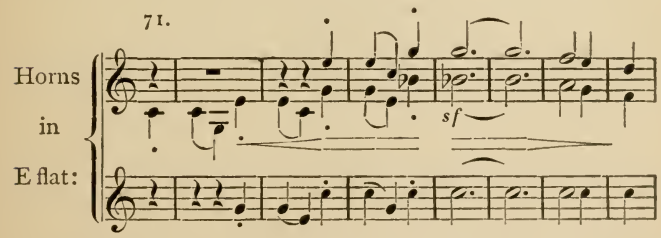
But, as already mentioned, the lowest notes, as soon as the bass clef is used, are generally written an octave too low (in horns and trumpets):



Horns and trumpets can produce the whole series, with exception of the lowest note, which speaks with great difficulty, and is therefore not used artistically. The notes 7, 11, 13 and 14 are not quite in tune, i. e. they do not fit into our musical system; the 7th and 14th are too low for B♭, the 11th is too high for F, and too low for F♯, the 13th is too high for A♭ and too low for A; but these deviations from just intonation allow of correction, as we shall see. So then, instruments in this category have an entirely different basis for the production of sound from the flute, oboe and clarinet. Overblowing was for

them, only a means of enlarging the scale obtained by the sound-holes; but here we have to do with instruments in which the scale obtained by overblowing constitutes the ground-work, further aid being sought only for the purpose of filling up the gaps in the scale. Here, be it at once remarked, that a chief defect in all brass instruments, is the inequality of intonation of the intervals, for whilst the intervals of the *natural* scale are quite true, those introduced artificially (at least by means of a fixed apparatus—as sound-holes, valves), are *tempered*, i. e. not quite true. And thence the varied effect of brass instruments according to the way in which they are handled. If a composer take into consideration the peculiar nature of the instrument, he can, by using the absolutely true notes of the natural scale, create effects which, for harmony, throw everything else into the shade. Sustained true thirds on the horn, are of a sweetness of tone that no other instrument can rival; indeed even the seventh natural tone, which, as the third below d^2, is too low and sounds out of tune, blends, on the contrary, as seventh with the chord of C major, in the most delicious harmony (Eroica Symphony):

71.

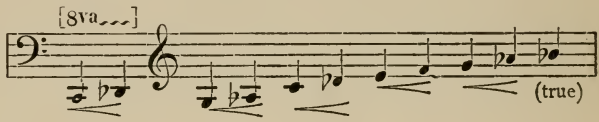


In other words, the character of brass instruments is suited, not for the execution of florid melody, but for enriching the harmony to the utmost. Let this be particularly remembered, in spite of a few successful attempts in an opposite direction. Horn *soli* will always prove of happiest effect when they keep to the natural scale, and introduce artificial notes as little as possible; even the trombone, which by means of the slide possesses unlimited power of melody, finds a more appropriate place in harmony. In short, *cantabile* does not befit these powerful

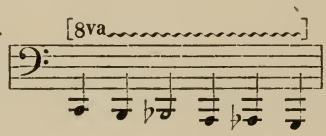
brass voices; trumpets and trombones must herald, proclaim, and not talk and sing like ordinary mortals.

61. By what means can horns and trumpets fill up the gaps in the natural scale?

First of all, without mechanical aid, by merely forcing the tone and decreasing it, and by what is called *stopping*. By forcing the note, which is effected by a simple modification of the pressure of the lips similar to that by which, in the higher natural notes, overblowing is achieved, notes are obtained which are insignificantly, at most a semitone, higher than the natural notes:

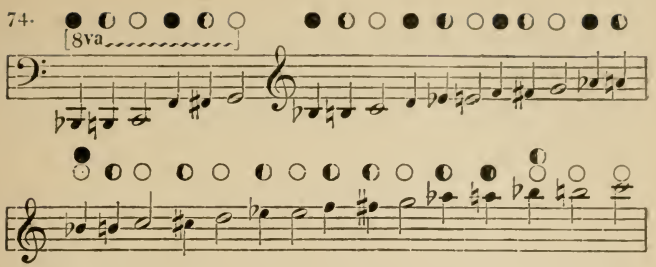
72. 

And vice-versa, by relaxing the lips, skilful horn players are able to produce a number of deeper notes, foremost those below note 2 (See Ex. 70):

73. 

and similarly also, corresponding ones below the third and fourth natural notes. If the absolutely secure command of the notes thus obtainable belongs to the virtuoso only, there is yet another means of obtaining the notes wanting in the natural scale, namely *stopping*. There are two methods of stopping; according to the first—the more important and usual method, which lowers the sound from a semitone to a tone,—the player inserts his outspread hand in the bell of the instrument, partially covering it therefore. But a distinction is made between *half* and *full* stopping, according as the opening is more or less covered; half stopping lowers the note a semitone or, if necessary, less; full stopping lowers the note a whole tone. The notes to be obtained in this way are (◐ = halfstop, ● = fullstop, ○ = natural notes):

74.

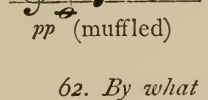


i. e. that from small $b^{\flat}$ to c^{3} inclusively, a chromatic series is obtained, with the single exception of $c^{\sharp 1}$, which would have to be gained by forcing. Unfortunately, however, the notes obtained by stopping are not of the same quality as the open ones; they sound muffled, forced, troubled,—wanting the freedom and breadth of the natural notes. They may be of great value æsthetically, where the composer requires that particular effect, but it is on the other hand indisputable, that the mixture of open, half and full stopped notes, is to such a degree noticeable, that a melody in which these three kinds of notes are used in indiscriminate succession, cannot possibly create a homogeneous impresssion. Nevertheless, the expedient of stopping was for a long time the only one available, at least for the horn, though for the trumpet it never obtained general acceptance. The inevitable deadening and suppression produced by stopping, affects the clear vigorous sound of the trumpet still more than the plaintive sound of the horn. But although, for this reason, stopping has lost its chief importance, since means have been found of filling up the gaps in the scale without changing the character of the sound, yet, on the other hand, it will maintain lasting importance, simply because this altered quality of tone may be turned to account. Full stopping is, to be sure, not generally worth much; half stopping can on the present valve instruments be obtained throughout the entire compass of the scale, as we shall see. Whoever writes for these horns should not forget, therefore, that he has no cause to abstain from turning this effect to account.

A second method of stopping (muffling) consists in pressing the fist firmly into the bell; this raises the sound

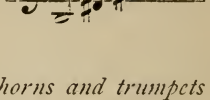
a semitone, but weakens it at the same time more than full stopping of the other kind. Horn players employ this muffling for the production of *pianissimo* echos and similar effects. Since, as mentioned, the sound is by this means raised a semitone, the player must act as if the passage were a semitone lower, e. g.:

75.



pp (muffled)

to be obtained by means of the second valve, thus:



62. By what mechanical means do horns and trumpets now fill up the gaps in the natural scale?

By so-termed valves or pistons, cylinders and other appliances however called, which finally have all this similarity, that by touching a lever with the finger, a longer or shorter piece is inserted in the sound-tube, or on the contrary taken out of it; in the former case the tube is lengthened, and the sound consequently lowered; in the latter it is shortened, and the sound therefore raised. The only system much known at present, that of the lengthening valve, has been applied both to horns and trumpets; it is everywhere adopted, and consists in the addition of three valves to the instrument, which lower the sound thus:

the first a tone,
the second a semitone,
the third $1^1/_2$ tones.

By the combination of two of these valves or even of all three, we get still lower: as,

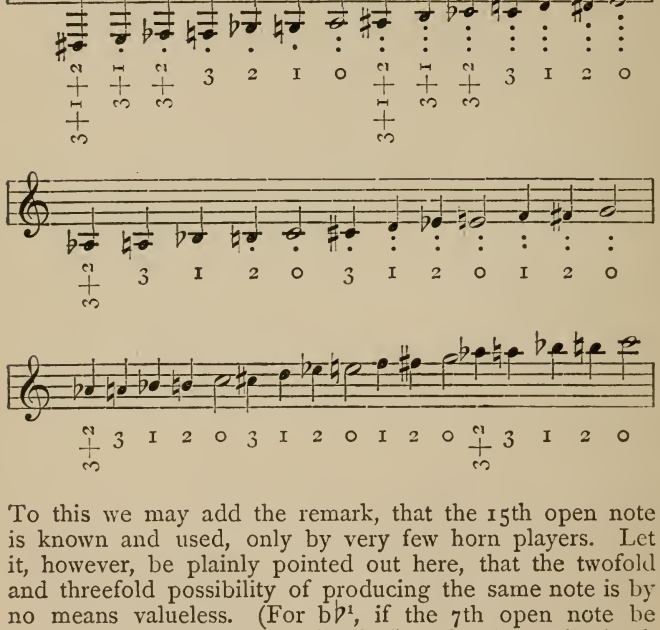
$1+2=1^1/_2$ tones (as with valve 3, but in some cases giving truer intonation),
$3+2=2$ tones (a major third),
$3+1=2^1/_2$ tones (a fourth),
$3+1+2=3$ tones (tritone).

The following view will show, in the clearest and simplest manner, how the entire natural scale may, in the same way, be lowered from 1 to 6 semitones; we omit the notes 7, 11, 13 and 14, as modern horn players prefer using the valve to giving these notes just intonation by means of partial stopping:

		(3+1+2)	(3+1 valve)	(3+2 valve)	(3 valve or 1+2)	(1 valve)	(2 valve)	(Natural notes)	
		.	.	.	.	.	.	c^3	= 16.
		.	.	.	.	.	b^2	b^2	= 15.
		.	.	.	.	$b\flat^2$	$a\sharp^2$	.	
		.	.	.	a^2	a^2	.	.	
		.	.	$a\flat^2$	$g\sharp^2$	.	.	.	
		.	g^2	g^2	.	.	.	g^2	= 12.
16.	=	$f\sharp^2$	$f\sharp^2$	.	.	.	$f\sharp^2$	.	
15.	=	$e\sharp^2$	.	.	.	f^2	.	.	
		.	.	.	e^2	.	.	e^2	= 10.
		.	.	$e\flat^2$	.	.	$d\sharp^2$	.	
		.	d^2	.	.	d^2	.	d^2	= 9.
12.	=	$c\sharp^2$	.	.	$c\sharp^2$	.	$c\sharp^2$	.	
		.	.	c^2	.	c^2	.	c^2	= 8.
		.	b^1	.	b^1	.	b^1	.	
10.	=	$a\sharp^1$	.	$b\flat^1$	.	$b\flat^1$	.	[$b\flat^1$	= 7.]
		.	a^1	.	a^1	.	.	.	
9.	=	$g\sharp^1$	.	$a\flat^1$	.	.	.	.	
		.	g^1	.	.	.	.	g^1	= 6.
8.	=	$f\sharp^1$	.	.	.	.	$f\sharp^1$	.	
		.	.	.	.	f^1	.	.	
		.	.	.	e^1	.	.	e^1	= 5.
		.	.	$e\flat^1$	.	.	$d\sharp^1$	.	
		.	d^1	.	.	d^1	.	.	
6.	=	$c\sharp^1$	.	.	$c\sharp^1$	.	.	.	
		.	.	c^1	.	.	.	c^1	= 4.
		.	b	.	.	.	b	.	
5.	=	$a\sharp$	.	.	.	$b\flat$	.	.	
		.	.	.	a	.	.	.	
		.	.	$a\flat$	.	.	.	.	
		.	g	.	.	.	.	g	= 3.
4.	=	$f\sharp$	.	.	.	.	$f\sharp$	.	
		.	.	.	.	f	.	.	
		.	.	.	e	.	.	.	
		.	.	$e\flat$	.	.	.	.	
		.	d	.	.	.	.	.	
3.	=	$c\sharp$	.	.	.	.	.	.	
		.	.	.	.	.	.	c	= 2.
		.	.	.	.	.	B	.	
		.	.	.	.	$B\flat$	.	.	
		.	.	.	A	.	.	.	
		.	.	$A\flat$	.	.	.	.	
		.	G	.	.	.	.	.	
2.	=	$F\sharp$	.	.	.	.	.	.	

