Chapter I.

GENERAL REVIEW OF ORCHESTRAL GROUPS.

A. Stringed Instruments.

The following is the formation of the string quartet and the number of players required in present day orchestras, either in the theatre or concert-room.

	Full orchestra	Medium orchestra	Small orchestra
Violins I	16	12	8
„ II	14	10	6
Violas	12	8	4
Violoncellos . . .	10	6	3
Double basses . .	8—10	4—6	2—3

In larger orchestras, the number of first violins may amount to 20 and even 24, the other strings being increased proportionately. But such a great quantity of strings over-powers the customary wood-wind section, and entails re-inforcing the latter. Sometimes orchestras contain less than 8 first violins; this is a mistake, as the balance between strings and wind is completely destroyed. In writing for the orchestra it is advisable to rely on a medium-sized body of strings. Played by a larger orchestra a work will be heard to greater advantage; played by a smaller one, the harm done will be minimised.

Whenever a group of strings is written for more than five parts—without taking double notes or chords into consideration—these parts may be increased by dividing each one into two, three and four sections, or even more *(divisi)*. Generally, one or more of the principal parts is split up, the first or second violins, violas or violoncellos. The players are then divided by desks, numbers 1, 3, 5 etc. playing the upper part, and 2, 4, 6 etc., the lower; or else the musician on the right-hand of each desk plays the top line, the one on the left the bottom line. Dividing by threes is less easy, as the number of players in one group is not always divisible by three, and hence the difficulty of obtaining proper balance. Nevertheless there are cases where the composer should not hesitate to employ this method of dividing the strings, leaving it to the conductor to ensure equality of tone. It is always as well to mark how the passage is to be divided in the score; Vn^{s} I, 1, 2, 3 desks, 6 'Cellos div. à 3, and so on. Division into four and more parts is rare, but may be used in *piano* passages, as it greatly reduces volume of tone in the group of strings.

Note. In small orchestras passages sub-divided into many parts are very hard to realise, and the effect obtained is never the one required.

String parts may be divided thus:

a { Vn^{s} I div. / Vn^{s} II div. } *b* { Vn^{s} II div. / Violas div. } *c* { Violas div. / 'Cellos div. } *d* { 'Cellos div. / D. basses div. }

Possible combinations less frequently used are:

e { Vn^{s} I div. / Violas div. } *f* { Vn^{s} II div. / 'Cellos div. } *g* { Violas div. / D. basses div. } etc.

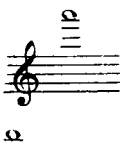
Note. It is evident that the tone quality in *b* and *e* will be similar. Still *b* is preferable since the number of Vn^{s} II (14 — 10 — 6) and Violas (12 — 8 — 4) is practically the same, the respective rôles of the two groups are more closely allied, and from the fact that second violins generally sit nearer to the violas than the first, thereby guaranteeing greater unity in power and execution.

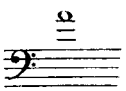
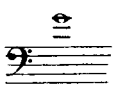
The reader will find all manner of divisions in the musical examples given in Vol. II. Where necessary, some explanation as to the method of dividing strings will follow in due course. I dwell on the subject here in order to show how the usual composition of the string quartet may be altered.

Stringed instruments possess more ways of producing sound than any other orchestral group. They can pass, better than other instruments from one shade of expression to another, the varieties being of an infinite number. Species of bowing such as *legato*, detached, *staccato*, *spiccato*, *portamento*, *martellato*, light *staccato*, *saltando*, attack at the nut and at the point, ⊓ ⊓ ⊓ and ⋁ ⋁ ⋁ (down bow and up bow), in every degree of tone, *fortissimo*, *pianissimo*, *crescendo*, *diminuendo*, *sforzando*, *morendo*—all this belongs to the natural realm of the string quartet.

The fact that these instruments are capable of playing double notes and full chords across three and four strings—to say nothing of sub-division of parts—renders them not only melodic but also harmonic in character (1).

From the point of view of activity and flexibility the violin takes pride of place among stringed instruments, then, in order, come the viola, 'cello and double bass. In practice the notes of extreme limit in the string quartet should be fixed as follows:

for violins:  , for violas:  ,

for 'cellos:  , for double basses:  .

Higher notes given in Table A, should only be used with caution, that is to say when they are of long value, in *tremolando*, slow, flowing melodies, in not too rapid sequence of scales, and in passages of repeated notes. Skips should always be avoided.

Note. In quick passages for stringed instruments long chromatic figures are never suitable; they are difficult to play and sound indistinct and muddled. Such passages are better allotted to the wood-wind.

A limit should be set to the use of a high note on any one of the three lower strings on violins, violas and 'cellos. This note should be the one in the fourth position, either the octave note or the ninth of the open string.

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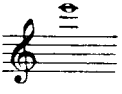
(1) To give a list of easy three and four-note chords, or to explain the different methods of bowing does not come within the scope of the present book.

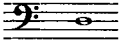
Nobility, warmth, and equality of tone from one end of the scale to the other are qualities common to all stringed instruments, and render them essentially superior to instruments of other groups. Further, each string has a distinctive character of its own, difficult to define in words. The top string on the violin *(E)* is brilliant in character, that of the viola *(A)* is more biting in quality and slightly nasal; the highest string on the 'cello *(A)* is bright and possesses a "chest-voice" timbre. The *A* and *D* strings on the violin and the *D* string on the violas and 'cellos are somewhat sweeter and weaker in tone than the others. Covered strings *(G)*, on the violin *(G* and *C)*, on the viola and 'cello are rather harsh. Speaking generally, the double bass is equally resonant throughout, slightly duller on the two lower strings *(E* and *A)*, and more penetrating on the upper ones *(D* and *G)*.

Note. Except in the case of pedal notes, the double bass rarely plays an independent part, usually moving in octaves or in unison with the 'cellos, or else doubling the bassoons. The quality of the double bass tone is therefore seldom heard by itself and the character of its different strings is not so noticeable.

The rare ability to connect sounds, or a series of sounds, the vibration of stopped strings combined with their above-named qualities—warmth and nobility of tone—renders this group of instruments far and away the best orchestral medium of melodic expression. At the same time, that portion of their range situated beyond the limits of the human voice, e. g. notes on the violin higher than the extreme top note of the soprano voice, from



upwards, and notes on the double bass below the range of the bass voice, descending from

 (written sound)

lose in expression and warmth of tone. Open strings are clearer and more powerful but less expressive than stopped strings.

Comparing the range of each stringed instrument with that of the human voice, we may assign: to the violin, the soprano and

contralto voice plus a much higher range; to the viola, the contralto and tenor voice plus a much higher register; to the 'cello, the tenor and bass voices plus a higher register; to the double bass, the bass voice plus a lower range.

The use of harmonics, the mute, and some special devices in bowing produce great difference in the resonance and tone quality of all these instruments.

Harmonics, frequently used to-day, alter the timbre of a stringed instrument to a very appreciable extent. Cold and transparent in soft passages, cold and brilliant in loud ones, and offering but little chance for expression, they form no fundamental part of orchestral writing, and are used simply for ornament. Owing to their lack of resonant power they should be used sparingly, and, when employed, should never be overpowered by other instruments. As a rule harmonics are employed on sustained notes, *tremolando*, or here and there for brilliant effects; they are rarely used in extremely simple melodies. Owing to a certain tonal affinity with the flute they may be said to form a kind of link between string and wood-wind instruments.

