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*ON SOME CAUSES OF THE CHANGES OF TONE-
COLOUR PROCEEDING IN THE MOST
MODERN ORCHESTRA.*

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THE limits of a paper such as the present are too confined, and perhaps the subject itself is too impalpable, to afford any hope that all the causes in the case mentioned in the title can be here set out in one view; the paper is therefore designated as only illustrating some causes. The term "tone-colour" has come to this country translated from the German, it is a word involving a metaphor, and it is just possible that twenty-five years ago it might have been resented by some as an affectation; but it is an accepted term of the enlarged musical diction of the present day. It conveniently expresses that total effect made on the ear by musical sounds, especially the collective sounds of the orchestra, which is dependent not on art structure proper but on the qualities and employment of the instruments which give interpretation to the art-idea. In a concert-room of to-day, an orchestra constituted so as to perform a Handel score, and one constituted so as to perform a Wagner score, differ entirely in tone-colour. Even where the constitution of the orchestra is the same, as say in performing works by Mendelssohn and Schumann respectively, the tone-colour is different, because those two composers used the instruments differently. By the most modern orchestra in my title I mean that of a period not exceeding say the last fifty years, or the lifetime of many in this room, and in some particulars the remarks will have reference to

the orchestra actually of the present day; many most able writers have treated of the historic growth of the orchestra, and the present paper is not to be regarded as historical in its aim except in the sense of drawing attention to some facts connected with the most recent developments.

Regarding the changes in point here I do not know whether an objection may be raised at the outset, by the expression of a doubt whether there are any recent changes to record. A statement is not unfrequently made in didactic works on music, that the orchestra of to-day is substantially the orchestra of the beginning of the century, or words to that effect. But I would reply to any such doubt, that though statements like that last mentioned may be correct in the context in which they appear, and though it is perhaps in dealing with the student more important to dwell on what remains permanent in orchestral work than to dwell on what exhibits a tendency to change, yet there have also been vast changes in recent times, which will naturally be considered by a body such as I am addressing. It will not invalidate my remarks if it be found that for many facts cited as belonging to recent times a parallel can be quoted as existing in older masters. A diligent searching of scores will always reveal a great number of such instances where a general tendency subsequently developed is forestalled by a partial tendency or an isolated example; but the case I wish to present here is essentially one of general tendencies and total effects, and I believe there will be no difficulty in showing that our half-century has in this way its own characteristics and prevailing orchestral tone-colour.

The subject of the changes under consideration may not unnaturally be divided into:—(A) The influence caused by developments in the mechanism of the instruments and in the practice of the players, (B) the influence caused by the demands of modern audiences, (C) the influence caused by composers acting on their artistic impulse in the development of what is inherent in the art of music.

(A) INSTRUMENTS AND THEIR PLAYERS.—It will be convenient here to take the instruments in their usual score order.

Flute.—The flute of the last sixty years has replaced the old "D" conical flute. This latter had a cylindrical bore in the short piece from the blow-hole back to the head, but its greater length or length from the blow-hole to the end was a reversed cone, that is to say a cone with the apex at the end away from the blow-hole. It had an 8^{ve} of fundamental sounds from d¹ upwards to c^{♯11}, then over-blew the same notes again into the first or octave harmonic so as to produce another series from d¹¹ to c^{♯111}, and then over-blew the

original notes into other various harmonics so as to produce the still higher notes. The reversed conical bore gave this instrument a weak tone, the action being in fact somewhat analogous to blowing into a conch shell from the side; and the mechanism of the instrument was defective. The flute of the present day has a bore which is exactly the opposite of that just mentioned, namely conical from the blow-hole back to the head and cylindrical throughout its greater length, and is by this means much stronger in tone. Larger stopping-holes also increase the tone. By greater length, and two to four extra stopping-holes governed by pads and levers to the right (with a $b\flat$ hole it is twenty-seven inches long), it gains two to four semitones below $d\sharp$. As however these latter holes stand normally unstopped so that the instrument does not normally go down to such notes, and as the old finger-holes remain constructed on substantially the same foundation-scale as before, the over-blowing is still always done from the series of fundamentals $d\sharp$ to $c\sharp^{11}$; for this reason the new flute may still be called a "D" flute, and the objection very constantly made to so doing does not seem valid. Regarding this increased length it must be remembered that the extension in this as in all other modern instruments gives increased tone, even when it is not used for stopping and giving lower pitch. Finally the mechanism of the new flute has been greatly improved under what is known as the Boehm system. The artistic use of the modern flute may properly be claimed as belonging to the period under notice in the present paper, composers having only gradually discovered its capabilities. The new applications, due to increased power and improved mechanism, are chiefly in the direction of use of the lower part of the scale (giving practically a new instrument of sombre quality), use of keys formerly thought extreme, use of passages of an extraordinary variety formerly scarcely practicable, and use of two or even three flutes together in harmony for colouring purposes. Owing to limits of space I will confine comments to the first and last of these heads. The flute and the brass are the only instruments in the orchestra which have no reed or other vibrating substance included in their manufacture, and depend wholly on a vibrating column of air the initial motion to which is given by the performer's lip; but the brass are always inharmonic at the point where the flute enters the orchestral scale, hence the low flute tones which are fundamentals have nothing in any way analogous to themselves at that part of the scale to compete with them, and in the new flute they are as already said very strong. Low flute sounds when doubling strings in the unison give a result very much like the gamba and salcional stops of the organ, which also, at any rate in Germany, are both

composed of narrow cylindrical pipes with a high blow-mouth. Low flute passages were first adopted in the dramatic orchestra and are now universal. Regarding the use of the flute class in harmony, the effects of occasional thirds and sixths have long been known and applied, but nevertheless the constant use of two flutes in all possible musical relations to enrich the harmony throughout a score is comparatively modern (Beethoven has only one flute in his earlier works); while the habitual use of three flutes, by which is meant piccolo and two flutes or three large flutes, has been reserved to Wagner, Liszt, and composers of quite our own day. The piccolo, hitherto regarded as a dangerous and exceptional instrument from the point of view of the orchestra, is becoming more tractable and is being used to extend compass while forming part of a flute trio, sometimes even polyphonically; Brahms uses it in this last way in both his overtures. The whole tendency of the modern orchestra is to develop its constituent classes within themselves. The piccolo is even now rather an extreme instrument, and it seems not improbable therefore that in the near future the tierce flute or some other intermediate high flute may come in again. On the other side of the normal flute, if the old narrow-bore *Flûte d'amour* in "B" was made cylindrical and mechanically brought up to date, it would make owing to the causes spoken of just now in the case of low flute sounds a very special class of tone at the bottom of the flute class. There is even in existence a thirty-two inch "G" bass-flute, which might possibly have its future. There is a tendency towards increased variety in the upper and more melodically significant parts of the orchestra.