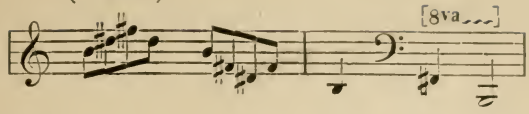
If we leave out of account the various possible ways of producing the same note, the chromatic scale printed in black type, in the above table, may be presented as follows (O = open note, 2 = 2 valve, etc.):

76. (the notation is an octave too low)

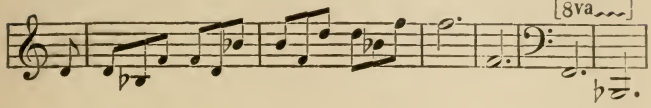


To this we may add the remark, that the 15th open note is known and used, only by very few horn players. Let it, however, be plainly pointed out here, that the twofold and threefold possibility of producing the same note is by no means valueless. (For $b\flat^1$, if the 7th open note be included, the possibility is fourfold). If it be maintained, that for brass wind instruments, movement through the natural scale is the natural form of melody, then valve instruments will appear not so much to have a complete chromatic scale at command, as to have a considerable number of natural scales (7) at their disposal side by side. Of these, those requiring only one valve (harmonic series of $_1B$, $_1B\flat$, and $_1A$) are of particularly good sound, i. e. the following progression may be got out of a valve horn or trumpet with excellent effect.

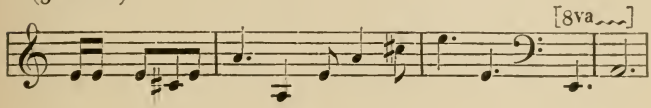
77. (2 valve)

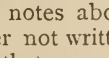


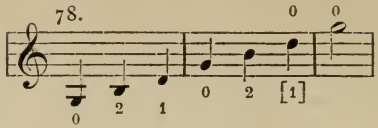
(1 valve)



(3 valve)



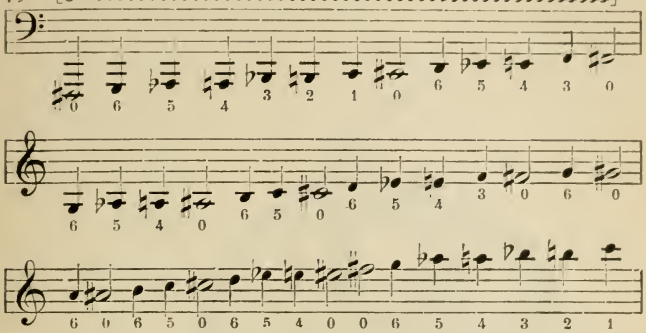
These, on well made instruments, are not to be distinguished from progressions in the natural scale of C. Unfortunately, the intonation becomes imperfect as soon as necessity compels the use of several valves simultaneously. For as the length of the additional tube of each single valve is calculated exactly, so as to lower the tone of the instrument by $^1/_2$, 1 or $1^1/_2$ tone, by adding $^1/_{15}$, $^1/_8$, and $^1/_5$ respectively to the length of the principal tube; it thus proves too short, and gives too high an intonation, the moment it is called to act upon a tube already lengthened; for $^1/_{15}$ is of course the 15th part of 1, but not of $1+^1/_5$. Of all intonations, the worst are those which, besides the third valve, require also the first and second. Progressions through the series of natural notes above $_1F\sharp$, $_1G$ and $_1A\flat$ are therefore, generally better not written. A glance at the table will teach us, moreover, that excepting $a\flat$ and $a\flat^1$ only notes under small e (written: ) require two valves, which in any case, would seldom be written, at least for the horn or trumpet. In the two highest octaves, however, (c^1 to c^3) instead of a series of natural notes with two valves, imperfectly in tune throughout, it would be preferable to make use of notes from several series; e. g.



The use of a valve always disturbs to some extent the smooth union of the notes. This must never be forgotten in giving valve instruments solo passages which are not supported by other instruments. For the sustained notes so commonly given, to the horns especially, sounds produced by one or more valves are at all times available, particularly as the player can always, by partial stopping, correct the intonation, which in quick movements he has not time to do. The faults of intonation become, moreover, greater and more numerous, if the horn or trumpet player insert a crook, which lowers the tone of the instrument a semitone or tone, as then all notes given by the valve are too high (for the reason given above). It is true the valves are provided with means (Auszüge) which admit of their being lengthened a little; but unfortunately, horn players seldom make the accurate use to be desired of this means. To obviate all these difficulties, and to give a more equal quality throughout to the intonation of brass wind instruments, A. Sax, the Parisian instrument maker, has invented the system of the shortening valve (à pistons indépendants), according to which the valve, instead of lengthening the sound-tube, shortens it, by cutting out a part. These Sax valve instruments, unfortunately not extensively used, have six valves which are always made use of singly. The Sax instruments therefore, give as natural notes, the notes obtained on the ordinary valve instruments by combination of all the three valves (but in tune), i. e. in notation the harmonics of F♯, and by use of the six valves, this natural pitch is gradually raised until, by use of the last valve (which Sax calls the first), those notes are obtained which in instruments on the ordinary system come out without any valve. But these 7 natural scales are all equally in tune. It is therefore much to be desired, that our horn players would procure for themselves the Sax valve instruments, as they are in every way superior to those on the old system, and need neither crook nor slide. The simplest chromatic scale on the Sax valve instruments has naturally quite a different position from

that of the instruments with lengthening valves as it starts from the point of the greatest length of the instrument. Owing to the importance of this subject, and in the firm conviction that this system will soon find an introduction amongst ourselves also, this scale is given here:

79. [8va

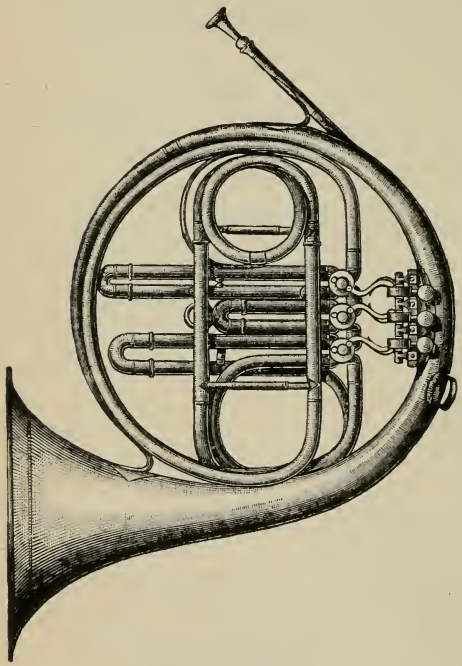


But as stated, all the seven natural scales are of equally perfect intonation, and therefore favour the use of the brass wind instruments in the sense emphasized above; i. e. that in the Sax instruments, all the different ways of producing the same note, to be seen from our table (p. 61), are equally valuable.

63. How are horns and trumpets distinguished from one another?

Firstly, by the external shape. The horn has its tube twisted in the form of a circle, and its bell turned to the side, that the player may be able the more readily to insert his right hand in it; whereas the trumpet is straighter and has its bell turned to the front. The horn too, in proportion to its length, is narrower than the trumpet, but gradually widens (coniform) from the mouthpiece to the bell; while the trumpet only begins to widen in the last third of the bell. The mouthpiece of the trumpet is convex, that of the horn conical, whence the *timbre* of the horn is soft and mournful (especially of those in medium keys), and that of the trumpet, vigorous and shrill. The property peculiar to brass wind instruments of preferring movement by the natural scale to all modulation, is particularly conspicuous in the trumpet,

which is fitted to lead the melody only in the strongest *tutti*. Sentimental melodies on the trumpet sound altogether trivial, while the horn can render them with the most beautiful effect. The trumpet is an instrument which lends itself by preference to the grand style, to the heroic and pathetic; there it can undertake even melodic progressions, or motives contrary to the nature of the original instrument (without valves). To the horn all doors are open; but for the naïve, for the expression of gladsomeness, content, sportiveness, it is better to give the horns as well as the trumpets, only series of notes which lie in the natural scale (original or transposed). Horns and trumpets generally differ an octave in compass. Horns are, as we say, instruments of 16 ft tone, trumpets, of 8 ft tone; i. e. horns in C sound an octave lower than the notation; trumpets in C sound as the music is written. A horn in C is about 16 ft long, a trumpet in C only 8 ft. Horns and trumpets in the same key mostly double each other in octaves. The *timbre* of the trumpet contrasts so forcibly with that of the horn that the union of two horns and two trumpets in a four-part composition is not feasible (though perhaps



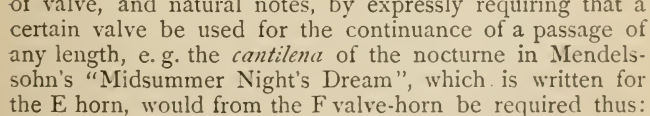
Valve Horn in F.

in a two-part one with octave-doubling). That is the reason why composers prefer to indicate two pairs of horns, or else prefer the two bassoons, or the two clarinets, as complement to the horns in four-part composition, leaving the trumpets either isolated (sometimes increased in number to three, especially since Wagner) or joining them with the trombones, to the sound of which their own is akin. To both the horn and trumpet the rapid repetition of a note is possible, by speaking consonants into the instrument (similar to "double-tongueing" on the flute): but in this particular effect the trumpet far surpasses the horn, as it can produce a sort of shake, or rather *tremolo*.

64. In what keys are horns made and what is their compass in sound and notation?

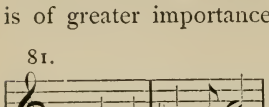
The natural horn, Ger. Waldhorn (like trumpets and kettle-drums) was originally in the key of D; but to this were gradually added others in E♭, E, C, low B♭, low A, F, G, A and high B♭; by the use of crooks these could be lowered a semitone and so the missing keys of B, D♭, F♯, and A♭, were obtained. Since the introduction of valves these instruments are unfortunately almost exclusively made in F (with crooks for tuning to E) which is greatly to be regretted, because the *timbre* of the lower horns (in C, B♭, A *basso*) differs materially from that of the higher ones by reason of its trombone-like fulness and greater roundness of tone. Nevertheless, the F horn is at least the nearest approach to the natural horn in its best sounding and most characteristic keys (D, E♭, and E) and gives these by means of the valve. Although the composer of the present day is compelled to take into account the fact that the natural horn and trumpet are disappearing, yet when seeking effects proper to the natural horn, there is nothing to hinder him from forbidding the alternate use of valve, and natural notes, by expressly requiring that a certain valve be used for the continuance of a passage of any length, e. g. the *cantilena* of the nocturne in Mendelssohn's "Midsummer Night's Dream", which is written for the E horn, would from the F valve-horn be required thus:

80. With valve No. 2 . . . . . .



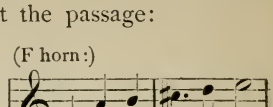
This is obvious for cases where few notes appear which could be obtained without a valve, but in other cases it is of greater importance; e. g. that the passage:

81.