Another radical change is effected by the use of mutes. When muted, the clear, singing tone of the strings becomes dull in soft passages, turns to a slight hiss or whistle in loud ones, and the volume of tone is always greatly reduced.

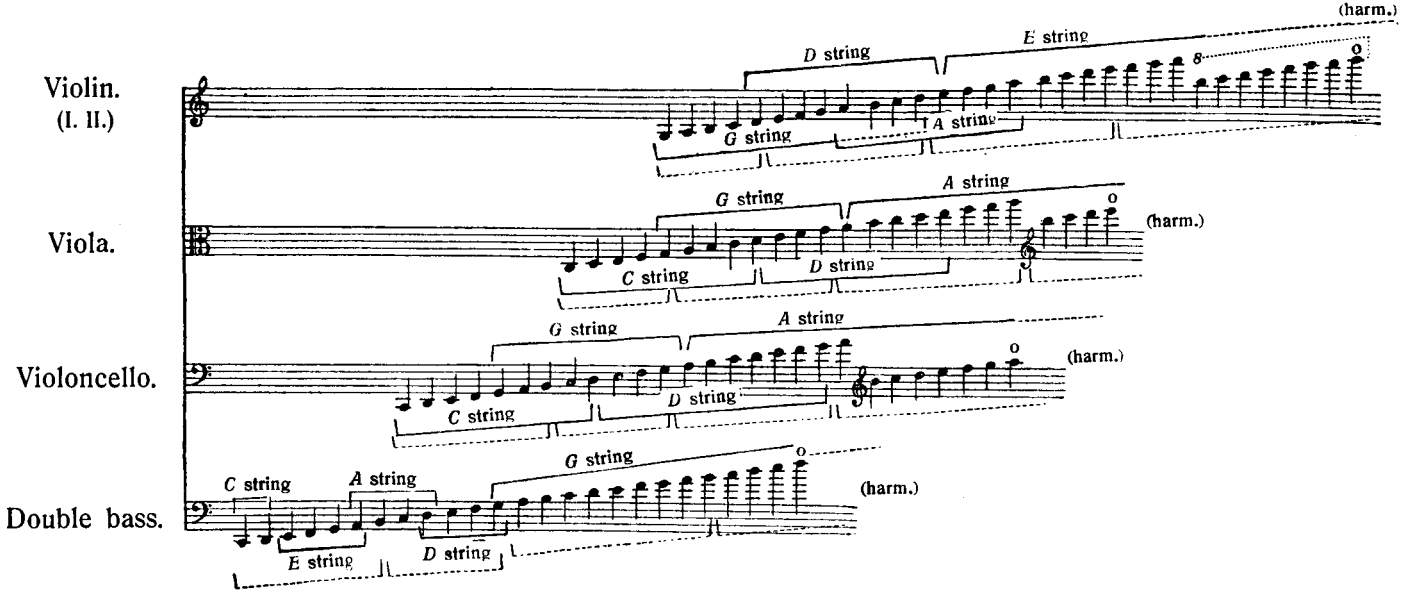
The position of the bow on the string will affect the resonance of an instrument. Playing with the bow close to the bridge *(sul ponticello)*, chiefly used *tremolando*, produces a metallic sound; playing on the finger-board *(sul tasto, flautando)* creates a dull, veiled effect.

Note. Another absolutely different sound results from playing with the back or wood of the bow (*col legno*). This produces a sound like a xylophone or a hollow *pizzicato*. It is discussed under the heading of instruments of little sustaining power.

The five sets of strings with number of players given above produce a fairly even balance of tone. If there is any surplus of strength it must be on the side of the first violins, as they must be heard distinctly on account of the important part they play in the harmonic scheme. Besides this, an extra desk of first violins is usual in all orchestras, and as a general

Table A. String group.

(These instruments give all chromatic intervals.)



Black lines on each string denote the general range in orchestral writing, the dotted lines give the registers, low, medium, high, very high.

rule they possess a more powerful tone than second violins. The latter, with the violas, play a secondary part, and do not stand out so prominently. The 'cellos and double basses are heard more distinctly, and in the majority of cases form the bass in octaves.

In conclusion it may be said that the group of strings, as a melodic element, is able to perform all manner of passages, rapid and interrupted phrases of every description, diatonic or chromatic in character. Capable of sustaining notes without difficulty, of playing chords of three and four notes; adapted to the infinite variety of shades of expression, and easily divisible into numerous sundry parts, the string group in an orchestra may be considered as an harmonic element particularly rich in resource.

B. Wind instruments.

Wood=wind.

Apart from the varying number of players, the formation of the string group, with its five constituent parts remains constant, satisfying the demands of any orchestral full score. On the other hand the group of wood-wind instruments varies both as regards number of parts and the volume of tone at its command, and here the composer may choose at will. The group may be divided into three general classes: wood-wind instruments in pair's, in three's and in four's, (see table on page 13).

Arabic numerals denote the number of players on each instrument; roman figures, the parts (1st, 2nd etc.). Instruments which do not require additional players, but are taken over by one or the other executant in place of his usual instrument, are enclosed in brackets. As a rule the first flute, first oboe, first clarinet and first bassoon never change instruments; considering the importance of their parts it is not advisable for them to turn from one mouthpiece to another. The parts written for piccolo, bass flute, English horn, small clarinet, bass clarinet and double bassoon are taken by the second and third players in each group, who are more accustomed to using these instruments of a special nature.

Wood-wind in pair's	Wood-wind in three's	Wood-wind in four's
(II—Piccolo).	(III—Piccolo).	1 Piccolo (IV).
2 Flutes I. II.	3 Flutes I. II. III.	3 Flutes I. II. III.
	(II—Bass flute).	(III—Bass flute).
2 Oboes I. II.	2 Oboes I. II.	3 Oboes I. II. III.
(II—Eng. horn).	1 Eng. horn (III).	1 Eng. horn (IV).
	(II—Small clarinet).	(II—Small clarinet).
2 Clarinets I. II.	3 Clarinets I. II. III.	3 Clarinets I. II. III.
(II—Bass clarinet).	(III—Bass clarinet).	1 Bass Clarinet (IV).
2 Bassoons I. II.	2 Bassoons I. II.	3 Bassoons I. II. III.
	1 Double bassoon (III).	1 Double bassoon (IV).

The formation of the first class may be altered by the permanent addition of a piccolo part. Sometimes a composer writes for two piccolos or two Eng. horns etc. without increasing the original number of players required (in three's or four's).

Note I. Composers using the first class in the course of a big work (oratorio, opera, symphony, etc.) may introduce special instruments, called *extras*, for a long or short period of time; each of these instruments involves an extra player not required throughout the entire work. Meyerbeer was fond of doing this, but other composers, Glinka for example, refrain from increasing the number of performers by employing *extras* (Eng. horn part in *Rousslân*). Wagner uses all three classes in the above table (in pair's: *Tannhäuser*—in three's: *Tristan* —in four's: *The Ring*).

Note II. Mlada is the only work of mine involving formation by four's. *Ivan the Terrible, Sadko, The Legend of Tsar Saltan, The Legend of the Invisible City of Kitesh* and *The Golden Cockerel* all belong to the second class, and in my other works, wood-wind in pair's is used with a varying number of *extras. The Christmas Night*, with its two oboes, and two bassoons, three flutes and three clarinets, forms an intermediate class.