Hautboy.— This instrument has under some aspects much in common with the flute; being like the earlier flute a conical tube, being like both old and new flutes essentially of nineteen-inch length so as to give the d^1 , and having like the new flute artificial prolongations of the tube which give at will extra fundamentals down to b^2 but do not radically affect the system of over-blowing (this remaining still more or less an 8^{vo} &c. over-blowing from the fundamentals d^1 to $c^{\sharp 11}$). The hautboy conical bore differs from the conical bore of the old flute in having its apex at the mouthpiece instead of away from it. It differs from the flute also of course in being blown from the extreme end of the instrument through a double reed. Though the stopping mechanism has been improved like that of the flute, the instrument is from the point of view of this paper the most stationary in the orchestra. Of the whole somewhat strident class to which it belongs, all the bass and tenor instruments have been swept away before the progress of concerted euphony, and though

the alto hautboy or Corno inglese is still used (especially for unusual effects), and the mezzo-soprano hautboy or Oboe d'amore exists as a revival, the soprano hautboy practically alone survives for general orchestral purposes at the top of the class and that mostly as a melodic instrument. Modern composers exercise considerable discretion even in using the second hautboy part which is available to them; and the second hautboy, which is too weak below to make an effective contralto part, and by its piercing quality might unduly distract attention from the melody proper, as often as not in recent compositions plays simply in unison with the first hautboy or rests. Each class-tone has its merits, and no doubt the combination in trio of two hautboys with the Corno inglese (the finest pure contralto voice in the orchestra) gives a unique effect; but as a matter of fact, and apart from theories of what might be done, this class seems to be progressing less than most. The short compass of the hautboy has to be noticed in this connection; it scarcely over-blows beyond the first harmonic, or in other words its normal compass is two octaves only.

Clarionet.—This commanding but difficult instrument is a tube cylindrical throughout except for the bell, blown into at the end opposite the bell over a single broad reed which beats against a slightly curved surface. Being cylindrical and practically closed at one end by the reed, it enjoys the advantage of cylindrical pipes which have one end stopped (in other terms "stopped pipes"), and requires only half of the normal speaking length for producing any given tone; hence its short dimensions, a "B $\flat$ " clarionet which goes down to d being a shorter instrument than the hautboy which goes down only to b $\flat$ a sixth above. No other orchestral instrument has this advantage, for all others are in part at any rate conical which deprives them of the double or reverse wave of sound and compels them to be of full normal speaking length. The old original of the clarionet, brought into existence no doubt by the discovery of this principle of a cylindrical tube stopped at one end sounding the note of double its length, was called "chalumeau," and was a tube giving an octave and a third of fundamentals only from f to a 1 . For the same reason that such a tube acts as a stopped pipe, it is capable of over-blowing only into the even-numbered harmonics (answering to the odd-numbered aliquot parts) and cannot over-blow into any of the octaves. The earliest arising even-numbered harmonic is the second at the interval of a twelfth; and the first improvement on the chalumeau, made about A.D. 1700, put a nodal orifice which assisted it to over-blow into the twelfth. It then gave a series of over-blown notes from c 1 to e 111 , in addition to the fundamentals f to a 1 , and became the

clarionet. It will be seen that this left two notes $b\flat$ and $b\sharp$ missing out of the scale, and to provide these a subsequent improvement gave two additional stopping-holes for e below and $b\sharp$ above; the instrument then over-blew into the series $b\sharp$ to $f\sharp$, and the scale was consecutive. Above this scale acute notes are now given by over-blowing certain fundamentals into the fourth and eighth harmonics, providing a vast range altogether. Mechanical improvements have recently gone on as in other wind instruments. The cylindrical shape of the clarionet gives it its power below, its over-blowing into the even harmonics gives it its power above, the single reed and stopped-pipe characteristic give it its limpid tone, and the mechanism of the day gives it its present wonderful agility. Its new applications under these combined circumstances are very varied. As late as the early part of the century the violas were frequently diverted from their work in the string group to make a contralto part for the wood-wind; the development of the low notes of the clarionet (which in its "B $\flat$ " and "A" varieties goes a major second and minor third respectively below the compass mentioned above) has rendered this device unnecessary, and the wood-wind has now a contralto almost a tenor voice of great individuality for use in at least two parts; there is not a modern composer who has not profited by this circumstance. Again in the treble the first and second clarionets have largely ousted the usual pair of hautboys as harmony instruments. The capacity of the modern instrument again for chromatic use, for every sort of figuration, and for most effects of expression, has operated more than anything else to render the wood-wind group a separate power almost rivalling the string group. The low-quint clarionet in "F," otherwise Basset horn, only occurs now as a revival; but the Bass clarionet in low "B $\flat$ " is since the days of Meyerbeer being freely used in dramatic scores, where individuality and variety of tone are specially a desideratum. Wagner's latest operas contain parts for three clarionets, in addition to the bass clarionet. The small clarionet in "E $\flat$ " is sometimes used now-a-days in the orchestra. The clarionet class in fact is beginning to make felt in the orchestra something of the ascendancy which it already possessed in the military band, and is having a powerful effect on tone-colour.

Saxophone.—This is an instrument of the last half-century, and its development and applications are quite recent. It may be called a conical-bore brass clarionet of mellow tone and over-blowing as all conical instruments do into the first harmonic directly after an octave of fundamentals. As a class it extends from high soprano to bass. It has been specially made in plain keys for orchestral use, and has

already been used as a solo instrument in opera by writers of the French and Belgian schools. Each instrument of the class has a splendid medium, and when it is used in groups of three or four, expressive polyphonic effects can be produced. Saxophones with or without clarionets &c. superadded would give good organ-effects, and might under some circumstances be scored so as to replace the usually not very satisfactory stage organ. At any rate the fact that the instrument has already been introduced into the orchestra justifies its mention here.