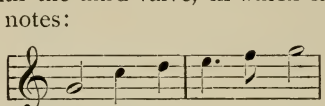
be played not as

(F horn:)

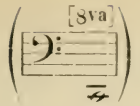


but throughout with the third valve, in which case it moves solely by natural notes:

82. (in D)

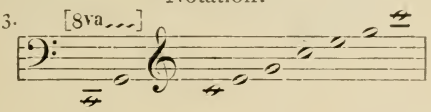


As our horn-players are accustomed to transposing from all the keys into that of F, one may still make use of a notation such as that of Ex. 82, without injurious effect; and there is this advantage that the score is easier to read. We should, therefore, regard the F valve horn as a combination of natural horns in F, E, E♭ and D, with which one may get on fairly well (horns in D♯, C, B are better avoided); interchange between these four keys may then be made in the course of a piece, at pleasure. As horn-players nowadays, only *stop* where this is expressly required, the indication *stopped*, or the addition of the sign ○, over the note, should not be omitted when any special effect is sought by the introduction of stopped notes. The compass of the valve horn in F comprises the entire extent of Ex. 76, and of the table on p. 61; but the highest notes (above the note g^2) are within reach only of the thorough virtuoso. Distinction must also be made between the first (high), and the second (low) horn, the former having readier command of the higher, and the latter of the lower notes, not merely in consequence of special practice in the one register, or in the other, but also because use is in each case made of a mouthpiece specially adapted for the purpose (that of the high horn is narrower). In four-part composition, the first and third horn are high, the second and fourth low. The high horn unwillingly goes below small g, the low horn unwillingly above e^2. In reference to natural horns, it is to be observed, that those in low keys (in C, and lower), have difficulty in producing the second natural note:



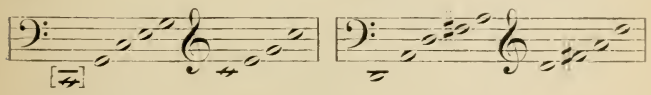
the 16th natural note generally forms the limit of the higher notes, but it is reached only by horns of low pitch (to C) easily, and by those of middle pitch (to F) with difficulty; the higher ones already have trouble in producing the 12th natural note. In general, therefore, the convenient compass of the natural horn according to sound, reaches from great C to c^2 (three octaves). The following summary will serve to complete the information given respecting the keys of the horn:

Notation:

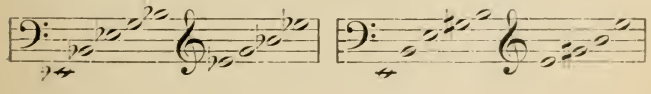
83. 

Sound:

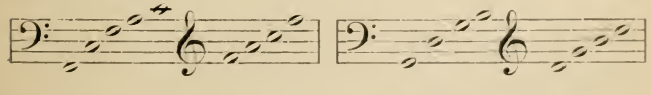
in C: 16 in D: 16



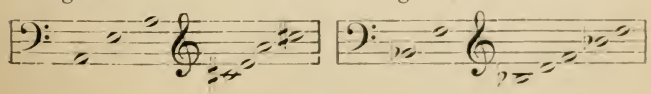
in E♭: 16 in E: 16

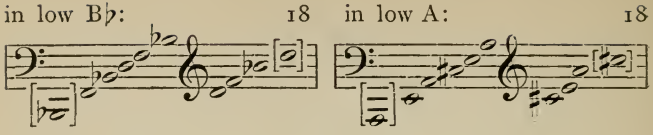


in F: 16 in G: 12



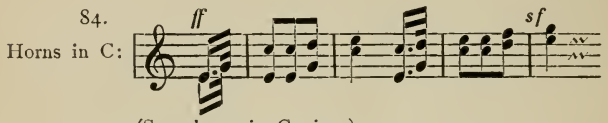
in high A: 10 in high B♭: 10





The nature of the sound of the horn, demands a rather close position of the parts if the harmony is to have a pleasing effect. When there are only two horns, they seldom move beyond an octave apart, playing mostly in thirds, with scattered fifths, sixths and fourths.

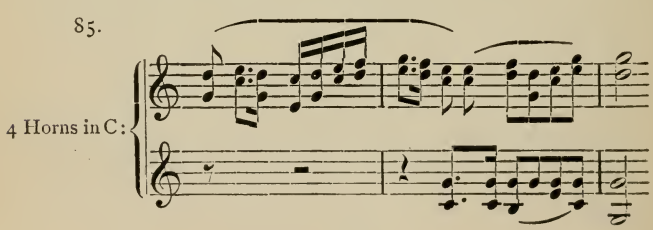
84.



(Symphony in C minor)

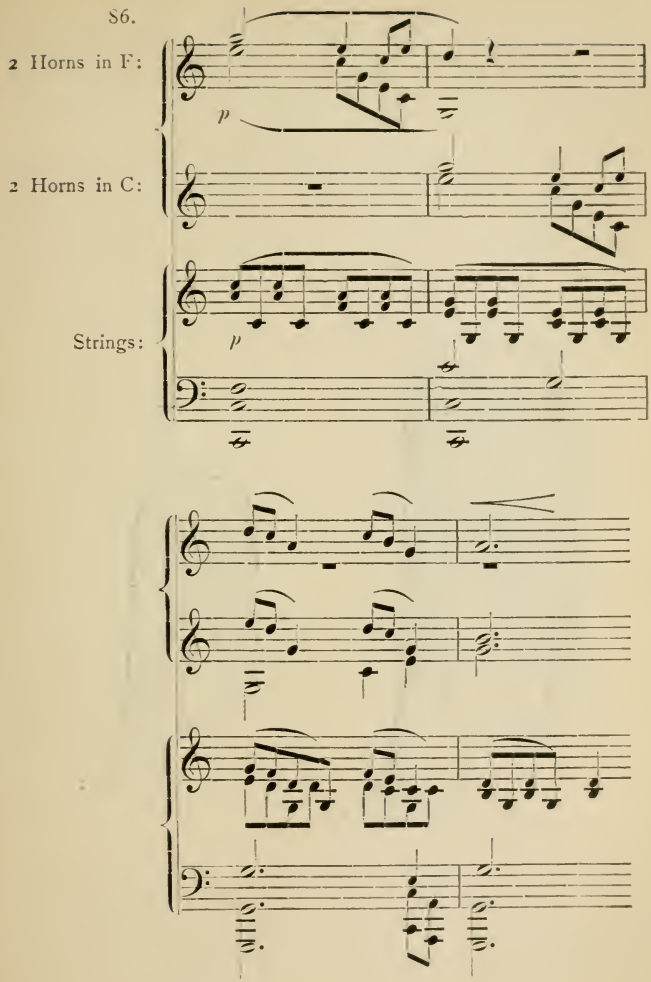
Three horns are also, generally kept close together (cf. Ex. 71); and not infrequently the great masters leave out the third of the dominant, even with three or four horns; e. g. (Beethoven, Overture Namensfeier, op. 115):

85.



where any thinness of effect in the sound is scarcely noticeable. The magically pleasing sound of the horn depends in part upon the absolute purity of intonation of the combined sounds, which only exists when horns in the same key are placed together; for this reason, at least two horns in the same key have always been used, a third and fourth in a different key appearing occasionally; e. g. in the Overture to "Freischütz", two in F, and two in C:

86.

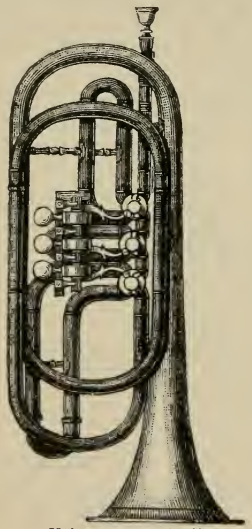


It is to be wished that manufacturers of instruments would make two sizes of valve horns, a high one in F, and a low one in C, which latter by the use of valves

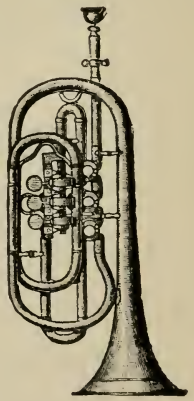
might take the place of the old horns in B, B♭, and A *basso*. Composers would not delay a moment in recognizing the quartet of two high and two low valve horns, and writing for them in place of the four valve horns in F, for which they do not care to write.

65. In what keys is the trumpet made?

Valve trumpets are chiefly made of two sizes, the larger being in F and the smaller in B♭. Trumpet players are inclined to allow the F valve trumpet to fall into disuse, a state of things to be prevented by every possible



Valve trumpet in F.



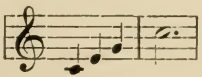
Small B♭ trumpet.

means. In the first place, the tone of the B♭ trumpet cannot compete with that of the large F trumpet; and, then a good part of the lower compass of the instrument is wanting entirely. The natural trumpet was made in all keys, from low A (in unison with horns in high A) to high B♭. Should it be thought the lower trumpets might be dispensed with, the trombones taking their place with good effect particularly in the low notes, those in D, E♭ and E cannot be done without, for though they might perhaps be

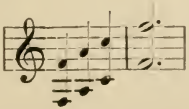
represented by the valve trumpet in F, they cannot be by that in B♭. If the Sax valve system (shortening valve) should also one day become general in Germany, which is greatly to be desired, then the valve trumpet in F would comprise at the same time the lower natural tunings to C and B inclusive. The small B♭ trumpet, in face even of the difficulties which players of our day have with the high notes that virtuosi of the last century were conversant with, is to be approved, but only for the highest registers; its lowest register is weak, and altogether unavailable. The compass of the trumpet coincides exactly with that of the horns an octave higher; but only reaches upwards to the 12th natural note; namely in all keys about to g^2 or a^2 according to sound. It may be mentioned here, that of late small trumpets have been made in D; but they are still weaker, of course, than those in B♭; they are used to facilitate the execution of the extremely high trumpet parts in J. S. Bach's church concertos. Composers should see that the two kinds of trumpets, the low one in F and the high one in B♭, are kept in use side by side; if one must be sacrificed it should be the one in B♭ rather than that in F. In writing for three trumpets, which lately (since Wagner) has frequently been done, it is possible to require, instead of three valve trumpets in F for which players so gladly substitute that in B♭, two in F and one in B♭, or two in B♭ and one in F. Concerning the notation for the trumpet, it may be observed that it is written exactly like that for the horn, only the sound is an octave higher; therefore,

87.

Valve trumpets in F and valve horns in F:

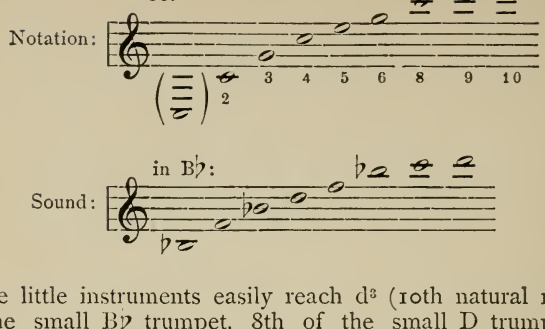


Sound:



But for the small B♭ trumpet as well as for the small D trumpet, the so-called cornet notation is used, which places the natural scale an octave higher:

88.