Considering the instruments it comprises, the string group offers a fair variety of colour, and contrast in compass, but this diversity of range and timbre is subtle and not easily discerned. In the wood-wind department, however, the difference in register and quality of flutes, oboes, clarinets and bassons is striking to a degree. As a rule, wood-wind instruments are less flexible than

strings; they lack the vitality and power, and are less capable of different shade of expression.

In each wind instrument I have defined the *scope of greatest expression*, that is to say the range in which the instrument is best qualified to achieve the various grades of tone, (*forte, piano, cresc., dim., sforzando, morendo,* etc.)—the register which admits of the most *expressive* playing, in the truest sense of the word. Outside this range, a wind instrument is more notable for richness of colour than for expression. I am probably the originator of the term "scope of greatest expression". It does not apply to the piccolo and double bassoon which represent the two extremes of the orchestral compass. They do not possess such a register and belong to the body of highly-coloured but non-expressive instruments.

The four kinds of wind instruments: flutes, oboes, clarinets and bassoons may be generally considered to be of equal power. The same cannot be said of instruments which fulfil a special purpose: piccolo, bass flute, Eng. horn, small clarinet, bass clarinet and double bassoon. Each of these instruments has four registers: low, middle, high and extremely high, each of which is characterised by certain differences of quality and power. It is difficult to define the exact limits of each register; adjacent registers almost blend together and the passage from one to another is scarcely noticeable. But when the instrument jumps from one register to another the difference in power and quality of tone is very striking.

The four families of wind instruments may be divided into two classes: a) instruments of nasal quality and dark resonance—oboes and bassoons (Eng. horn and double bassoon); and b) instruments of "chest-voice" quality and bright tone—flutes and clarinets (piccolo, bass flute, small clarinet, bass clarinet).

These characteristics of colour and resonance—expressed in too simple and rudimentary a form—are specially noticeable in the middle and upper registers. The lower register of the oboes and bassoons is thick and rough, yet still nasal in quality; the very high compass is shrill, hard and dry. The clear resonance of the flutes and clarinets acquires something nasal and dark in the lower compass; in the very high register it becomes somewhat piercing.

Note to Table B.

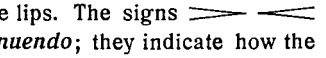
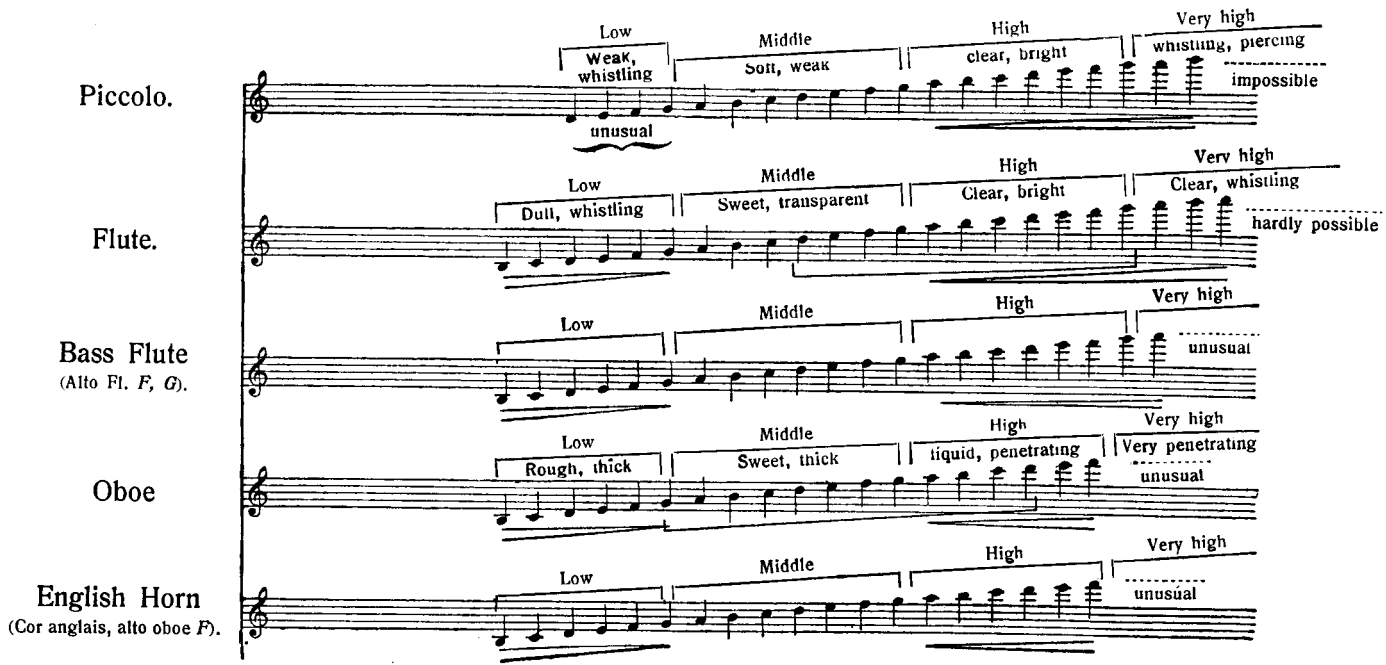
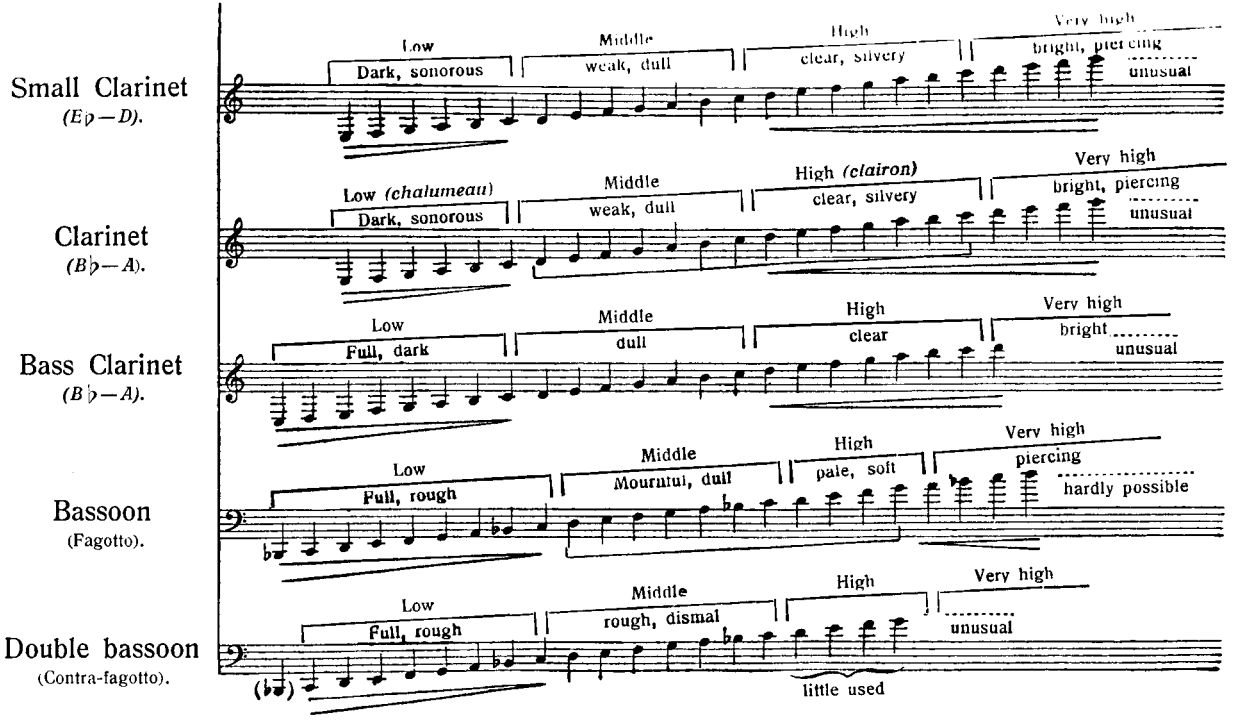
In the following Table B the top note in each register serves as the bottom note in the next, as the limits to each register are not defined absolutely. The note *G* fixes the register of flutes and oboes, *C* for the clarinets and bassoons. In the very high compass those notes are only given which can really be used; anything higher and not printed as actual notes are either too difficult to produce or of no artistic value. The number of sounds obtainable in the highest compass is indefinite, and depends, partly on the quality of the instrument itself, partly on the position and application of the lips. The signs  are not to be mistaken for *crescendo* and *diminuendo*; they indicate how the resonance of an instrument increases or diminishes in relation to the characteristic quality of its timbre. The scope of greatest expression for each typical instrument is marked thus, under the notes; the range is the same in each instrument of the same type.