Bassoon.—This is a narrow conical-bore instrument akin to the hautboy class, of which the essential length is about six feet sufficient to give the note F. It over-blows into the first harmonic after an octave of fundamentals, and after this additional harmonic octave it over-blows yet again into the second or higher harmonics; these further over-blowings are however vastly easier than those of the hautboy, the bassoon being three times the length of the hautboy, and indeed the bassoon is in practical use being gradually forced into regions where there is a double over-blowing. It is prolonged downward beyond its natural scale more than any other orchestral instrument, and in this way gains seven more fundamental semitones down to BB $\flat$, which however do not affect the over-blowing. The points about the bassoon chiefly to be noted here are the constant tendency to force it up as just mentioned, and its being supplemented by the Contra-fagotto or low-octave bassoon. The first-named tendency has arisen on account of the similar tendency to rise shown by the improved clarionet, by the improvement of its own mechanism for the high notes, by the fact that the string basses are now more numerous than they were, and by the fact that new bass wind-instruments have come into the orchestra in the brass group. All these causes have probably acted with equal force; but however brought about, it is a fact that the prevalence of the bassoon-tone in the tenor octave f to f' is greatly on the increase in modern scores, and this has a considerable effect on the general colour. Sometimes one bassoon stays low while the other plays in the high register; but more frequently both move in close harmony or at any rate in octaves; and in either case the low bass is robbed. The use of the contra-fagotto is on the increase, with a view to filling the gap thus left; but no doubt a third bassoon answers the purpose as well or possibly better; Wagner used three bassoons in his Faust overture, which is not a heavy score, and in all his later dramatic works.

Horn.—In passing to the French horn a highly interesting part of the question arises, and some detailed retrospect is here a necessity. The French horn was originally a simple brass narrow conical tube with a hyperbolic-shaped funnel

mouthpiece at the fine end, the tube being coiled circularly so as to be worn over one shoulder and under the other arm for giving hunting signals during the chase. When first taken into the orchestra at the beginning of the eighteenth century this instrument was about fifteen feet from mouthpiece to bell, giving the note DDD for fundamental; in other words it was a "D" horn, to match the "D" flute and "D" hautboy. The fundamental on such a long narrow tube, though it would be procurable by the application of a reed or some such contrivance, cannot be brought out by the action of the lips alone in the mouthpiece; instruments of this sort being therefore called in German half-instruments. A considerable series of natural harmonics can however be brought out by the lips compressed in various degrees, beginning with the first or 8th harmonic, and ending with the fifteenth harmonic or fourth 8th above. I will not trouble my hearers by describing the intermediate thirteen harmonics which are well known; it is sufficient to say that the best on a horn are the medium series third to ninth, giving the familiar broken scale of notes somewhat like a large chord of the dominant seventh and ninth extending over an interval of a tenth, and that the horn runs up in compass of actual sounds to "C" in the middle of the treble clef. The idea of opening sound-holes or stopping-holes in the horn, as in the case of the opicleide or of the keyed bugle of the beginning of this century, has never been entertained, and the horn has always been made to depend on the harmonics to be obtained from a tube which is entire from mouthpiece to bell. But in its primitive state the orchestral horn had consequently nothing like a consecutive scale. Except for the stopped notes and irregularly blown notes, which are a pure makeshift and which I will not here discuss, it had only the broken series on a single tube of the harmonic scale above mentioned. Soon however a change was made by substituting for the single "D" horn a set of horns standing with different fundamentals. This was effected by doing what had already been done in the trumpet; by dividing the tube that is to say into three portions, a "body" of permanent length, a "crook" of variable length, and the mouthpiece. The permanent body of the hand-horn as finally developed in this way was about seven feet long; the crooks inserted between that and the mouthpiece varied in length from about eighteen inches to about twelve feet, the first giving the key of "B $\flat$ alto" and the last that of "B $\flat$ basso." These crooks with the help of some supplementary lengthening pieces gave a set of thirteen horns, one for each semitone in the octave "B $\flat$ " to "B $\flat$," and the whole apparatus went into one box which could easily be conveyed to and from the orchestra. Thus by changing crook, which

could be done between movements or even during some bars' rest, the composer and player had it in their power to at any rate vary the fundamental and attendant harmonics at not very long intervals. Considering however that the remedial mechanical measure now about to be mentioned was already invented in the middle of the eighteenth century, it seems somewhat wonderful that the art should have been content with these certainly primitive arrangements till within the period covered by the present paper. The use of the limited harmonics of the hand-horn, even though the key of that instrument could be changed now and then, had a most potent effect in sterilising orchestral music. It caused stereotyped formulæ in one of the best classes of instruments, it gave thin middles to the harmonic structure, and it deprived the orchestra of an additional chromatic melody-instrument of the greatest possible beauty. It is true that composers early, or at about the time of Beethoven's second period, found the advantage of adding a second pair of horns regularly to the orchestra and having two or even more keys going on at the same time, which gave some relief under each head. But even thus it was much like having a game of post among the instruments in order to secure this and that note, and the arrangements could not compare with the use of instruments each of which had a consecutive scale within itself. The mechanical device introduced for brass instruments about 1830 (and already invented as abovesaid nearly a century before that) was the lengthening valve, called in German ventil, which instantaneously on the touch of a finger on a piston, &c., lengthened the whole bore from mouthpiece to bell by opening out short lengths in the middle. The valves thus brought into action by the fingers are as finally developed four in number; lowering the fundamental sound of the tube by a semitone, a tone, a tone and a half, and two tones and a half, respectively. By different combinations of the four valves and using them singly or cumulatively the fundamental can be more or less efficiently lowered through eleven successive semitones or over an interval of a major seventh, and the harmonic series will begin anew at each semitonal stage; in other words the instruments can be put instantaneously and without recourse to the crooks into eleven different keys, which is the same thing as giving them a consecutive semitonal scale throughout their whole range. The French horn has three valves only, lowering it through six semitones or over an interval of a diminished fifth; which is quite enough for its purpose, and indeed the third valve is sparingly used by the skilful horn player.

The art generally must be said to have been slow in adapting itself to the requirements of this new device in the

case of the French horn, and as the matter is all important from the point of view of the present paper I will endeavour to analyse the motives and causes which have operated in it.