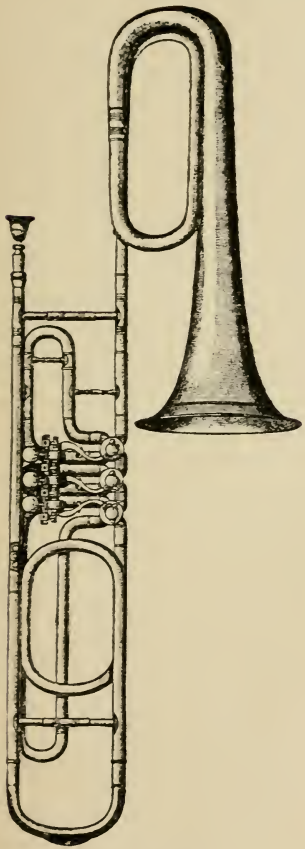


These little instruments easily reach d^3 (10th natural note of the small B♭ trumpet, 8th of the small D trumpet), which Bach so often wrote for the large trumpet in D (16th natural note). Where the aim is to represent the heroic, and when the overwhelming strength and piercing sharpness of the trumpet tone is required, the small trumpet is of no use whatever and the F trumpet must be strictly adhered to. It is the business of conductors to prevent the use of cornet-like little trumpets whenever they are not explicitly enjoined. As already mentioned, the sound of the trumpet does not blend with that of the horn fully enough to allow of any attempt at combining two trumpets and two horns, in four part harmony. Trumpets and trombones, on the contrary, blend excellently, for being made on a similar scale, their sound is consequently akin. The difference in the outer form results merely from the way of making them. The trumpet used in England, the slide trumpet, is only a treble trombone (the Italian word trombone, augmentative of tromba, means a large trumpet).

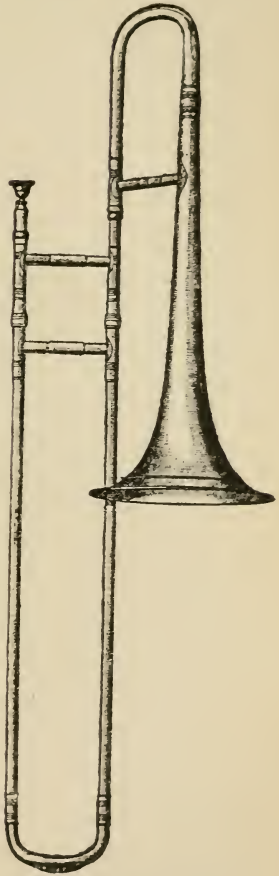
66. In what way do trombones fill up the gaps in the natural scale?

Either by means of valves like horns and trumpets, or more generally at least since the 15th century, by changing the length of the sound-tube (by pulling in and out). In the latter case the stretched and twisted tube of the trombone consists of two parts inserted in one another, to one of which the mouthpiece and bell are joined. The two arms of each part are united by a handle which gives security in drawing the parts further out or in. The sound-tube throughout its greater length is cylindrical, like that of the trumpet, and widens out in

the last third near the bell. As the trombone is on a rather larger scale than the trumpet, its sound is more powerful, fuller, and of majesty that bears no contra-



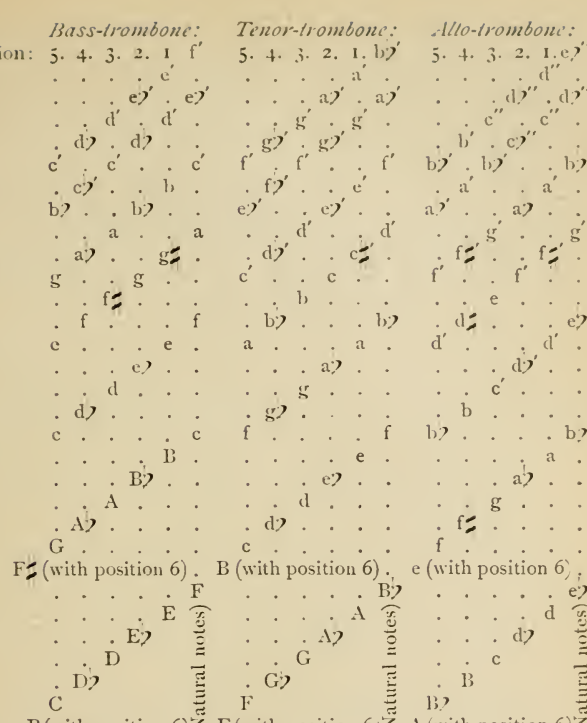
Valve Bass Trombone.



Slide Tenorbass Trombone.

diction. But the trombone shares with all the brass wind instruments hitherto mentioned, the peculiarity, that its lowest natural note speaks with difficulty, and is therefore

scarcely ever used. It can, however, be written exceptionally, only the same power and firmness must not be expected in it as in trombone tones of middle register. Since the 16th century the trombone family has comprised three members: the bass, tenor, and alto trombones; the treble instrument belonging to them, is the English slide-trumpet (mentioned in 65). In Germany the old cornet (Ger. Zinken, It. *cornetto*) served as treble instrument to trombones. But while the slide-trumpet has only three different shifts or positions, genuine trombones have six, i. e. the pieces of the tube can be drawn out six steps further, each step lowering the pitch a semitone. First, let us consider the tenor trombone, which is to-day, near supplanting all the rest. It is in B♭, i. e. its fundamental note is contra B♭, and its upper compass easily reaches the eighth natural note. The notation is not a transposing one, but agrees with the sound. Just as in the valve instruments, every change in the length of the sound-tube, means a shifting of the natural scale; and we therefore get a large number of notes, that could be obtained in various ways, and of equal quality, since the last positions also permit of perfect intonation. As trombones are scarcely ever used as instruments of melody (unless as unisono accompaniment to a chorus) it is not so necessary as in the case of horns, and especially of trumpets, to remember that the melody suited to them must be in the natural scale, or in one of its transpositions. Nevertheless, it is to be recommended that when they appear independently, trombones should also be characterized as natural instruments. The possibility of producing the same note in the various ways exhibited in the following table is of great value practically, as, e. g. the succession g♭′f′e♭′ is easier to play on the tenor trombone with positions 2, 3, 2 than, for instance, with 4th position, back to normal position, and then to 5th position. For the 5th and even the 6th position (the latter only used for notes not otherwise to be obtained), demands a long stretch of the arm (especially in the bass trombone) and a return to the normal position is a violent manipulation, which, often repeated, would become very inconvenient. The joint compass of the three different kinds of trombones is:

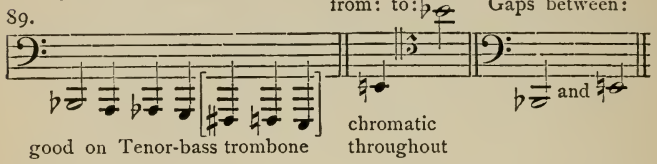


That is to say, the bass-trombone is in F, a fourth lower than the tenor-trombone, and for this reason it was also called, formerly, the fourth-trombone. The alto-trombone is in E♭, a fourth higher than the tenor-trombone. All three reach the eighth natural note easily; but the true fundamental notes, together with the notes to which they are lowered by shifting, are not of much value. If these are given up willingly in the higher trombones, they are less readily dispensed with in the bass-trombone and in the tenor-bass-trombone, nearly always used of late in place of the bass-trombone, and which is a tenor-trombone made on a scale that ensures its first natural note speaking with certainty. In symphony of the present day the tenor-trombone is usually put in threefold, the two higher parts

being then usually noted in the tenor clef, and the lower one in the bass clef. But if need or fancy so dictate, all three may be noted on one staff, either with the tenor, or the bass clef. The alto trombone, now out of date, demands the alto instead of the tenor clef:

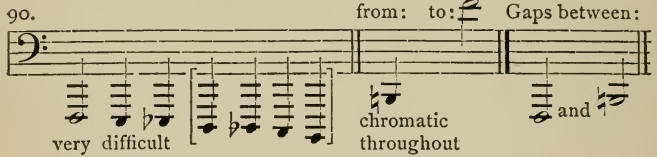
1. Tenor-trombone:

89.



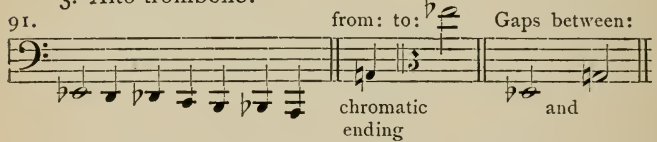
2. Bass-trombone:

90.



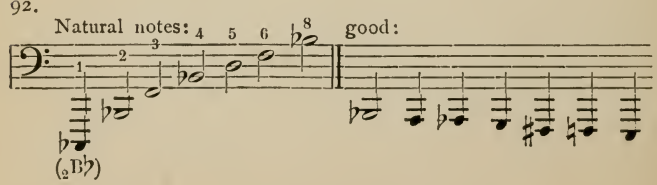
3. Alto-trombone:

91.



It must be noticed that the gaps in the tenor trombone are filled up by the pedal notes of the alto trombone. A bass-trombone in E♭, a tone lower and less used than the fourth-trombone, may be simply registered here by name. Its compass downwards is naturally a tone lower. Of quite recent origin (first demanded by Wagner in the Nibelungen) is the contrabass-trombone, which is an octave lower than the tenor one; its compass is:

92.

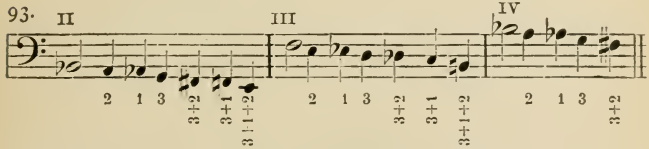


Wotan's spear motive goes down to this contra E. The bass-trombone could with the 1st position, produce this same $_1$E as its first natural note, and the tenor-bass-trombone even, could with the sixth position produce it, also as its first natural note; but it is a known fact, that in all wind instruments, the sound of overblown notes is richer, more voluminous, and at the same time firmer than that resulting from single vibrations.

As far as valve trombones are concerned, they enjoy, in comparison with slide trombones, but little favour, for the reason, doubtless, that with a combination of two valves, there result the same imperfect intonations (too sharp) as in the case of horns and trumpets; and these obtain still greater importance as the trombones are much used exactly in the octave, where they cannot play without the combination of several valves, while horns and trumpets prefer to use the positions where they only need one valve at a time (cf. Ex. 76):

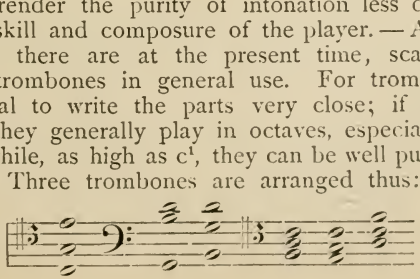
Valve-tenor-trombone:

93.