Table B. Wind group.

These instruments give all chromatic intervals.




Small Clarinet
(E♭—D).
Low
Dark, sonorous
Middle
weak, dull
High
clear, silvery
Very high
bright, piercing
unusual
Clarinet
(B♭—A).
Low (chalumeau)
Dark, sonorous
Middle
weak, dull
High (clairon)
clear, silvery
Very high
bright, piercing
unusual
Bass Clarinet
(B♭—A).
Low
Full, dark
Middle
dull
High
clear
Very high
bright
unusual
Bassoon
(Fagotto).
Low
Full, rough
Middle
Mournful, dull
High
pale, soft
Very high
piercing
hardly possible
Double bassoon
(Contra-fagotto).
Low
Full, rough
Middle
rough, dismal
High
Very high
unusual
little used

Note. It is a difficult matter to define tone quality in words; we must encroach upon the domain of sight, feeling, and even taste. Though borrowed from these senses, I have no doubt as to the appropriateness of my comparisons, but, as a general rule definitions drawn from other sources are too elementary to be applied to music. No condemnatory meaning however should be attached to my descriptions, for in using the terms thick, piercing, shrill, dry, etc. my object is to express *artistic* fitness in words, rather than material exactitude. Instrumental sounds which have no musical meaning are classed by me in the category of *useless sounds*, and I refer to them as such, giving my reasons. With the exception of these, the reader is advised to consider all other orchestral timbres beautiful from an artistic point of view, although it is necessary, at times, to put them to other uses.

Further on, a table of wind instruments is appended, outlining the approximate limit of range, defining different qualities of tone and indicating the scope of greatest expression (the piccolo and double bassoon excepted).

Flutes and clarinets are the most flexible wood-wind instruments (the flutes in particular), but for expressive power and subtlety in *nuances* the clarinet supersedes them; this instrument can reduce volume of tone to a mere breath. The nasal instruments, oboe and bassoon, are less mobile and supple; this is accounted for by their double reed, but, having to effect all sorts of scales and rapid passages in common with the flutes and clarinets, oboes and bassoons may be considered melodic instruments in the real sense of the word, only of a more *cantabile* and peaceful character. In very quick passages they often double the flutes, clarinets or strings.

The four families are equally capable of *legato* and *staccato* playing and changing from one to the other in different ways, but distinct and penetrating *staccato* passages are better suited to the oboes and bassoons, while the flutes and clarinets excel in well-sustained *legato* phrases. Composite *legato* passages should be allotted to the first two instruments, composite *staccato* passages to the latter pair, but these general directions should not deter the orchestrator from adopting the opposite plan.

In comparing the technical individualities of the wood-wind the following fundamental differences should be noted:

a) The rapid repetition of a single note by single tonguing is common to all wind instruments; repetition of a single note by means of double tonguing is only possible on the flute, a reedless instrument.

b) On account of its construction the clarinet is not well adapted to sudden leaps from one octave to another; these skips are easier on flutes, oboes and bassoons.

c) *Arpeggios* and rapid alternation of two intervals *legato* sound well on flutes and clarinets, but not on oboes and bassoons.

Wood-wind players cannot manage extremely long sustained passages, as they are compelled to take breath; care must be taken therefore to give them a little rest from time to time. This is unnecessary in the case of string players.

In the endeavour to characterise the timbre of each instrument typical of the four families, from a psychological point of view, I do not hesitate to make the following general remarks which apply generally to the middle and upper registers of each instrument:

a) Flute. — Cold in quality, specially suitable, in the major key, to melodies of light and graceful character; in the minor key, to slight touches of transient sorrow.

b) Oboe. — Artless and gay in the major, pathetic and sad in the minor.

c) Clarinet. — Pliable and expressive, suitable, in the major, to melodies of a joyful or contemplative character, or to outbursts of mirth; in the minor, to sad and reflective melodies or impassioned and dramatic passages.

d) Bassoon. — In the major, an atmosphere of senile mockery; a sad, ailing quality in the minor.

In the extreme registers these instruments convey the following impressions to my mind:

	Low register	*Very high register*
a) Flute —	Dull, cold	Brilliant
b) Oboe —	Wild	Hard, dry
c) Clarinet —	Ringing, threatening	Piercing
d) Bassoon —	Sinister	Tense.

Note. It is true that no mood or frame of mind, whether it be joyful or sad, meditative or lively, careless or reflective, mocking or distressed can be aroused by one single isolated timbre; it depends more upon the general melodic line, the harmony, rhythm, and dynamic shades of expression, upon the whole formation of a given piece of music. The choice of instruments and timbre to be adopted depends on the position which melody and harmony occupy in the seven-octave scale of the orchestra; for example, a melody of light character in the tenor register could not be given to the flutes, or a sad, plaintive phrase in the high soprano register confided to the bassoons. But the ease with which tone colour can be adapted to expression must not be forgotten, and in the first of these two cases it may be conceded that the mocking character of the bassoon could easily and quite naturally assume a light-hearted aspect, and

in the second case, that the slightly melancholy timbre of the flute is somewhat related to the feeling of sorrow and distress with which the passage is to be permeated. The case of a melody coinciding in character with the instrument on which it is played is of special importance, as the effect produced cannot fail to be successful. There are also moments when a composer's artistic feeling prompts him to employ instruments, the character of which is at variance with the written melody (for eccentric, grotesque effects, etc.).

The following remarks illustrate the characteristics, timbre, and employment of special instruments:

The duty of the piccolo and small clarinet is, principally, to extend the range of the ordinary flute and clarinet in the high register. The whistling, piercing quality of the piccolo in its highest compass is extraordinarily powerful, but does not lend itself to more moderate shades of expression. The small clarinet in its highest register is more penetrating than the ordinary clarinet. The low and middle range of the piccolo and small clarinet correspond to the same register in the normal flute and clarinet, but the tone is so much weaker that it is of little service in those regions. The double bassoon extends the range of the ordinary bassoon in the low register. The characteristics of the bassoon's low compass are still further accentuated in the corresponding range of the double bassoon, but the middle and upper registers of the latter are by no means so useful. The very deep notes of the double bassoon are remarkably thick and dense in quality, very powerful in *piano* passages.