The new valve-horn has two drawbacks. In the first place though the valve attachments reside in the body of the horn and act more or less whatever crook is put on to the body, yet on the other hand they do not act *true* except on a limited number of crooks for which they have been specially constructed. Though each valve has an extension sub-valve by which it can be up to a certain point tuned, no lengthening valve has yet been made sufficiently expansible to serve equally for a very small crook like the high "B $\flat$ " and a very large crook like the low "B $\flat$." The valve can only add a more or less fixed middle length, and that middle length speedily gets out of proportion if the length of the whole tube is greatly increased or diminished by crook. As a matter of fact lengthening valves as made at present only contemplate the application of three or at most four medium crooks, and according to the best practice of valve-making these crooks will only be G, F, E, and E $\flat$, of which F and E are the preferable. Now I have not seen a case certainly where a composer boldly indicated such an impossibility as "valve horns in C" at the beginning of his score, but numerous modern composers have done what is practically equivalent, namely to indicate a "horn in C," "horn in B $\flat$ basso," &c., and then include in the part notes which they obviously mean to be played with valves and which cannot indeed be played in any other way. This practice is common with horns in D, and possibly the valves as made in some countries may cover though indifferently that crook. But valve horns in C and low B $\flat$ are decidedly at present non-existent. The consequence of this is that modern horn players who always have the valve attachment have acquired a habit, since the beginning of the transition period, of transposing all such parts on to the crooks which suit their valves, and chiefly on to the F crook. This, though probably the best compromise under the circumstances, is not satisfactory. The tone of a horn crooked into a low key, say C, is more full, more trombone-like, than the tone of a horn crooked into F; furthermore the conversion of the greater part of the composer's natural notes into piston notes cannot be attended with exactly the same results, especially in a running passage; and furthermore again on the second horn at any rate a number of low notes thus transposed must be of doubtful intonation. And this last point brings me to the second drawback of the present valve horn, which is that its valves when used cumulatively always give too sharp a note, even

when the crook is favourable; they are quite accurate only when taken singly. Thus a held note on the low F# on the space below the bass clef can only be rendered on the F horn by depressing three pistons together and taking a diminished fifth off the second harmonic; but this is considerably too sharp, the player has to correct the intonation as best he can by his breath, and the note shakes.

I beg to say that there is only one proper course open to the modern composer, namely to study duly the conditions of the existing valve-horn, which is a valve instrument that can be reduced to a natural instrument by simply not touching the pistons and is in fact a natural and valve instrument in one. He must then, if he wishes to specify one of the extreme crooks of the horn, either to get its special tone or to have the benefit of the natural notes in that key, write only natural notes throughout the part, or at most confine his accidentals to the use of the semitone-valve in the upper register which can easily be tempered. On the other hand if he writes (as he probably much more often will) for the medium crooks peculiar to the valve-horn, he should in his own interest score so as to make the least possible use of the cumulative valve; with the crooks of F, E, and E $\flat$ open to him he can very easily do so. This general procedure on the part of the composer is what Wagner, after some tentative and certainly not always satisfactory proceedings, finally arrived at; and I do not know that his practice as shown at the last can be improved upon. Turning to the performers, I think they also should remember that they have a double instrument under their control. That they should transpose miscalculated parts, where extreme crooks have been erroneously combined with demands on the valves, or where as in the case of Wagner's middle-period operas impossibilities are asked of them in the way of suddenly changing crook, is not only excusable but necessary. But why they should apply this practice to the works of the older masters who wrote obviously for the hand-horn and nothing else, I do not understand. Neither should they transpose the parts of modern composers who write for this and that crook and know what they are about. I think that conductors should consider these distinctions and make the horn players bring the crooks necessary in each case into the orchestra with them. The present plan of universal transposition is not the way to get the best tone out of the orchestra.

However it is time that I proceeded to deal more directly with the function proper of my paper, which is to show the effects of the valve horn generally on tone-colour. Whether quite correctly written for and used or not, the fact remains

that the valve-horn has for modern music supplanted the mere natural-horn; and as this new instrument still retains its character of natural horn if the pistons are not put down (for the mere presence of the attachment itself does not appreciably disturb the tone), the result is a clear gain and a gain of an inestimable nature. The modern horn can sing any melody, take part in any polyphony, and proceed chromatically to any note; while it can revert at pleasure to the functions which formerly characterised it. The genius of composers knows how to utilize all these capabilities without going to excess. The result has been an extraordinary enrichment of the medium register of the orchestra in numerous combinations, while there is the accessory advantage of increased freedom given to other groups to spread beyond the medium; the horn acting here alike as coadjutor and as substitute. Even two valve-horns would be sufficient to secure much of this result, but as four horns have been left in the orchestra as a heritage from the period at the early part of the century when modern chromatic and modulatory work caused the introduction of the second pair, and as these four must remain if only for the execution of so many compositions of that fertile period, the composer will always have a full group at his disposal. Where solidity in the medium has degenerated into heaviness or confused effect, it is only from composers sometimes forgetting that they need not always use the four instruments because they are there. Apart from making three and four-part harmony with the first pair, the second pair of horns finds a sufficient rôle in occasional employment of the extreme crooks with natural notes, in taking say the E $\flat$ or E crook against the F crook of the first pair where there is much modulation, in alternating with the first pair to give the latter rest, or in actual doubling of the first pair so as to increase power. No tone in the wood-wind group can in any case compare with that of the horn in its power of piercing through superimposed sounds, while its player has to be essentially a singer; and on the whole the valve-horn is the chief factor in our new orchestral developments.

Trumpet and Cornet.—The Trumpet is the 8-foot instrument lying above the 16-foot horn, being of narrow bore with the first two-thirds cylindrical, and blown into with a hemispherical cup for mouthpiece so as to produce a brilliant tone. The natural instrument had crooks at first for E $\flat$, D, and C; but since then it has had crooks semitonally from high B $\flat$ to low A. Three piston lengthening-valves have been fitted to the natural trumpet, applicable chiefly to the F crook, but also to the E and E $\flat$, and sometimes to the D crooks; and this valve-trumpet is the instrument of our modern orchestras. In England a short slide

working by the finger over the cylindrical portion on the trombone principle has been applied to the natural trumpet in the crooks F, E, E $\flat$, and D, lowering its fundamental through two semitones and producing an instrument of very perfect intonation at any rate; but the slide has given place to the valves, which can lower through six semitones, and are also more favourable to the legato. Precisely the same remarks apply here as were made for the horn, as to the modern trumpet being a natural instrument and valve instrument in one, and as to the uncertain action of composers. Owing to the simplicity of the part however, and the want of importance of the lower register for practical purposes, there are perhaps less objections here to the valve trumpet players transposing natural-trumpet parts to suit valve-crooks. In a less degree than the horn, but not dissimilarly, the chromatic trumpet has contributed to change the character of our modern orchestra. It is idle I think to say that a trumpet which can sing a part has lost its essential qualities. That depends solely on the composer. The whole orchestra is moving together in the direction of increased polyphony in varied tints, and there is no reason why the trumpet tone should not be included. The use of chromatic trumpets in three parts is also a feature of the new orchestra, where the score is large; and these combined with the bass-tuba and three trombones form a magnificent septett covering the whole range of a chorus of human voices, for the trumpet goes up to A above the treble-clef stave. The piano effects also of the trumpet in the medium or low are now more used than formerly. It is to be observed that a special narrow-bore valve-trumpet exists also in high B $\flat$, running up to D above the treble clef; and this is the proper instrument to use where very high effects are required.