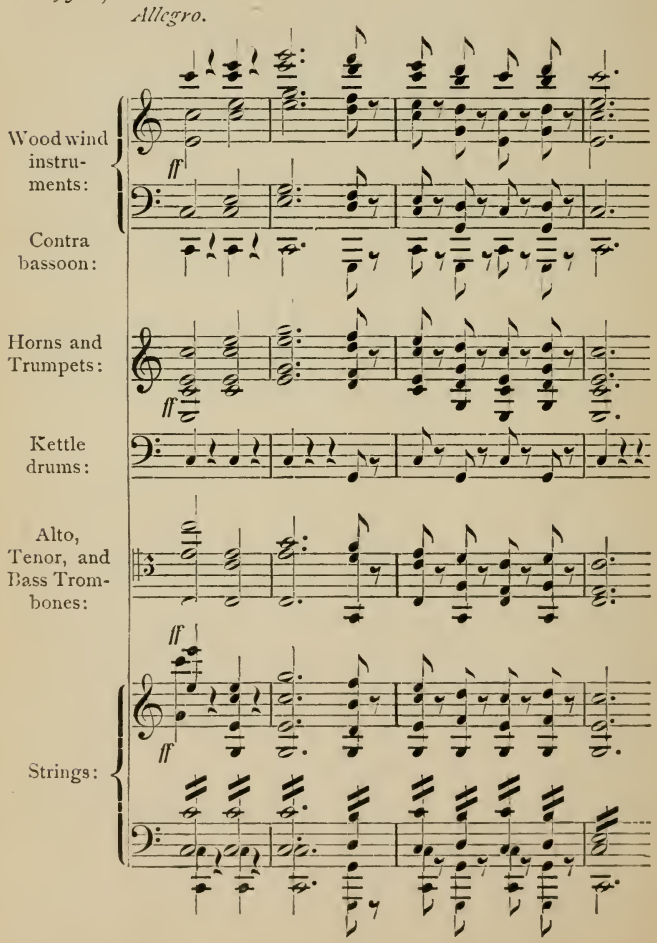
A. Sax has, to be sure, extended his admirable system of shortening valves to trombones, and makes these as alto, tenor, bass, and contrabass-trombones, of the pitch above indicated, and each with six valves, which completely obviate the shifting of position (but by shortening instead of lengthening, so that the lowest notes are produced without valve), and are so far preferable to them that they render the purity of intonation less dependent upon the skill and composure of the player. — As already mentioned, there are at the present time, scarcely any but tenor-trombones in general use. For trombones, it is not usual to write the parts very close; if two only are used, they generally play in octaves, especially in low position, while, as high as c^1, they can be well put together in thirds. Three trombones are arranged thus:

94.

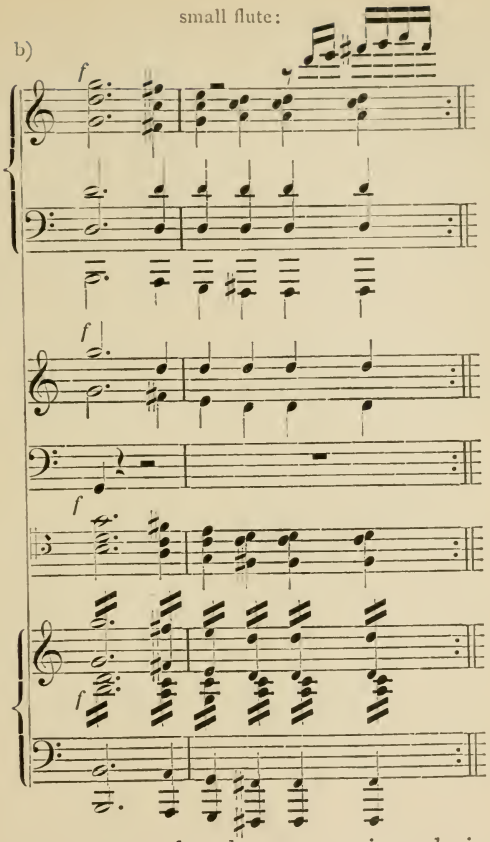


The classical composers only occasionally introduce trombones in symphony; Beethoven, for instance, in the last movement of his C minor Symphony, where they play a principal part in rendering both the subjects:

95. a)



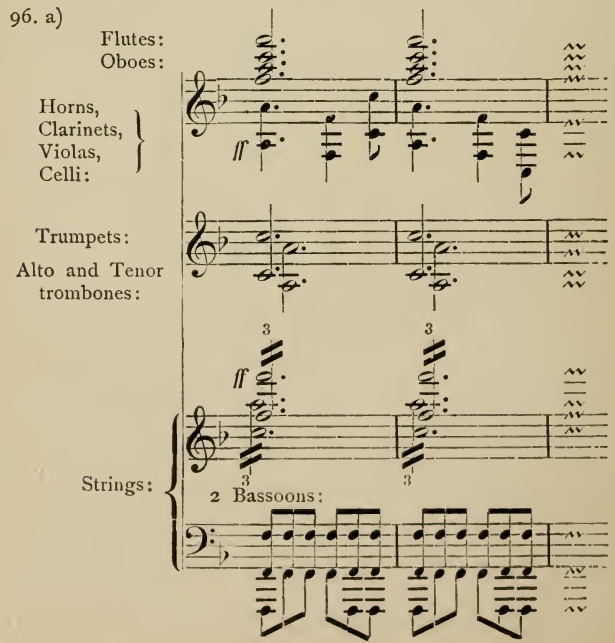
and:



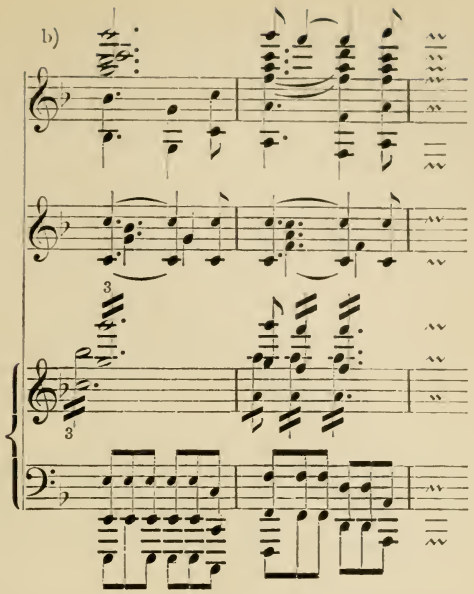
As trombones are heard very conspicuously in *forte*, care must be taken, not to give them a long succession of chords, unless these are thematic; so also in the contrary case, if the trombones accompany a *sostenuto* melody with only short notes, the effect is very unpleasant. The two chief peculiarities of the instrument must always be kept in mind: first its solemnity, which seems to transform it into a male voice of potent fulness, into a natural representative of a choral voice; and next its all penetrating force and acuteness, on account of which the rôle

is assigned to it of emphasizing and fortifying the accent. There are plenty of scores in which the trombones have nothing further to do than to strengthen the harmony considerably in *fortissimo*. In the Pastoral Symphony, where the modest means of two trumpets, two horns, kettle-drums, and two trombones, besides of course, the wood wind instruments (with piccolo) and strings, suffice him for the storm, Beethoven places the trombones almost throughout in octaves, or adds the trumpets to fill in the harmony (v. Ex. 96); he also introduces them with grand effect in the ninth Symphony (in the Scherzo, and in the Finale, to support the voices). Still more frequently, the trombone has at all times been used in accompanied vocal composition, particularly in opera as representative of the sublime, or of inexorable fate, etc. In church music, besides supporting the voices, the trombones are also called to represent the 'trumpet' of the Day of Judgment.

96. a)



and:

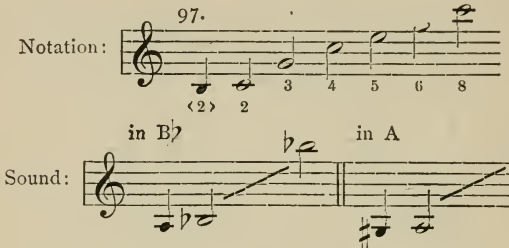


67. *Has not an attempt been made to apply the method by which wood wind intruments obtain a complete scale, to brass instruments also?*

The key-bugle (called also Kent-bugle or key trumpet) which was in vogue at the beginning of the present century and enjoyed great favour till 1830 (when valve instruments satisfying all demands, were introduced), was an instrument of this kind, in as far as the process of opening the sound-holes, closed by the keys, shortened the sound-tube (as in the flute, oboe, etc.). The sound-tube of the key-bugle, like that of the bugle from which it was developed and that also of its present descendants—bugles, sax-horns and tubas (cf. 69), is conical, and widens out indeed from the beginning, much more rapidly than does that of the horn. The tone of all instruments of this kind, is neither mellow, nor does it possess either the power of the trombone nor the crashing "blast" of the trumpet, nor yet the longing suppressed tone of the horn. The key-bugle proper was an instrument of the compass of the small B♭ trumpet and

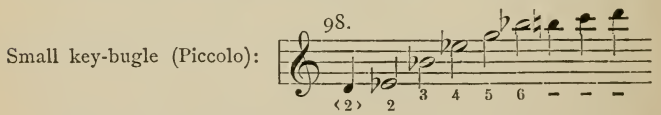
noted similarly, that is, in cornet notation. By inserting a crook in the B♭ key-bugle, another in A could be made. Five keys opened the sound-holes, and so shortened the sound-tube; a sixth closed the last, generally open, near the bell. The compass (with the intermediate chromatic notes), was therefore:

97.



The manipulation of the instrument was easy, but the intonation was partly very bad. Besides this key-bugle proper another was made, the small key-bugle or *piccolo* which was a fourth higher in E♭, and had easier command of the upper notes, though not really of higher compass:

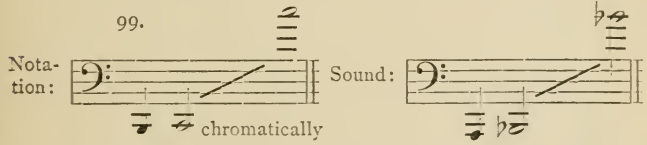
98.



While both key-bugle and piccolo found place in wind bands only, not being accepted at all for symphony and only exceptionally under special protection (Meyerbeer) in opera, the so-called Ophicleide (a bass bugle) obtained for a time greater consideration. Indeed the fact, that the bugle is of rather large dimensions, and broadens considerably from mouthpiece to bell (not suddenly, near the bell like the horn and trumpet (favours the more ready answering of the lowest actual note of the instrument—the fundamental note which all brass instruments hitherto considered are compelled almost entirely to forego. Recognizing this, instrument makers constructed bass instruments of the same kind, but with keys enough for the gaps between the first and second natural notes to be filled in chromatically. The want of good bass brass instruments would thus have been obviated, had the

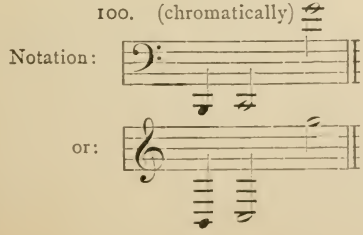
intonation of the ophicleide not been in part more doubtful than that of the bugle; in any case it must be observed that the various types of instruments were now found, from which modern bass and contrabass brass instruments were to be developed, the key mechanism having given place to that of the valves. The instrument which was an octave lower than the bugle, was called the bass ophicleide, or simply the ophicleide. Like the bugle it was in B♭, and was generally similar to it in construction; it also had a key mostly open, but which when shut gave the instrument the semitone below its fundamental tone; it had, however, ten raising-keys instead of five. Being treated as a bass instrument it was always noted in the bass clef. Its entire compass was:

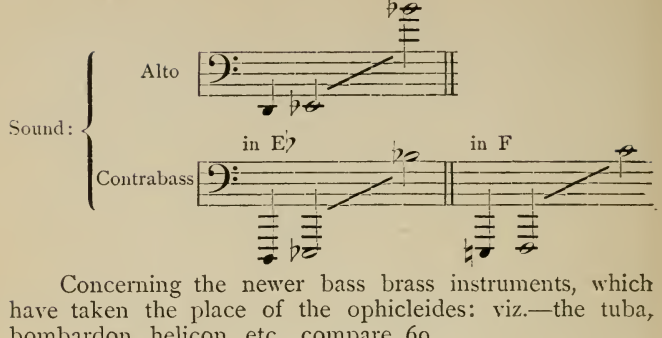
99.