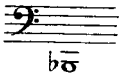
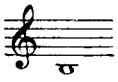
Note. Nowadays, when the limits of the orchestral scale are considerably extended (up to the high *C* of the 7th octave, and down to the low *C*, 16 ft. contra octave), the piccolo forms an indispensable constituent of the wind-group; similarly, it is recognised that the double bassoon is capable of supplying valuable assistance. The small clarinet is rarely employed and only for colour effects.

The English horn, or alto oboe (oboe in *F*) is similar in tone to the ordinary oboe, the listless, dreamy quality of its timbre being sweet in the extreme. In the low register it is fairly penetrating. The bass clarinet, though strongly resembling the ordinary clarinet, is of darker colour in the low register and lacks the silvery quality in the upper notes; it is incapable of joyful expression. The bass flute is an instrument seldom used even today; it possesses the same features as the flute, but it is colder in

colour, and crystalline in the middle and high regions. These three particular instruments, apart from extending the low registers of the instruments to which they belong, have their own distinctive peculiarities of timbre, and are often used in the orchestra, as solo instruments, clearly exposed.

Note. Of the six special instruments referred to above, the piccolo and double bassoon were the first to be used in the orchestra; the latter, however, was neglected after Beethoven's death and did not reappear until towards the end of the 19th century. The Eng. horn and bass clarinet were employed initially during the first half of the same century by Berlioz, Meyerbeer, and others, and for some time retained their position as *extras*, to become, later on, permanent orchestral factors, first in the theatre, then in the concert room. Very few attempts have been made to introduce the small clarinet into the orchestra (Berlioz etc.); this instrument together with the bass flute is used in my opera-ballet *Mlada* (1892), and also in my most recent compositions, *The Christmas Night*, and *Sadko*; the bass flute will also be found in *The Legend of the Invisible City of Kitesh*, and in the revised version of *"Ivan the Terrible"*.

Of late years the habit of muting the wood-wind has come into fashion. This is done by inserting a soft pad, or a piece of rolled-up cloth into the bell of the instrument. Mutes deaden the tone of oboes, Eng. horns, and bassoons to such an extent that it is possible for these instruments to attain the extreme limit of *pianissimo* playing. The muting of clarinets is unnecessary, as they can play quite softly enough without artificial means. It has not yet been discovered how to mute the flutes; such a discovery would render great service to the piccolo. The lowest notes on the bassoon,

 and on the oboe and Eng. horn 

are impossible when the instruments are muted. Mutes have no effect in the highest register of wind instruments.

Brass.

The formation of the group of brass instruments, like that of the wood-wind is not absolutely uniform, and varies in different scores. The brass group may be divided into three general classes corresponding to those of the wood-wind (in pair's, in three's, and in four's).

Group corresponding to the wood-wind in pair's	Group corresponding to the wood-wind in three's	Group corresponding to the wood-wind in four's
2 Trumpets I, II.	3 Trumpets I, II, III. (III — Alto trumpet or: [2 Cornets I, II. [2 Trumpets I, II.	(II — Small trumpet). 3 Trumpets I, II, III. (III — Alto trumpet or Bass trumpet.
4 Horns I, II, III, IV.	4 Horns I, II, III, IV.	6 or 8 Horns I, II, III, IV, V, VI, VII, VIII.
3 Trombones.	3 Trombones I, II, III.	3 Trombones I, II, III.
1 Tuba.	1 Tuba (1).	1 Tuba.

The directions are the same as in the preceding table for wood-wind. It is evident that in all three classes the formation may vary as the composer wishes. In music for the theatre or concert room page after page may be written without the use of trumpets, trombones and tuba, or some instrument may be introduced, temporarily as an *extra*. In the above table I have given the most typical formations, and those which are the most common at the present day.

Note I. Besides the instruments given above, Richard Wagner used some others in *The Ring*, notably the quartet of tenor and bass tubas, and a contra-bass trombone. Sometimes these additions weigh too heavily on the other groups, and at other times they render the rest of the brass ineffective. For this reason composers have doubtless refrained from employing such instruments, and Wagner himself did not include them in the score of *Parsifal*. Some present-day composers (Richard Strauss, Scriabine) write for as many as five trumpets.

Note II. From the middle of the 19th century onward the natural brass disappeared from the orchestra, giving place to valve instruments. In my second opera, *The May Night* I used natural horns and trumpets, changing the keys, and writing the best notes "stopped"; this was purposely done for practise.

Though far less flexible than the wood-wind, brass instruments heighten the effect of other orchestral groups by their powerful resonance. Trumpets, trombones, and tubas are about equal in

(1) Of late years sometimes two tubas are employed, by Glazounov for instance in his *Finnish Fantasia*. (Editor's note.)

strength; cornets have not quite the same force; horns, in *forte* passages, are about one half as strong, but *piano*, they have the same weight as other brass instruments played softly. To obtain an equal balance, therefore, the marks of expression in the horns should be one degree stronger than in the rest of the brass; if the trumpets and trombones play *pp*, the horns should be marked *p*. On the other hand, to obtain a proper balance in *forte* passages, two horns are needed to one trumpet or one trombone.

Brass instruments are so similar in range and timbre that the discussion of register is unnecessary. As a general rule quality becomes more brilliant as the higher register is approached, and *vice versa*, with a decrease in tone. Played *pp* the resonance is sweet; played *ff* the tone is hard and "crackling". Brass instruments possess a remarkable capacity for swelling from *pianissimo* to *fortissimo*, and reducing the tone inversely, the *sf* $\Longrightarrow$ *p* effect being excellent.

The following remarks as to character and tone quality may be added:

a) 1. *Trumpets (B♭—A).* Clear and fairly penetrating in tone, stirring and rousing in *forte* passages; in *piano* phrases the high notes are full and silvery, the low notes troubled, as though threatening danger.

2. *Alto trumpet* (in *F*). An instrument of my own invention, first used by me in the opera—ballet *Mlada.* In the deep register (notes 2 to 3 in the trumpet scale) it possesses a fuller, clearer, and finer tone. Two ordinary trumpets with an alto trumpet produce greater smoothness and equality in resonance than three ordinary trumpets. Satisfied with the beauty and usefulness of the alto trumpet, I have consistently written for it in my later works, combined with wood-wind in three's.

Note. To obviate the difficulty of using the alto trumpet in ordinary theatres and some concert rooms, I have not brought into play the last four notes of its lowest register or their neighbouring chromatics; by this means the alto trumpet part may be played by an ordinary trumpet in *B♭* or *A*.

3. *Small trumpet* (in *E♭—D*). Invented by me and used for the first time in *Mlada* to realise the very high

trumpet notes without difficulty. In tonality and range the instrument is similar to the soprano cornet in a military band.

Note. The small trumpet, ($B\flat — A$) sounding an octave higher than the ordinary trumpet has not yet appeared in musical literature.

b) *Cornets* (in $B\flat — A$). Possessing a quality of tone similar to the trumpet, but softer and weaker. It is a beautiful instrument though rarely employed today in theatre or concert room. Expert players can imitate the cornet tone on the trumpet, and *vice versa.*

c) *Horn* (in *F*). The tone of this instrument is soft, poetical, and full of beauty. In the lower register it is dark and brilliant; round and full in the upper. The middle notes resemble those of the bassoon and the two instruments blend well together. The horn, therefore, serves as a link between the brass and wood-wind. In spite of valves the horn has but little mobility and would seem to produce its tone in a languid and lazy manner.