Along with the trumpet ought to be mentioned the Cornet. The use of this wide bored 4-foot instrument to replace by its necessarily lower harmonics the higher harmonics and commanding tone of the 8-foot trumpet is quite deplorable, and is the only serious element of retrogression which I have to call attention to in our modern tendencies. The cornet cannot attempt to rival the second trumpet in the low notes below the treble clef stave, while on account of its wide bore it goes no higher in upward compass than the ordinary first trumpet. Its tone is snappy. It has been allowed to take the place of the trumpet partly because it is easier to play; but I confess I am not in possession of the reasons which prevent the player from bringing both trumpet and cornet into the orchestra, and using each as required by the scores to be performed. It has also obtained its present position because it was first in the field, having been one of

the products of the French dramatic orchestral revival, before the valve trumpet had been invented; but the valve-trumpets are now manufactured in abundance. The cornet has a legitimate function in the orchestra only for taking some florid part, where its executive powers can come into play, superimposed over the two ordinary trumpets; and this is how some of the best dramatic composers from Meyerbeer onwards have used it. I trust I may meet with some sympathy in my protest against its use to replace the trumpet in scores which are not written for it. The valve-trumpet is there ready for all modern and ancient uses, and I believe it merely requires the fiat of conductors to restore the trumpet to its legitimate place in the orchestra, where its clear piercing tone is quite unique and unrivalled.

Trombone.—The trombone is approximately a 7 or 9 or 11-foot instrument, with a bore which is for the first two-thirds cylindrical specially designed for bringing out the low harmonics, and with a slide which lowers the fundamental through six semitones or over an interval of a diminished fifth, the same as the three cumulative pistons on the horn. Its three varieties, alto, tenor, and bass (covering altogether exactly the range of the contralto, tenor, and bass voices), are the natural substratum in the score on which rest the two trumpets; nevertheless it is to be observed that such instruments are explosive in their sound, while the use of the slide prevents legato effects, so that on the whole their introduction in the bass and low medium produces a very special effect, and artistically speaking they with the bass-tuba below them form a separate group. An endeavour has been made to replace the action of the slide by three piston-valves, which, as the third piston is here a piston of two tones, gain one semitone below over the trombone slide, and of course furnish a better legato; but the intonation-defects of the cumulative valve are very noticeable on the trombone, whose principal function is to fill in the low part of the harmony, and the ancient slide for that reason still holds its own. The employment of three trombones in trio almost belongs to the period here under notice, being greatly developed since 1830; but otherwise there is not very much to record as to artistic change in their use. The alto trombone being uncertain in its lower notes is giving way to a first tenor trombone, which is a pity, especially where the trumpet just above it is also allowed to drop out. The bass trombone in G, F, or E $\flat$, though a magnificent instrument with an extraordinary compass, is also going out of fashion in favour of a third tenor trombone; partly because it is a fatiguing instrument, and partly because its register is being pushed up by the inclusion in the orchestra of the bass-tuba next to be mentioned. Modern composers are making great use of

the versatility of the trombone trio in the way of presenting very close or very extended harmonies, they are also much using its piano effects, and some writers as for instance Brahms are beginning to use it even polyphonically within itself as a mere orchestral feature.

Bass-tuba.—This is the lowest bass of the bugle family, that is to say of instruments which have an ever-widening bore and are called in German whole-instruments because they can sound their fundamental with little difficulty. The old Ophicleide was a large bugle with stopping-holes and keys, the Saxhorn is another name for the bugle family as fitted with valves and pistons since about 1845, and Euphoniums, Bombardons, and Bass-tubas are names for low representatives of these last; I give these definitions as the nomenclature is not always well understood. With the help of four valves the bass-tuba gives a chromatic very low bass, and as its mouthpiece though conical is large the performer can correct the errors of the cumulative valve; hence it is regarded as a trustworthy foundation to the brass group. The bass-tuba is playing an important part in the development of the orchestra of our day. It is forcing up the bass trombone and converting the trombone trio of three-part harmony into a quartett of four-part harmony; it is in many cases replacing the old less strong low held-notes on the horn, and it is even with its genial and accommodating tone furnishing a substitute for the violoncello or second bassoon when the double-bass is playing uncovered by the superior octave. The first of these is really an important matter. No doubt the presence of a fixed bass at the bottom of a set of instruments which like slide-trombones are played quite subjectively at the will of the player just as human voices sing, has a very steadying effect on the performance; and the opportunity for four-part harmony in the low medium of the most powerful part of the orchestra is also a valuable new resource. Still if the bass trombone was reduced to taking the tenor part in the harmony, it would very soon cease to exist, and this would be a great loss. In the best scores the bass-tuba is independent, acting first with one set of instruments and then with another, and the bass trombone is only now and then put into the position just mentioned. On the whole this latest born member of the Sax family is probably destined to play a noteworthy part in the building up of the modern orchestra; but I beg to protest in passing at the frequent substitution for it of the baritone tuba, otherwise called Euphonium, which has by no means the same calibre or qualities.

Percussion.—Among these instruments I wish to point to the third or medium kettle-drum ranging from A to D recently introduced. It is to be found now in every

respectable orchestra, and by removing some of the intolerable restrictions caused by having only two kettle-drum notes at a time to cover all modulations it has given variety to many scores. Composers however seem rather slow to take it up. The bass drum or *Gran cassa* has lately been used in a half-tremolo with its own stick, a prominent example of which is in Rubinstein's "Ocean"; or in a regular tremolo with a pair of kettle-drum sticks, examples of which are frequent in Liszt.

Harp.—The habitual use of the harp in the orchestra belongs exclusively to the period under notice. It requires a refined taste to employ it correctly, and being obtrusive it is apt to betray any shallowness which may lie in the music; but the modern dramatic orchestra at any rate would not be complete without it. Its low tones are splendid and can be heard against a moderately full orchestra, while the treble and harmonic effects are well known.