Until the invention of the bass tuba (i. e. until the introduction of valve mechanism for instruments in this category also), this was the chief bass instrument of the wind band. It is distinguished from the bassoon by the timbre peculiar to brass instruments, and from the trombone by the absence of gaps between the lowest notes of the scale. For symphony orchestra an ophicleide in C was used (e. g. in Mendelssohn's Midsummer Night's Dream), or at least the composer imagined such a one, and did not transpose. The alto ophicleide in E♭, and the contrabass in E♭, or in F, were but little used; their compass was:

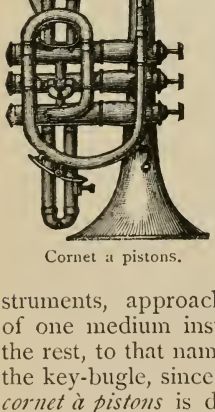
100. (chromatically)





Concerning the newer bass brass instruments, which have taken the place of the ophicleides: viz.—the tuba, bombardon, helicon, etc., compare 69.

68. To which type of instruments does the cornet à pistons belong?


Cornet a pistons.

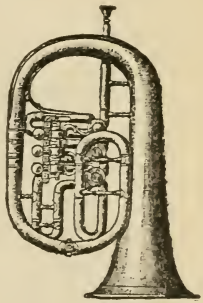
Judging from the form of its sound-tube it belongs to the type of the French horn, and its bell should therefore properly be a copy of that of the natural horn. If the posthorn be regarded as the natural instrument from which the *cornet à pistons* was developed, it is to be regretted that manufacturers so far alter the distinctive features of the instrument, that not one of them in reality remains (the bell, as in the bugle, entirely wanting, its bore also being copied from that of the bugle, and widening from the beginning). The construction of the different types of high brass wind instruments, approaches in fact nearer and nearer to that of one medium instrument which threatens to supersede all the rest, to that namely, which has derived its existence from the key-bugle, since the introduction of valves (v. 69). The *cornet à pistons* is distinguished from the *Flügelhorn* in B♭, chiefly by the shape of the mouthpiece, which resembles that of the trumpet; and as the small B♭ trumpet is now gradually widening its bore, the cornet only differs from it in the form of the bell. The *cornet à pistons* is the oldest valve instrument; and, if its toyish sound has no great artistic value, yet in its philistine jollity are cha-

racteristics which, compared with the coarse, screaming tones of the high bugle, possess enduring worth. The compass and *technique* of the *cornet à pistons* are the same as in the small B♭ trumpet. Besides the key of B♭, the cornet, by means of a crook, can also take that of A. The *cornet à pistons* is the favourite melody instrument for wind band, as its tone, in consequence of its trumpet-like mouthpiece, is more brilliant than that of the high bugle. For symphony, however, neither is of use. And we would here give further warning not to allow the bugle, or cornet, to take possession of the highest part for brass instruments, under the mask of the little B♭ trumpet.

69. What valve instruments belong to the family of the bugle?

All the instruments which the French call saxhorns. There are two groups to distinguish: namely,

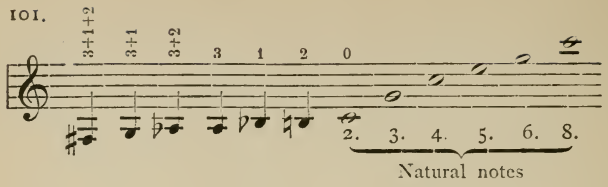
a) those which do not use the first natural note (the bugle proper),
b) those which use the first natural note (tubas).

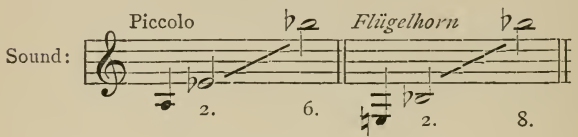


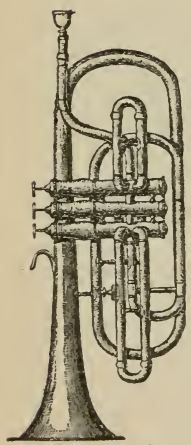
Flügelhorn in B♭.

Of the first class, no instrument has been adopted in the orchestra for symphony. With the second class it is otherwise, as it supplies a remedy for the frequently mentioned defect in good bass brass instruments. Remembering that the high valve bugles are only used in wind bands, it is natural they should be in E♭, and B♭, the keys that the latter have long preferred. As, formerly, besides concert pitch, distinction was likewise made between choir-pitch a tone higher, and *cornetto*-pitch a tone and a half higher, this preference of brass instrumental music for the key of E♭, seems to extend back to the times even of the old cornet players (Zinkenisten). The now generally used immediate descendants of the key-bugle are: the *piccolo* in E♭ and the bugle in B♭; which do not differ materially in their upper compass. Like the valve horn, valve trumpet, and valve *cornetto*, they have three valves, and like all these forbear using the first natural note; they have therefore the following compass (the notation is what is called the cornet notation, cf. 65):

101.

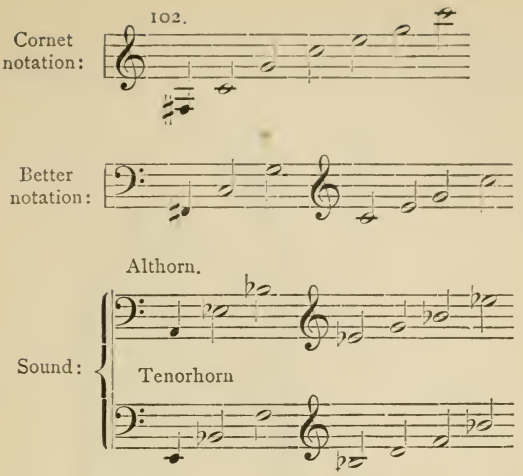






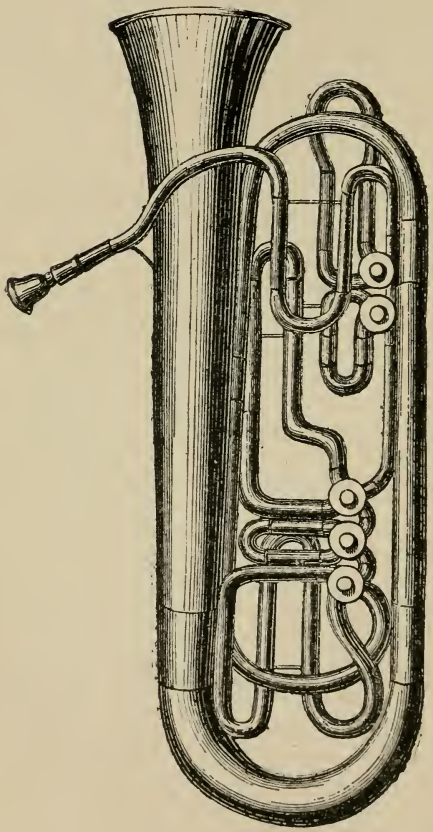
Althorn in E♭.

All the instruments of this family render melody with facility; but it is of course given by preference to these two in the highest keys. As in music of wind instruments, not to speak of that of brass instruments only, the question cannot arise of making the special characteristics of brass instruments appear, according to the several properties of each instrument, there is great value in the ease with which these instruments execute even chromatic passages, embellishments, shakes, etc. Middle parts are given in preference to the *althorn* in E♭, and the tenorhorn in B♭ (also called bass bugle), the tones of which lie an entire octave lower than that of the two mentioned previously. It is customary to write these also in the cornet notation, indeed even the bass and contrabass instruments which will be described presently usually play from the cornet notation. But this is a serious evil for any one trying to read the score; it wants clearness, and is therefore not to be praised. These two instruments of middle register should rather be noted an octave lower, and the bass and violin clefs interchanged according to need. Both systems of notation may be given here together. The compass is as follows:



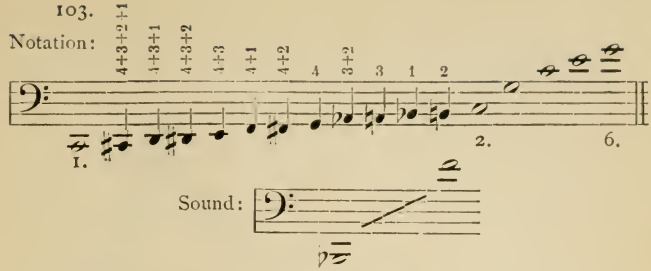
For the reader of the score, it would of course be more convenient were every tone noted according to sound; but the player of a brass instrument, having generally had but a defective musical education, wishes the notation of brass instruments so arranged that he may not require any extra knowledge, if, for instance, instead of the bugle in B♭, he has to play the tenorhorn. The method of fingering must be the same, that is, the notation must indicate the fingering. But since the notation in the bass clef is still rather general for bass instruments of the family, and is as simple for tuba and bombardon as the cornet notation, it might, more suitably to the purpose at least, be settled, that as soon as the bass clef is used, the lower position of the natural scale is meant. The group of deep bugles could be divided again into bass and contrabass instruments. Contrary to the custom with other contrabass instruments (contrabass and contrabassoon) those in the lowest keys are noted the same as those pitched an octave higher; but thence arises the inconvenience of notes with many ledger lines. Instead of this, those instruments which are distinguished by the name of contrabass instruments, should be noted an octave higher than they sound. The first bass instrument that we meet with

is the *baryton horn*, or *euphonium* in B♭, also called the *tenor-bass*, or *bass tuba* in B♭. This is on a scale identical with that of the tenor-horn, and only distinguished

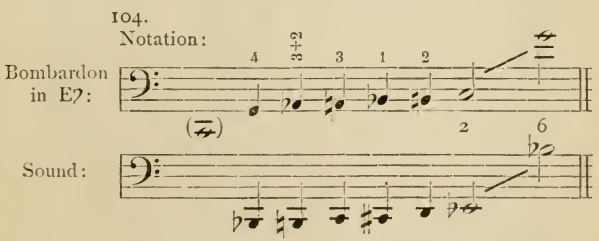


Contrabass Tuba with 5 valves.

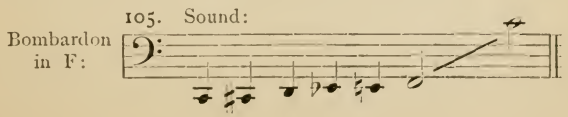
from it by the addition of a fourth valve which carries the chromatic scale downward, to the first natural note. The compass is, therefore:



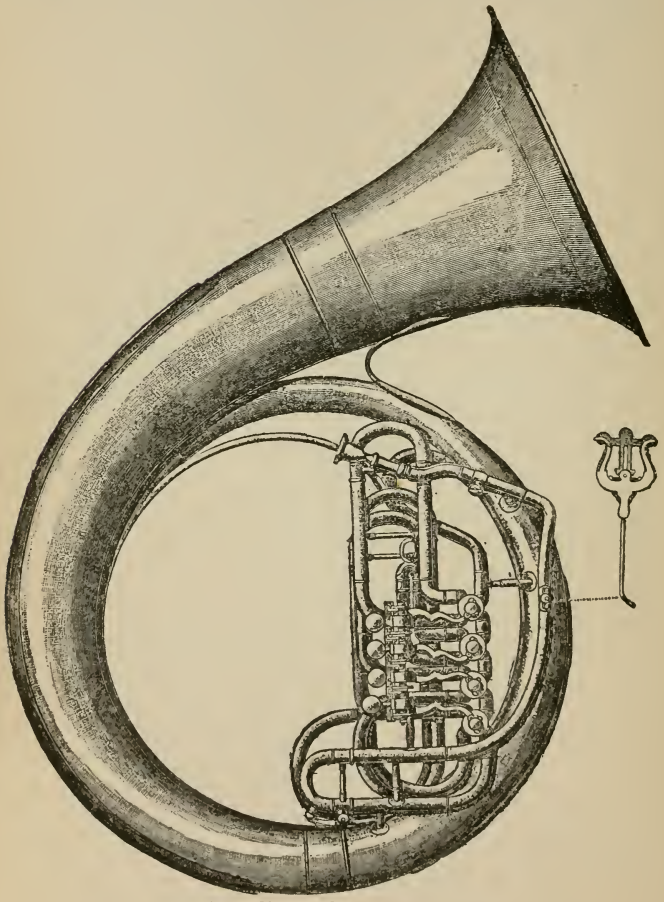
Below the first natural note, two degrees of a semitone each, of inferior quality of tone, may be obtained by aid of the valve. That, with a multiplication of valves, the intonation must be out of tune (too high), we have had several times occasion to remark. The Sax system of the shortening valve, which would require 11 valves (just as the ophicleide required 11 keys), has not yet been applied to bass instruments. If composers write for the bass tuba in symphony or opera, they are accustomed to write the notes as they sound, consequently, as for an instrument in C, though the instrument is never made in that key. With the *bombardon in E♭*, we have at once greater richness in the low notes; and although scarcely able to reach its fundamental, it gives down to contra B♭, firm, solid tones:



This instrument, besides being in E♭, is also made in F, and forms a very respectable foundation for the trombones in the orchestra:



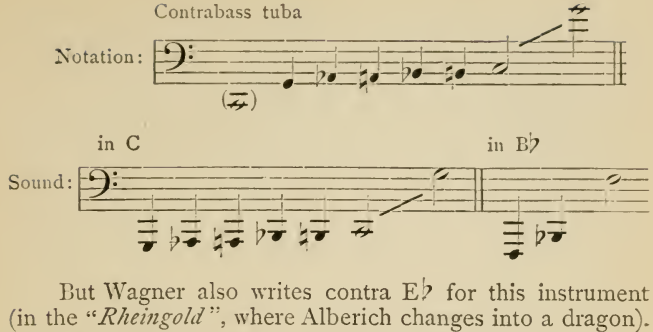
In the *contrabass tubas* in B♭ and C, we meet at length, the most formidable instrumental voices; the first is used in military music, and the latter has been intro-



Helicon (Circular Contrabass Tuba).

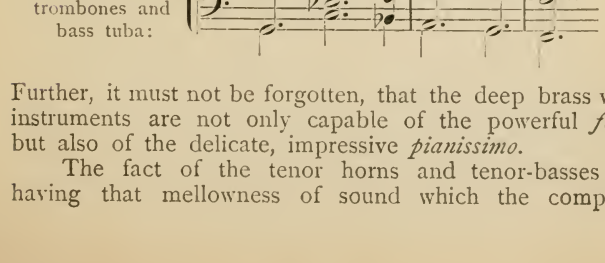
duced by Wagner into opera. Wagner writes for the instrument according to the sound; it would be well, however, to recommend writing it an octave higher, thus:

106.
Contrabass tuba



But Wagner also writes contra E♭ for this instrument (in the "*Rheingold*", where Alberich changes into a dragon). However excellent the effect of these powerful tones is, when they appear as the foundation of the harmony, as in military music where they represent the string double-basses, they should be introduced with caution in symphony and opera. And this applies not only to the contra-bass tubas and bombardons, but even to the bass tuba, the tones of which have the explosive—I might say the dull, heavy sound of dead weight, peculiar to all instruments of this family. Instruments of this kind should consequently never be introduced, save in company with relatives of rather higher compass that would alter the tone-colour, e. g. as the foundation of a powerful harmony of trombones and trumpets (or of trombones only), as Wagner often introduces them:

107.

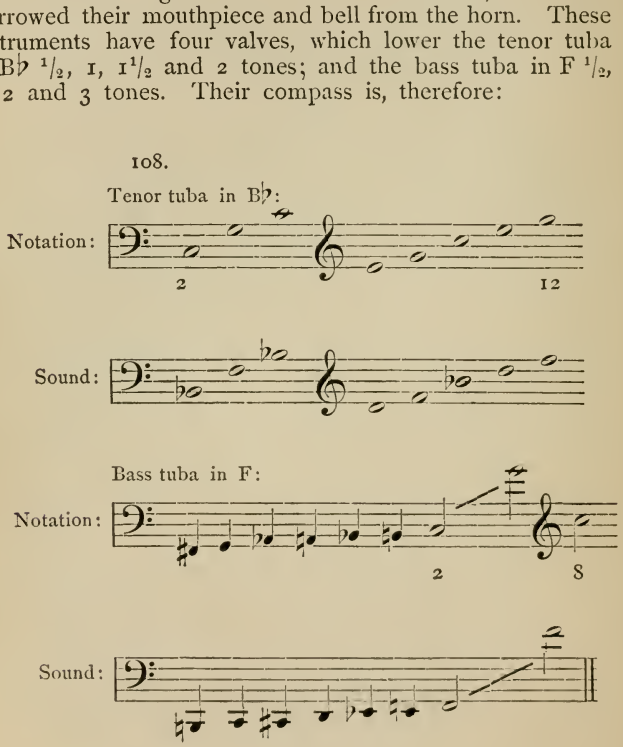


Further, it must not be forgotten, that the deep brass wind instruments are not only capable of the powerful *forte*, but also of the delicate, impressive *pianissimo*.

The fact of the tenor horns and tenor-basses not having that mellowness of sound which the composer

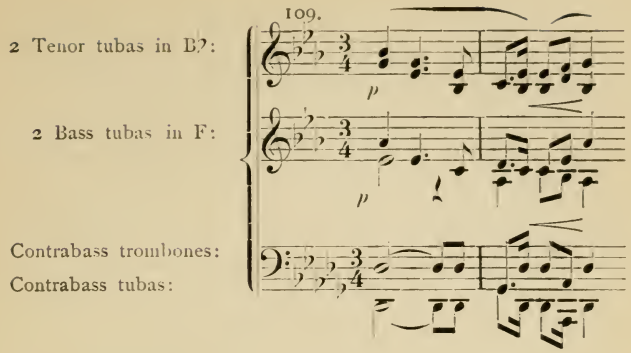
deemed necessary for the expression of his sublime ideas, led Wagner to have instruments constructed for his *Nibelungen Tetralogie* that would combine the readily responsive sound of the bass bugle with the mellowness of the horn. These are the instruments known as the tenor tubas in B♭ and the bass tubas in F, which are most like the bugle in the size of the bore, but have borrowed their mouthpiece and bell from the horn. These instruments have four valves, which lower the tenor tuba in B♭ 1/2, 1, 1 1/2 and 2 tones; and the bass tuba in F 1/2, 1, 2 and 3 tones. Their compass is, therefore:

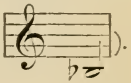
108.



It is to these instruments (partly, however, for the more easy reading of the score, written for the tenor tuba in E♭, and the bass tuba in F, i. e. as for althorn and tenorhorn), that Wagner entrusts the solemn sounds of the Walhalla motive:

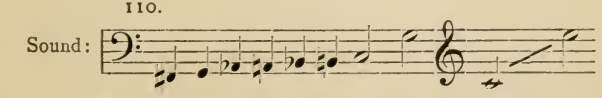
109.



Similar to Wagner's tubas with horn-shaped bells, are the *saxotrombas* invented by A. Sax, partaking of the character both of the horn and bugle-horn. Sax makes them of seven sizes, corresponding with the six sizes of the bugle-horn, from the *piccolo* to the contrabass tuba in B♭, and in addition to these as the smallest instrument one in high B♭. (The 1st natural note = ).

Not one of these instruments uses the first natural note. For the sake of completeness, we must still mention Wagner's bass-trumpet, which is merely a low valve trumpet (in C), and has therefore, a range of notes denied to the valve trumpet in F, and to the high one in B♭. It has a large bore, and owing to this can descend chromatically three tones below the second natural note:

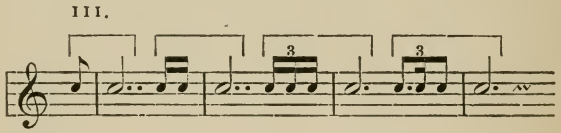
110.



(Written an octave higher, in the treble clef.)

Wagner calls for this instrument sometimes in E♭, and in D, and again in C. For further information, vide Fr. A. Gevaert's "Neue Instrumentenlehre" (German edition by H. Riemann, p. 300).

To close the chapter, it may be pointed out that wind instruments make demands on the breath, and cannot therefore do without rests, nor continue long *holding notes* at pleasure like the stringed instruments. It must not be forgotten either that the continuous prolonging of harmonies causes monotony, stiffness and great heaviness; art then lies, on the one hand in allowing well-timed rests for the players, which is easily done by letting them play alternately, and on the other, in giving their parts rhythmical life. Quick passages are to be demanded only from the wood wind instruments; they are suited to brass instruments, only within the natural scale (Fanfare). For all brass instruments, however, the sharp rhythmical repetition of a note is easy; therefore, let motives like the following be well impressed upon the mind:



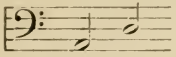
CHAPTER V.

INSTRUMENTS OF PERCUSSION.

70. What instruments of percussion take the foremost place in the orchestra?

The kettle-drums, which belong to the category of instruments furnished with stretched membrane. They are distinguished from the drums, not only by the fact that their skins can be more or less stretched, and the sound thus rendered clearer or duller, but by the possibility of their being tuned to the exact pitch desired by the com-

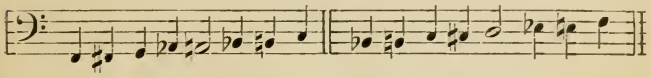
poser. At least two kettle-drums, one of which is considerably larger than the other, are as a rule employed side by side, and both are entrusted to the same player. The original tuning of these two kettle-drums is in:

112. 

in harmony with the original key of the trumpets (also of the horns), of which they form the natural bass; but both drums can be tuned either a minor third higher, or a major third lower, so that the composer is free to choose any note out of the following two series:

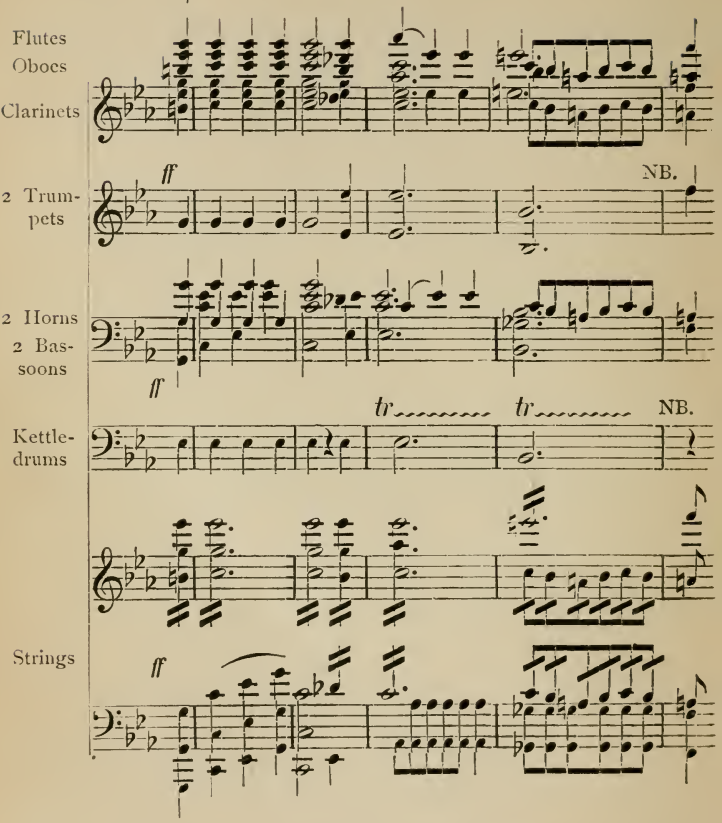
113.