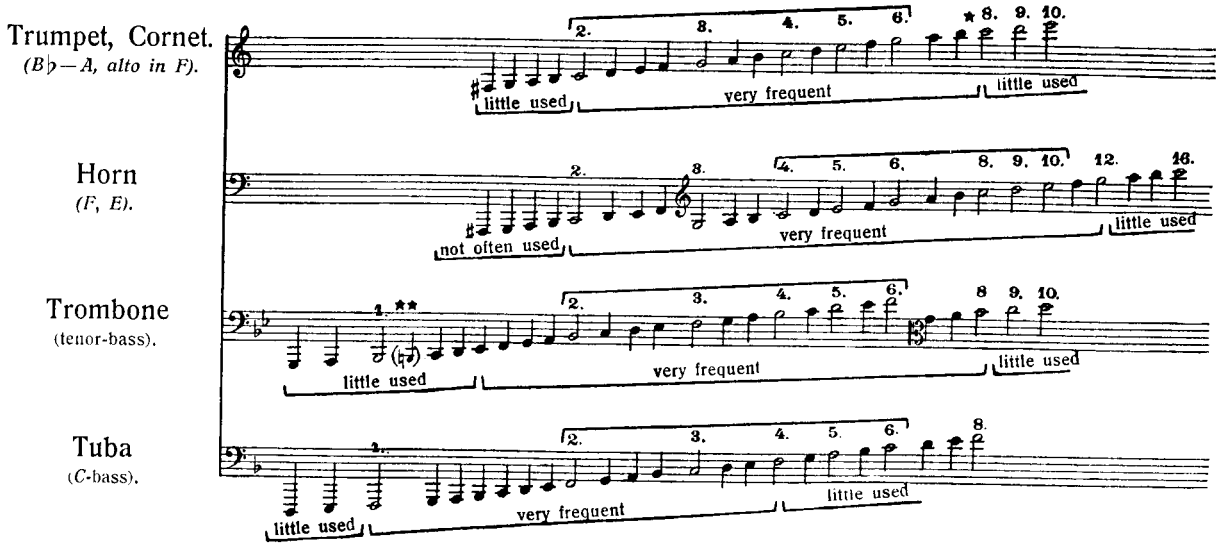
d) *Trombone.* Dark and threatening in the deepest register, brilliant and triumphant in the high compass. The *piano* is full but somewhat heavy, the *forte* powerful and sonorous. Valve trombones are more mobile than slide trombones, but the latter are certainly to be preferred as regards nobility and equality of sound, the more so from the fact that these instruments are rarely required to perform quick passages, owing to the special character of their tone.

e) *Tuba.* Thick and rough in quality, less characteristic than the trombone, but valuable for the strength and beauty of its low notes. Like the double bass and double bassoon, the tuba is eminently useful for doubling, an octave lower, the bass of the group to which it belongs. Thanks to its valves, the tuba is fairly flexible.

The group of brass instruments, though uniform in resonance throughout its constituent parts, is not so well adapted to expressive playing (in the exact sense of the word) as the wood-wind group. Nevertheless, a scope of greatest expression may be distinguished

Table C. Brass group.

These instruments give all chromatic intervals.



Natural sounds are given in white notes. The upper lines indicate the scope of greatest expression.

* The 7th natural harmonic is everywhere omitted as useless; the same in the horns, the notes 11, 13, 14 and 15.

** The $b\flat$ of the octave — 1 does not exist on the trombones.

in the middle registers. In company with the piccolo and double bassoon it is not given to the small trumpet *(E♭ — D)* and tuba to play with any great amount of expression. The rapid and rhythmical repetition of a note by single tonguing is possible to all members of the brass, but double tonguing can only be done on instruments with a small mouth-piece, trumpets and cornets. These two instruments can execute rapid *tremolando* without difficulty. The remarks on breathing, in the section devoted to the wood-wind, apply with equal force to the brass.

The use of stopped notes and mutes alters the character of brass tone. Stopped notes can only be employed on trumpets, cornets and horns; the shape of trombones and tubas prevents the hand from being inserted into the bell. Though mutes are applied indiscriminately to all brass instruments in the orchestra, tubas rarely possess them. Stopped and muted notes are similar in quality. On the trumpet, muting a note produces a better tone than stopping it.

In the horn both methods are employed; single notes are stopped in short phrases, muted in longer ones. I do not propose to describe the difference between the two operations in detail, and will leave the reader to acquire the knowledge for himself, and to form an opinion as to its importance from his own personal observation. Sufficient to say that the tone is deadened by both methods, assuming a wild "crackling" character in *forte* passages, tender and dull in *piano*. Resonance is greatly reduced, the silvery tone of the instrument so lost and a timbre resembling that of the oboe and Eng. horn is approached. Stopped notes *(con sordino)* are marked + underneath the note, sometimes followed by ○, denoting the resumption of open sounds, *senza sordini*. Brass instruments, when muted, produce an effect of distance.

C. Instruments of little sustaining power.

Plucked strings.

When the usual orchestral string quartet (Vn^{s} I, Vn^{s} II, Violas, 'Cellos, D. basses) does not make use of the bow, but plucks the strings with the finger, it becomes to my mind a new and inde-

pendent group with its own particular quality of tone. Associated with the harp, which produces sound in a similar manner, I consider it separately under the heading of plucked strings.

Note. In this group may be classed the guitar, zither, balalaïka; instruments plucked with a quill, such as the domra, (1) the mandoline etc., all of which may be used in an orchestra, but have no place in the scope of the present book.

Pizzicato.

Although capable of every degree of power from *ff* to *pp*, *pizzicato* playing has but small range of expression, and is used chiefly as a colour effect. On open strings it is resonant and heavy, on stopped strings shorter and duller; in the high positions it is rather dry and hard.

Table D on page 31 indicates the range in which *pizzicato* may be used on each stringed instrument.

In the orchestra, *pizzicato* comes into operation in two distinct ways: a) on single notes, b) on double notes and chords. The fingers of the right hand playing *pizz.* are far less agile than the bow; *pizz.* passages therefore can never be performed as quickly as those played *arco.* Moreover, the speed of *pizzicato* playing depends upon the thickness of the strings; on the double basses, for instance, it must always be much slower than on the violins.

In *pizzicato* chords it is better to avoid open strings, which produce a more brilliant tone than of covered strings. Chords of four notes allow of greater freedom and vigour of attack, as there is no danger of accidentally touching a wrong note. Natural harmonics played *pizz.* create a charming effect; the tone is weak however, and they are chiefly successful on the violoncello.

Harp.

In the orchestra, the harp is almost entirely an harmonic or accompanying instrument. The majority of scores require only one harp part, but in recent times composers have written for two or even three harps, which are sometimes compressed into the one part.

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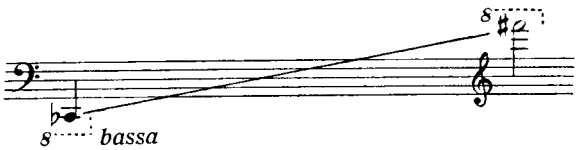
(1) A Russian instrument which, like the balalaïka, is better known abroad. (Translator's note.)

Note. Full orchestras should include three or even four harps. My operas *Sadko, The Legend of the Invisible City of Kitesh,* and *The Golden Cockerel* are designed for two harps, *Mlada* for three.