Organ.—Apart from the special effect of the stage organ, this is only useful for assisting the orchestra to support vocal masses. The introduction of its pedal notes, especially if the organ has 32-foot tones, creates a complete transformation of the whole body of sound, and it is to be feared that many anti-climaxes have been committed by not sufficiently recognising this in preparing the score; but modern composers have made great use of it, even sometimes in secular music, and it has to be mentioned here.

Strings.—The stringed orchestral instruments played with the bow have this peculiarity, that their four strings are (unlike the pianoforte) all of the same length, and gain their difference of pitch only by difference of substance; this bears on the present subject, because the natural tendency has consequently been towards the use of the higher strings and especially the first, where the brilliancy of the sound is greatest. However as to actual manufacture the only fact here noteworthy is that the E string on the double-bass has become a necessity to balance the increased power and upward tendency of the orchestra; though the fourth string mounted on the bridge rather impedes execution, the four-string double-bass is in our times ousting the three-string double-bass.

The cause of the changes in the general tone of the string orchestra in our times consists almost exclusively in the enlarged skill of the executants, whether for left-hand technique or for bowing; and I find that this subject divides itself into the following heads, (*a*) figuration, (*b*) forms of accompaniment in monodic work, (*c*) double-stopping, (*d*) divisi work, (*e*) special effects of pizzicato, sourdine, and harmonics, (*f*) departure from the medium register, (*g*) use of extreme keys:—

"a."—There was scarcely more change from the time when the strings merely duplicated voice parts to the developed figuration of the masters of the early part of the nineteenth century, than there has been since the time of Beethoven down to our own in this direction of the creation of varied figures. A glance at any score by the modern writers will reveal this without my going into detail. There is very little now in the way of figure that a violinist cannot do on one string or across the strings. Some stock figures still remain more effective than others, but nevertheless the variety of modern figuration almost eludes analysis. Perhaps the most polyphonic part of modern scores is the second violin, which thus asserts an individuality against the melodic first violin. The violoncello again is more independent of the double-bass than it ever was before, and this free voice moving about in the lower part of the scale is one of the chief causes of the enrichment of our modern orchestra.

"b."—Though polyphony and contrapuntal treatment are on the increase, the monodic style concurrently holds its own, and for this modern scores show a great increase in variety of forms of accompaniment. The ordinary tremolo on one string, or two strings double-stopped, is well known. The broken tremolo on two strings double-stopped, that is to say where the up-bow takes one string and the down-bow takes the other string, is less known, but has an effect of its own. The accompaniment figure which may be called the "widened trill" is almost a specialty of modern times; in the widened trill on a single string, the first finger stops and the third or fourth finger rises and falls on the same string at a distance which may extend to about a perfect fourth, while the bow continues its course; in the widened trill on two strings, one finger stops on one string, while another finger rises and falls on the next adjacent string at an interval which may extend to an octave, while the bow continues its course and the wrist oscillates between the two strings. The figure here mentioned has in the upper region produced those delicate and almost ethereal effects in which the moderns have so frequently acted on the initiative of Berlioz and Wagner. Arpeggio accompaniments, with all sorts of complications of bowing, are also on the increase, though they are not very effective.

"c."—Double-stopping, unknown to Handel and scarcely known to Bach, is at the present day an essential feature of the orchestra, where modern harmonies could hardly be carried on without them. When judiciously used on favourite intervals, double-stoppings are an unmixed gain, and are one of the chief causes of modern sonority. The violoncello has a specialty here. Violins and violas being

instruments *da braccia* must be held in position by the thumb at back of the neck of the instrument; almost equally so the double-bass on account of its size. But the violoncello is an instrument *da gamba*, which can be supported conveniently by the body alone, and the thumb can with ease come from behind on to the finger-board for various purposes. The thumb laid transversely stops fifths very purely; in other double-stopping also it can stop one note of the interval while the whole stretch of the hand is available to go forward for completing the interval up to the limits of an octave. Violoncello double-stopping is becoming increasingly resorted to for developing sonority in the lower registers.

"d."—Where double-stopping fails modern composers are having recourse throughout the whole string range to "divisi" work, thereby immensely increasing the fulness of the harmony and its extension both downwards and upwards. Violas are so largely divided now-a-days, that it is doubtful if we shall not shortly see first and second violas introduced as a normal feature in the constitution of orchestras and scores; the change if it ever occurs will be a potent one, for the tone of the viola is very special.

"e."—I will not stop to do much more than mention the increased use of pizzicato, sourdine, and harmonic effects. These devices are sometimes abused; for instance too much sourdine is as bad as the incessant employment of the soft pedal on the pianoforte adopted by indifferent accompanists of singers, who do not realise that this tone effect when prolonged is quite unnatural and painful. On the other hand it is to be observed that a pizzicato on the lower part of the double-bass is at least as good as a bowed note of the same duration, and the moderns are fully alive to this.

"f."—Constant use is now-a-days made of close harmonies in the higher and lower regions as opposed to the medium. When this is done one seems to have three orchestras in place of one. It is almost unnecessary to point out that orchestral violinists now mount to such positions as the tenth and eleventh on the first and second strings.

"g."—Lastly I would mention that composers are less afraid now-a-days of extreme keys for the strings than they used to be. This is not an unmixed advantage, and perhaps is one of the few things where the tone of the orchestra is changed for the worse, for the strings must always have their favourite keys. In connection with this subject however it is to be noticed that the composers of the present day are rapidly throwing enharmonic considerations whether of notation or fact to the winds, and boldly treating the orchestra as an instrument of equal temperament, which if

not an advantage, must I think at least be classed as a strict necessity of our times impossible to be contended against.