Big kettle-drum: Small kettle-drum:



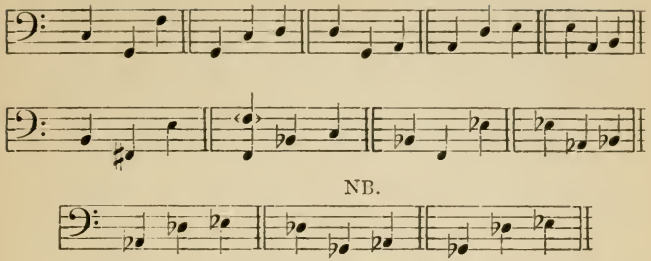
For the kettle-drum, the tonic and dominant of the governing key are generally chosen as the most essential notes; but this is not compulsory. The kettle-drums come in mostly only in *forte tutti;* it will naturally depend therefore on the order of modulation in the piece, which notes may be required for the kettle-drum first. In general the drums would only be introduced where the bass remains for a time stationary; for as the drums cannot be tuned to other notes without rests, even though short ones, being allowed, one is otherwise compelled either to give the drums notes which do not agree with the other bass notes, or else to leave them out altogether. The first, to be sure, often happens, even with the classical composers. Beethoven, in the first movement of the "Eroica" has the kettle-drums tuned throughout in $\frac{e♭}{B♭}$; upon the first entrance of the drums he at once employs the e♭ as the tonic of the chord of E♭ major, then as the third of the chord of C minor, and as fifth of the chord of A♭ major; B♭ he employs as the seventh in c e g♭ b♭; and the F at the close of the passage he leaves out, as he has not got it on the drums.

114.



To do away with this evil, three kettle-drums are now often used, which helps composers over a good many difficulties. Abnormalities such as the eight pairs of kettle-drums in Berlioz' Requiem, are, of course, not to be taken into account; but three kettle-drums may now be required of every orchestra. The third kettle-drum is as a rule of medium size, i. e. it can be tuned from A to d. Thus it is now easy to have the tonic, dominant and subdominant of every key.

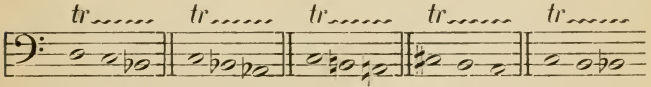
115.



Only, for D♭ major, the middle drum would have to be tuned down to a♭.

Peculiar tunings of the kettle-drums are not rare (in the octave $\frac{f}{F}$ in Beethoven's 8th and 9th symphonies, in $\frac{f}{A}$ in the 7th symphony, in $\frac{e\flat}{A}$ in the prison scene in *Fidelio* &c.). With three drums, it would be possible to allow a sort of pedal-note roll of the drums to descend two steps:

116.



which as climax of the development would be very effective.

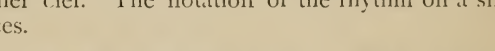
The kettle-drum is played by means of two sticks, which have their knobs either bare or covered in leather, felt, or sponge. The bare drum-stick gives the hardest tone, and the sponge-covered one the softest; but sticks well padded in leather serve for everything. The embellishments in drum-playing are either short strokes or (particularly in *pianissimo*) resounding strokes, of every kind, and whirls of strokes running into one another so as to form one continuous roll (indicated by Tremolo, or the shake).

117.

Nothing is easier than to create confusion with the drum when it is used to excess. Although the drum gives a troubled sound *in pianissimo* and *in fortissimo* is overwhelming, there is nothing so wearisome and disagreeable, or so directly destructive to musical feeling as the excessive use of the drum. In the art of using the kettle-drum, no one has yet surpassed Beethoven; let the student study his way of using it, and make it his own with the additional convenience of a third kettle-drum.

71. What are the other kinds of drums (Trommeln)?

The large (Turkish) bass-drum, the tenor-drum (Rolltrommel), the side-drum (Militärtrommel), and the Basque-drum (pandero, tambourin). The bass-drum (*gran cassa*), belongs to Turkish-music with cymbals and triangles, and is only used for the accentuation of single rhythmical strokes (cf. Ex. 59). The tenor-drum used for rolls (tamburo rullante) has likewise no snares (strings of catgut) and therefore sounds dull and gloomy (though much higher than the big drum). The side-drum sounds clear and sharp. Moreover, we are so accustomed to connect it with military representations, that it could be used with success, only in a procession on the stage. To muffle the sound of this drum, cloth is wound round the snares, or these are loosened (e. g. in a funeral march). The Basque drum (tambourin) is a favourite instrument for accompanying South European or Oriental dances, and is held in the hand of the dancer. It is a small flat drum with jingles (small pieces of metal) inserted in the frame. It is either struck with the back of the hand or shaken so that it jingles, or the vellum is stroked with the finger, whereby a soft jingling and tremolo is produced. It is purposeless writing for any of the drums on the full staff of five lines, whether with this or the other clef. The notation of the rhythm on a single line suffices.

118. 

72. What other percussion instruments, used in the orchestra, give notes of fixed pitch?

Only the *Glockenspiel* and the xylophone. The *Glockenspiel*, at present in use, has a compass from $e\flat^2$ to $a\flat^3$, and is noted an octave lower than it sounds. A better

known instrument, however, and one of very similar effect, is the *Stahlspiel*, also called lyra from the shape of the frame to which the steel bars tuned for playing, are attached. The *Stahlspiel* has a compass from $b\flat^2$ to c^5, but its notation is two octaves lower. These instruments are both played by means of a plectrum. They have but small artistic merit, yet their introduction often gives great pleasure to the multitude. The sound of the *Glockenspiel*, as also that of the lyra has rather a tiring effect; for this reason these instruments are ordinarily used merely for accenting prominent notes of the melody, and not for playing the melodies themselves. The xylophone, in German named also *straw fiddle* (Strohfidel) and *woodharmonika*, an old instrument which has been known in the Tyrol for centuries, is very similar to the lyra (Stahlspiel); but instead of steel bars it has bars of wood, and its sound rattles rather than rings. Its compass is from c' to c^4. Saint-Saëns uses it in his *Death Dance* (Danse Macabre) to represent the rattling of the bones of the dancing skeletons.

73. What percussion instruments consist of bars and plates having no fixed pitch?

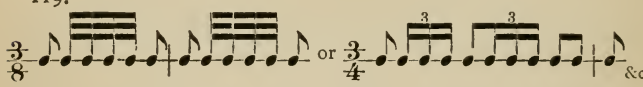
The triangle, cymbals, and gong. The triangle is a steel bar bent into triangular shape; it is held by a strap, and struck with another short bar, when it gives out a high, clear, clinking sound. Either settled rhythms are marked by it, or the metal bar is made to strike rapidly backwards and forwards in one corner, an embellishment which is indicated by  or *tr....* The cymbals are plates of metal moulded in the middle into basin-like form; and through these hollow parts are drawn straps by which the cymbals are held, so that they can strike each other with the force desired, or jingle their edges together. In brass instrumental music, and orchestras of inferior class, one cymbal is generally fastened to the big drum, so that the same man who plays the drum with his right hand, can also with the left hand, strike the fastened cymbal with the other. For musical works of higher aim, this is not admissible; the cymbals must be taken into the hands, if they are to be used to effect. A sharp, short *forte*-stroke excites a feeling of terror. The continuance of the sound is prevented by pressing

the cymbals to the breast; otherwise they would vibrate a long time. But it is the gong, more than the cymbals, that makes the blood curdle, and the hair stand on end, with its immense-spreading, abodeless sound, that in *pianissimo* as well as in *fortissimo*, is truly supernatural. The gong resembles the cymbals in form, and is made of metal-plate, a mixture of various refined metals (Chinese manufacture); it is struck with a stick covered with cork or felt.

74. What finally, is to be observed concerning castanets?

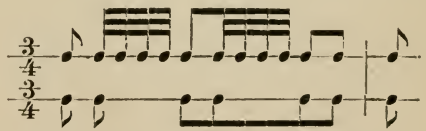
In regard to sound they are the most insignificant of all percussion instruments. They consist of two pieces of wood, in form like half the shell of a chestnut, tied together in pairs; one half is fastened to the hand, and the other, which is held with the fingers, is brought rapidly in contact with it, thereby producing rhythms such as:

119.



The dancers of Spain and south Italy, who accompany their song with the castanet, generally use a pair in each hand, a pair of higher sound to render the more complicated rhythms (in the right hand), and a larger pair of deeper sound, to mark the principal beats (in the left hand) e. g.

120.



The bolero, seguidilla, fandango and jota aragonese are dances which are accompanied with castanets in this way; during the song, that alternates with the dance, the castanets are silent.

75. How is a full score generally arranged?

The wood wind instruments are usually written uppermost, their order of arrangement, from the top downwards, being according to their compass in regard to the low notes, thus: small flutes, large flutes, oboes (possibly, cor anglais), clarinets (possibly, bass clarinet), bassoon (possibly,

contrabassoon). To these instruments one bracket is given in common, that they may be read more easily together. The brass wind instruments with the percussion instruments, then form a second (middle) group. Next to the bassoons and first among the brass come the horns then the trumpets, then the trombones, and possibly the bass tuba; below these the kettle-drums, and any other instruments of percussion used. These instruments are likewise connected by a common bracket. Last of all are placed the stringed instruments, in the following order: first violins, second violins, violas, celli and double-basses. The harp is placed between the brass and stringed instruments, on a special double-staff; the piano similarly, but the organ on the contrary, below the double-basses. Vocal parts are placed either above the violins, or between the violins and violas; the former is preferable where several staves, e. g. choruses and solos, have to find room; otherwise difficulty arises in reading the parts of the strings from their being placed so far apart. Some prefer placing the brass and percussion instruments, or at least the latter, above the wood wind, which is so far advantageous that the strings and wood wind instruments (which always have most to do) are thereby brought nearer together, and are therefore more easily read conjunctively. The most important point of view in the arrangement of a full score is and must be—facility in reading.

76. What exercises are to be recommended as an introduction to instrumentation?

First of all, the repeated study of the full scores of good masters, not beginning with Wagner, but ending with him, i. e. going on from simple to complicated—from the symphonies of Haydn to those of Mozart and Beethoven, with the gradual introduction of vocal scores, as e. g. Haydn's Creation and Seasons, Mendelssohn's St. Paul and Elijah, then operatic scores by Gluck, Mozart, Beethoven, Weber, etc. Of course

Playing from Full Score

either alone, or at 2 pianos (one performer playing the string parts, the other the wind) is very important, also

attempts to reconstruct fragments of works previously heard, from the pianoforte arrangements,

are very helpful as well as instructive. Care must be taken in arranging pianoforte scores for the orchestra;

such work could only be profitable to beginners when the piece selected is really conceived for the orchestra. For this reason, re-instrumentation from pianoforte arrangements, is always to be preferred. In working out an original orchestral composition, a sketch should first be made, allowing sufficient space (at least 4—6 five-line staves) to introduce additions (Ergänzungen) and alterations, and also for defining the instrumentation presented to the mind during the writing down of the sketch. He who wishes to write for the orchestra must have, not abstract musical thoughts, but thoughts directed straight to the instrument, thoughts, indeed, that come from the instrument; then only, will life and colour be imparted to the instrumentation.

Detailed information respecting instrumentation, with extended examples of orchestration, may be found in Hector Berlioz' "Large Guide to Instrumentation"; also in the "New Guide to Instrumentation", by Fr. A. Gevaert (German, by H. Riemann: II vol. "Practical Guide to Instrumentation", in preparation); and in IV vol. of the "Guide to Composition", by Ad. B. Marx (5th ed., edited by H. Riemann).

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