The special function of the harp lies in the execution of chords, and the florid figures springing from them. As only four notes at the most can be played by each hand, the notes of a chord should be written close together, with not too great a space between one hand and the other. The chords must always be broken *(arpeggiato)*; should the composer wish otherwise he should notify it *(non arpeggiato)*. In the middle and lower octaves the resonance of the strings is slightly prolonged, and dies away gradually. In changes of harmony the player stops the vibration of the strings with his hands, but, in quick modulations, this method is not feasible, and the mixture of one chord with another produces a discordant effect. It follows that more or less rapid figures can only be realised clearly and neatly in the upper register of the harp, where the strings are shorter and harder in tone.

As a general rule, in the whole range of the harp:



only the notes of the first to the fourth octave are used; the extreme notes in both compasses may be employed in special circumstances, and for doubling in octaves.

The harp is essentially a diatonic instrument, since all chromatic passages depend on the manipulation of the pedals. For this reason the harp does not lend itself to rapid modulation, and the orchestrator is advised to bear this fact in mind. But the difficulty may be obviated by using two harps alternately. (1)

Note. I would remind the reader that the harp is not capable of double sharps or double flats. For this reason, certain modulations from one key to another one, adjacent to it can only be accomplished enharmonically. For instance, the transition from *C* flat, *G* flat or *D* flat, major to their minor subdominant chords or keys is not possible owing to double flats. It is therefore

(1) A chromatic harp without pedals has now been invented in France (Lyon's system), on which the most abrupt modulations are possible.
(Translator's note.)

necessary to start enharmonically from the keys of *B*, *F* sharp or *C* sharp, major. Similarly, on account of double sharps, it is impossible to change from *A* sharp, *D* sharp or *G* sharp, minor to their respective dominant major chords or keys; *B* flat, *E* flat and *A* flat, minor must be the starting-points.

The technical operation known as *glissando* is peculiar to the harp alone. Taking for granted that the reader is conversant with the methods of acquiring different scales by means of double-notched pedals, it will be sufficient to remark that *glissando* scales produce a discordant medley of sound owing to the length of time the strings continue to vibrate, and therefore, as a *purely musical* effect, *glissando* can only be used in the upper octaves, quite *piano*, where the sound of the strings is sufficienty clear, yet not too prolonged. *Forte glissando* scales, entailing the use of the lower and middle strings are only permissible as embellishments. Glissando passages in chords of the seventh and ninth, enharmonically obtained, are much more common, and as the above reservations do not apply, every dynamic shade of tone is possible. Chords in harmonics can only consist of three notes written close together, two for the left hand and one for the right.

The tender poetic quality of the harp is adapted to every dynamic shade, but it is never a very powerful instrument, and the orchestrator should treat it with respect.

At least three, if not four harps in unison are necessary, if they are to be heard against a full orchestra playing *forte*. The more rapidly a *glissando* passage is played, the louder it will sound. Harmonic notes on the harp have great charm but little resonance, and are only possible played quite softly. Speaking generally, the harp, like the string quartet, *pizzicato*, is more an instrument of colour than expression.

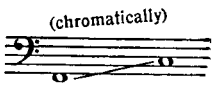
Percussion instruments producing determinate sounds, keyed instruments.

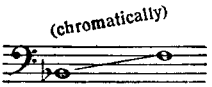
Kettle-drums.

Kettle-drums, indispensable to every theatre and concert orchestra occupy the most important place in the group of percussion instruments. A pair of kettle-drums *(Timpani)*, in the tonic and dominant keys, was the necessary attribute of an orchestra up to, and

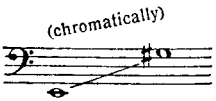
including Beethoven's time, but, from the middle of the 19th century onward, in western Europe and in Russia, an ever-increasing need was felt for the presence of three or even four kettle-drums, during the whole course or part of a work. If the expensive chromatic drum, permitting instant tuning is rarely met with, still, in the majority of good orchestras, three screw drums are generally to be found. The composer can therefore take it for granted that a good timpanist, having three kettle-drums at his command, will be able to tune at least one of them during a pause of some length.

The limits of possible change in Beethoven's time was considered to be:

Big kettle-drum: 

Small kettle-drum: 

In these days it is difficult to define the precise extent of high compass in the kettle-drums, as this depends entirely on the size and quality of the smallest one, of which there are many kinds, but I advise the composer to select:



Note. A magnificent kettle-drum of very small size was made for my opera-ballet *Mlada*; this instrument gave the *D* ♭ of the fourth octave.

Kettle-drums are capable of every dynamic shade of tone, from thundering *fortissimo* to a barely perceptible *pianissimo*. In *tremolando* they can execute the most gradual *crescendo, diminuendo*, the *sfp* and *morendo*.

To deaden the sound, a piece of cloth is generally placed on the skin of the drum, according to the instruction: *timpani coperti* (muffled drums).

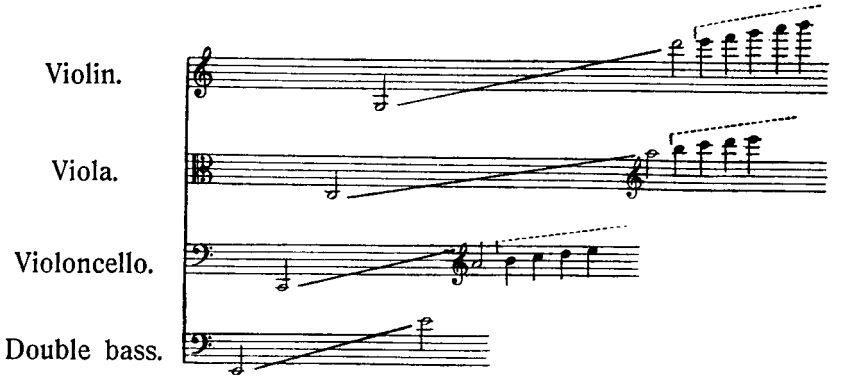
Piano and Celesta.

The use of a piano in the orchestra (apart from pianoforte concertos) belongs almost entirely to the Russian school (1). The object is two-fold: the quality of tone, either alone, or combined with

(1) Rimsky-Korsakov's opera *Sadko* and Moussorgsky's *Boris Godounov* are particularly interesting in this respect. (Translator's note.)

Table D.

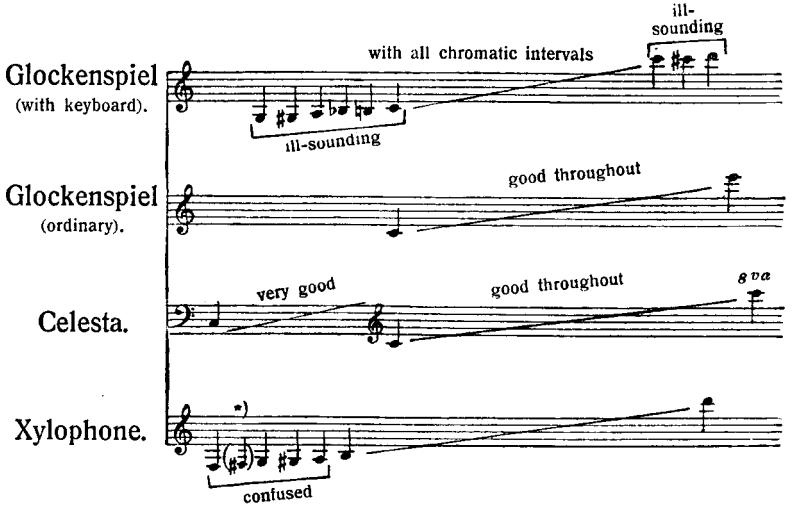
Pizzicato.