Summary of Heading (A).—As the instruments have necessarily been considered piecemeal, it will be better that I should here sum up results concerning them. The application of new key mechanism to the flute by Boehm to reduce it to equal temperament and otherwise improve it happened rather more than half-a-century ago, and all the other members of the wood band have subsequently been treated in like manner or nearly so. The chief characteristic of the wood-wind of the most modern scores is an increasing freedom from such traditional methods as held notes and simple melodic doublings, and a development in their place or in supplement to them of figurations special to the classes and independent of the string group. This proceeds from the improved mechanism just mentioned and the increased sense of polyphony among composers and audiences, each acting upon the other. Another characteristic is the greater variety caused by instruments occupying new parts of the scale or having their tone improved in particular regions. A third characteristic is increased richness due to numerical enlargement of the classes within themselves; though this of course will only take place in specially large scores. Passing to the brass, the valve horn has almost revolutionized the modern orchestra. That sense of fulness and sonority which distinguishes it, making it as compared with the old orchestra much what the new organ with double diapasons or double reeds is to the old organ without them, is due in great part to the use of the valve horn and all the consequences it brings with it. The brilliant trebles now found in the brass, and the new basses found in the bugle family, are all due to the valve. The third kettledrum deserves notice in making what the poet Campbell calls "the stormy music of the drum," and in helping out the swing of the orchestra. In the string foundation to the orchestra, immense volume and effect have been gained by increased demands upon the skill of the executants, and by converting what was once a quartett into virtually a group of very many parts largely emancipated from the rules of the older counterpoint but developing a new contrapuntal system of its own. If there are those who would suggest that all these changes tend to noise, I can only say that now as in all ages there are those who abuse and those who know how to wisely use the resources of the time in which they live. Wordsworth says that "sweetest melodies are those that are by distance made more sweet"; but though this may represent a frequent mood of the dreaming amateur, yet well-directed fulness and power will always appeal to the general audience.

(B.) DEMANDS OF THE PUBLIC.—I may now for the short remainder of my paper emerge a little from technicalities; with which I hope I have not overcharged the paper, but it is necessary to build inferences upon facts. Dramatic music has always from the times of Monteverde's "*Orfeo*" to the present day been the precursor of concert-room music in the way of orchestral innovation, and French music has always been nearly exclusively occupied with the drama. The revolutionary period of French history from 1830 to 1848, that is to say the period during which the people though nominally under the elected citizen-king Louis Philippe were in reality trying conclusions with the monarchical principle, witnessed a great outburst of popular craving for effect in the music of the stage. This was the period of Halévy's "*Juive*," Berlioz' "*Benvenuto Cellini*," and Meyerbeer's "*Robert le Diable*," "*Huguenots*," and "*Prophète*"; following as they all did Rossini's "*William Tell*," which had appeared just before in the reign of Charles X. This was also the period, it may be added for indicating the chronology though the works were not written for the Paris stage, of Verdi's "*Ernani*," Balfe's "*Bohemian Girl*," and Wagner's "*Rienzi*," "*Flying Dutchman*," and "*Tannhäuser*"; "*Rienzi*" was written under the Meyerbeer influence and the "*Flying Dutchman*" was written at Paris. During this period the Boehm system of mechanism was being applied successively to the flute, hautboy, and clarionet; the corno inglese was incorporated regularly into the dramatic orchestra; the clarionet, not perhaps very well used by Rossini, was given great prominence to by his successors; and the new bass-clarionet was taken into the orchestra. Simultaneously the valve cornet or cornet-à-pistons then new was introduced into the orchestra as a melodic part lying over the two trumpets, and the keyed ophicleide also comparatively new was added to the basses; thus giving altogether to the brass group an independence never before thought of. The harp was also added permanently to the orchestra. These considerable changes may fairly be set down to demands of the French public. The historic period of the Second Empire in France from 1848 to 1870 was one in great measure of martial display, gratifying to if not initiated by the nation; and the requirements of the military system gave opportunity for the inventive faculties of the instrument maker Adolphe Sax, a Belgian by birth but naturalized from 1842 onwards in France. Apart from his invention of the keyed saxophone he developed the valve as applied to all brass instruments, and the consequence of his improved mechanism was the adoption of the valve-horn throughout Europe as a permanent feature of orchestras, in lieu of its tentative and occasional use as for instance in the

"Juive" of Halévy. The valve-horn was followed by the valve-trumpet. I have already indicated the great importance to the orchestra of such developments. The bass-tuba again is the orchestral representative of M. Sax's large family of saxhorns. There can be no doubt that all these changes in the brass had their first impulse in the military spirit prevailing among the French during the early part of the Second Empire. An instance of the direct effect on the orchestra caused by public demands is the question of the accommodation of audiences. Now-a-days the number of those who wish to hear is so greatly increased that the old moderate-sized concert rooms are going out of fashion and larger orchestras are quite a necessity, while orchestras more fully constituted are certainly also directly to the taste of the listeners. I have always been under the impression that the best form for a concert-room is an oblong room with a parabolic recess at the end, the orchestra being grouped round the focus of the parabola. If the larger rooms could maintain this or some similar principle there would be nothing to complain of; but, unfortunately this is not so, and the orchestra in many large modern buildings exhibits acoustic defects. On this question of the shape of our buildings I am doubtful whether we are advancing. Another instance of the action of the public is the increased demand, caused by increased knowledge and sensibility, for detailed light and shade and expression of every kind; the consequence is that in a hundred matters which were formerly left to the performer the orchestra is now de-individualized and made to act under word of command in the shape of expression marks carefully distributed among the different performers and controlled by the conductor. The effect of this on the collective tone is of course very great.

(C.) ACTION OF COMPOSERS.—From one point of view this head may be considered to be not distinguishable from the last, on the ground that composers only respond to the public demand. But the greater the artistic gift, the less this is so; and though the approval of the public must be the ultimate aim of every artist, yet with many the interior impulse to create is so great as to act almost alone and without any reference to eventualities. In other words in the case of many composers, and probably in the case of all the best, the initiative proceeds from them and not from the public. Among composers who have helped to push forward the most modern orchestra as a direct result of the exercise of their genius, I think the following may be specially mentioned:—Meyerbeer, Berlioz, Wagner, Liszt, Verdi, and Brahms. The remark applies less perhaps to Meyerbeer than to any other on the list, but nevertheless his genius for the spectacular march was genuine and went a long way