The black notes are dry and hard, without resonance, and should only be used when doubled with the wood-wind.

*Table E.

Glockenspiel, celesta, xylophone.



*) This note is often missing.

that of the harp, is made to imitate a popular instrument, the guzli, (as in Glinka), or a soft peal of bells. When the piano forms part of an orchestra, not as a solo instrument, an upright is preferable to a grand, but today the piano is gradually being superseded by the celesta, first used by Tschaikovsky. In the celesta, small steel plates take the place of strings, and the hammers falling on them produce a delightful sound, very similar to the *glockenspiel.* The celesta is only found in full orchestras; when it is not available it should be replaced by an upright piano, and not the *glockenspiel.*

Glockenspiel, Bells, Xylophone.

The *glockenspiel (campanelli)* may be made of steel bars, or played with a keyboard. The first type is the more satisfactory and possesses greater resonance. The use of the *glockenspiel* is similar to the celesta, but its tone is more brilliant and penetrating. Big bells in the shape of hollow discs or metal tubes (1), or real church bells of moderate size may be considered more as theatrical properties than orchestral instruments.

The xylophone is a species of harmonica composed of strips or cylinders of wood, struck with two little hammers. It produces a clattering sound, both powerful and piercing.

To complete this catalogue of sounds mention should be made of the strings playing *col legno,* that is with the wood or back of the bow. The sound produced is similar to the xylophone, and gains in quality as the number of players is increased.

A table is appended showing the range of the celesta, *glockenspiel* and xylophone.

Percussion instruments producing indefinite sounds.

Instruments in this group, such as triangle, castanets, little bells, tambourine, switch or rod (*Rute.* Ger.), side or military drum, cymbals, bass drum, and chinese gong do not take any harmonic or melodic part in the orchestra, and can only be considered as ornamental instruments pure and simple. They have no intrinsic

(1) Recently, bells have been made of suspended metal plates possessing the rare quality of a fairly pure tone, and which are sufficiently portable to be used on the concert platform. (Editor's note.)

musical meaning, and are just mentioned by the way. The first three may be considered as *high*, the four following as *medium*, and the last *two* as deep instruments. This may serve as a guide to their use with percussion instruments of determinate sounds, playing in corresponding registers.

Comparison of resonance in orchestral groups and combination of different tone qualities.

In comparing the resonance of the respective groups of sound-sustaining instruments we arrive at the following approximate conclusions:

In the most resonant group, the brass, the strongest instruments are the trumpets, trombones and tuba. In loud passages the horns are only one-half as strong, 1 Trumpet = 1 Trombone = 1 Tuba = 2 Horns. Wood-wind instruments, in *forte* passages, are twice as weak as the horns, 1 Horn = 2 Clarinets = 2 Oboes = 2 Flutes = 2 Bassoons; but, in *piano* passages, all wind-instruments, wood or brass are of fairly equal balance.

It is more difficult to establish a comparison in resonance between wood-wind and strings, as everything depends on the number of the latter, but, in an orchestra of medium formation, it may be taken for granted that in *piano* passages, the whole of one department (*all* 1st Violins or *all* 2nd Violins etc.) is equivalent in strength to one wind instrument, (Violins I = 1 Flute etc.), and, in *forte* passages, to two wind instruments, (Violins I = 2 Flutes = 1 Oboe + 1 Clarinet, etc.).

It is still harder to form a comparison with instruments of little sustaining power, for too great a diversity in production and emission of sound exists. The combined force of groups of sustained resonance easily overpowers the strings played *pizz.* or *col legno*, the piano played softly, or the celesta. As regards the *glockenspiel*, bells, and xylophone, their emphatic tone will easily prevail over other groups in combination. The same may be said of the kettle-drums with their ringing, resounding quality, and also of other subsidiary instruments.

The influence of the timbre of one group on another is noticeable when the groups are doubled; for instance, when the wood-wind timbre is closely allied to the strings on the one hand, and to the brass on the other. Re-inforcing both, the wind *thickens* the strings

and *softens* the brass. The strings do not blend so well with the brass, and when the two groups are placed side by side, each is heard too distinctly. The combination of the three different timbres in unison produces a rich, mellow and coherent tone.

All, or several wind instruments in combination will absorb one department of added strings:

2 Fl. + 2 Ob. + Vns I,
or: 2 Ob. + 2 Cl. + Violas,
or: 2 Cl. + 2 Fag. + 'Cellos.

One department of strings added to the wood-wind in unison produces a sweet coherent quality, the wood-wind timbre still predominating; but the addition of one wind instrument to all or part of the strings in unison, only thickens the resonance of the latter, the wood-wind timbre being lost in the process:

Vns I + Vns II + 1 Ob.,
or: Violas + 'Cellos + 1 Cl.
or: 'Cellos + D. basses + 1 Fag.

Muted strings do not combine so well with wood-wind, as the two tone qualities remain distinct and separate. Uniting plucked strings and percussion with instruments of sustained resonance results in the following: wind instruments, wood and brass, strengthen and clarify *pizzicato* strings, harp, kettle-drums and percussion generally, the latter lending a touch of relief to the tone of the wood-wind. Uniting plucked strings and percussion with bowed instruments does not produce such a satisfactory blend, both qualities being heard independently. The combination of plucked strings with percussion alone, is excellent; the two blend perfectly, and the consequent increase in resonance yields an admirable effect.

The relationship which exists between string harmonics and the flute or piccolo constitutes a link between the two groups in the upper range of the orchestra. Moreover, the timbre of the viola may be vaguely compared to the middle register of the bassoon and the lowest compass of the clarinet; hence, in the medium orchestral range, a point of contact is established between the quartet of strings and the wood-wind.

The bassoon and horn provide the connection between wood-wind and brass, these two instruments being somewhat analogous

in character when played *piano* or *mezzo-forte*; the flute also, in its lowest register, recalls the *pianissimo* trumpet tone. Stopped and muted notes in horns and trumpets are similar in quality to the oboe and Eng. horn, and blend tolerably well with the latter instrument.

Concluding this survey of orchestral groups I add a few remarks which seem to me of special importance.

The principal part in music is undertaken by three instrumental groups of sustained resonance, representing the three primary elements, melody, harmony and rhythm. Instruments of little sustaining power, though sometimes used independently, are chiefly employed for ornament and colour; instruments producing indeterminate sounds play no melodic or harmonic part, their functions being purely rhythmical.

By glancing at the order in which the six orchestral groups are placed, strings, wood-wind, brass, plucked strings, percussion producing definite, and those producing indefinite sounds, the reader will be able to determine the part played by each in the art of orchestration, from the secondary standpoint of colour and expression. As regards expression, the strings come first, and the expressive capacity of the other groups diminishes in the above order, colour being the only attribute of the last group of percussion instruments.

The same order obtains from the standpoint of general effect in orchestration. We can listen to strings for an almost indefinite period of time without getting tired, so varied are their characteristics (*vide* the number of string quartets, suites, serenades etc. written for strings alone). The addition of a single group of strings will add lustre to a passage for wind instruments. On the other hand, the quality of wind instruments soon becomes wearisome; the same may be said of plucked strings, and also percussion of every kind which should only be employed at reasonable intervals in orchestral composition.

It cannot be denied that the constant use of compound timbres, in pair's, in three's etc. eliminates characteristics of tone, and produces a dull, neutral texture, whereas the employment of simple, elementary combinations gives infinitely greater scope for variety in colour.

7 (20) June 1908.