towards securing the independence of the brass group in the score and the orchestra which now prevails. Berlioz' powers, if highly inspired, were certainly irregular and uncertain; and so I think with his orchestral effects, some of which are perfect in their balance, while others seem to have been miscalculated. Berlioz' strength did not I believe lie in the grandiose, though he was much addicted to that, but in the subtle and delicate. The unrivalled violin effects in the scherzo of the "Romeo and Juliet" symphony were compared by a hostile if witty critic of the day to the squeaking of badly greased syringes; but a more sympathetic writer said that they formed the ideal orchestra of insects and grasshoppers, and I think that that is the verdict of posterity. These elfin-like effects in the orchestra were invented by Berlioz and bequeathed by him to Wagner, on whom generally he had much the same influence that Spontini had on Rossini. No modern composer has modified the orchestra by direct impulse from within himself so much as Wagner. It is not perhaps always realised that he did not begin by any particular alterations or reforms in orchestral usages, and that these only grew up along with the expansion of his powers as a creative composer; up till "Lohengrin" in 1847 there is nothing very special in his use of the orchestra, and he did not attain his true orchestral style till he had created an entirely new form of composition by "Tristan and Isolde" in 1857. Apart from such questions as reliance on the separation and individual treatment of the minor classes of the orchestra, the employment of an excessively large score in his latest works, and the introduction of a new class of brass instruments of the sax-horn family, Wagner's chief characteristic is an immense polyphony throughout the whole range of the score; his counterpoint has the boldness of Bach, with all the resources added of nineteenth century effects, the license of dramatic music, and his own individuality. Though Liszt was two years older than Wagner, his career as a composer for the orchestra began after the appearance of "Lohengrin," and after he himself had attained his fortieth year. While learning much from Wagner he treated the orchestra in quite his own way; as indeed was natural considering that he wrote for the concert-room. It is at first sight somewhat remarkable that an artist who had given the whole of his life theretofore to becoming the first virtuoso in the world upon the pianoforte and to writing music for the technical display of that instrument, should with little effort or delay obtain the position of an almost incomparable model for effective orchestral treatment. However it is probable that the same minute attention to detail which his first career necessitated,

enabled a man of his gifts to treat the orchestral instruments also in a sympathetic spirit. Certain it is that he developed brilliancy and every description of expression in the orchestra, as he had previously done on the pianoforte; the best examples of which are his 13th Psalm and his Symphonic poems. Verdi not only is the founder of the new Italian school of musical drama, but must also be included in considering the developments of the orchestra; the broad polyphony created by the intellect of Wagner is unknown to him, but short of that his characteristic in his later works is an infinite variety of orchestral tone peculiar to himself. Brahms has brought the effects of polyphony in wind and string parts, and contrast of groups, to the same pitch in the concert-room that Wagner had done in the theatre, while using scarcely more than the orchestra of Wagner's first manner. He is the direct descendant of the great masters, especially those of the Vienna school; and while I wish to say the least possible in this paper regarding the merits of composers as such, I must point out that orchestration which has a great style at its back must *ceteris paribus* be more effective than orchestration which has not. I think there will not be much cavil at the statement that for sonority and general completeness Brahms's works show the acme yet attained in orchestral tone.

DISCUSSION.

THE CHAIRMAN.—I am sure we are much obliged to Dr. Maclean for this paper, so learned and interesting, and which we shall find most instructive to read. There will always be an immense amount of difference of opinion of the quality of tone and evenness; but I must say I do not altogether sympathize with those who are afraid of valved instruments, for the improvement in the making of this class has been enormous the last few years. As far back as 1878 I was on a jury in Paris with Mr. Gevaert. We put valved instruments to most severe tests, we listened to them from behind screens, making the players sound the harmonic series with each valve separately and in combinations, but I thought their tone very pure, and their intonation just.

Tampering with the tone-colour of a composer, one of his most important means of expression, is objectionable. No one would dream of altering the colours of a fine picture, but in music this is often done without the slightest compunction. It is much to be regretted that although we have had this

interesting historical account of the orchestra's tone-colour, we have no means of letting you hear by mechanical means the exact tone of an orchestra of the past. We shall, however, have a revolution in this matter, for the phonograph will be able to register accurately and permanently the tone-colour of our present orchestras and hand it down to posterity. How interesting it would have been if we could have turned a handle and heard the effect produced by ancient hautboys and other old instruments. No one has ever heard the qualities of tone which Handel heard, and to re-produce all these different tones would be most valuable if it were possible. It seems to me that Dr. Maclean has given us a great deal to think about. There is no doubt that we shall have in these days of advanced musical education to make this question of tone-colour in orchestras a real branch of study. You know how very little is learned by the young student who buys a book on instrumentation and finds out how high an instrument can go and how low it can go, and so on; that is merely the threshold of a subject of enormous interest, and I hope that some day we shall have professors who will take their pupils to the phonograph and let them hear the different combinations. It should, I think, be in the power of important institutions to have an orchestra on the spot, and let the students hear such harmonies as Dr. Maclean has alluded to—for instance, a four-part trombone harmony. It would give young composers a chance of forming individuality in their style, and as they grow up they would know the resources at their disposal. There is no reason why the tone-colours of an orchestra should not be known to us as by special names, just as blue, green, red, and yellow are used to describe particular colours. Names, no doubt, *will* be found for them. It was a long time before mankind found names for colours. Dr. Maclean, as an old classical scholar at Oxford, will bear me out that the Latin purple was used for blue, and white, and sea-green, and all sorts of things, not because the Romans did not know the difference, but because they had no name to express it, and there is no doubt that Hebrews and other ancient nations knew differences in colours but did not know what to call them. Somebody must have invented those terms, blue, red, yellow, and green; and there is no reason why somebody should not some day invent colour-names for the orchestra, which we now put down as brilliant, sombre, light, or heavy. I hope some day that the expense will not deter us from giving historical concerts with the music of Handel in its own tone-colour, instead of adapting it to the modern orchestra or adapting the modern instruments to them. It would be deeply interesting, presenting us with an enormous amount of novelty in music.

Mr. CUMMINGS.—How are you to get hautboys and trumpets? Certainly not the same instruments now as in Handel's time. It is on record that the trumpets of Handel's time played as soft as the hautboy, so that we may take it for granted that the tone was very different to that now.

The CHAIRMAN.—They would have to be made; but is that impossible?

Mr. CUMMINGS.—The instruments are now only made experimentally, and in a sort of tentative way; we have nothing to guide us.

The CHAIRMAN.—They might have some in museums. There must be a large number of trumpets existing of the time of Handel, even in old regimental bands; they often preserve old instruments.

Mr. CUMMINGS.—An interesting thing perhaps to mention in connection with the subject is, that although in Purcell's time the orchestra did not practically exist, he used three oboes (tenor hautboys), bassoon, and trumpets.

Mr. COBBETT.—It might perhaps be interesting to call attention to the incompleteness of the flute family in the orchestra. It is the only instrument of the orchestra which has not a complete tone scale—that is to say, that no member of this family goes from the top to the bottom of the orchestral range. There have been tenor and bass flutes, but they have never gone beyond manufacturers' experiments. They have never been successfully performed upon, I think. I recollect hearing some concerts many years ago under the auspices of Rudall Carte & Co., in which these instruments were used, and I believe the drawback was the excessive effort of wind power required on the part of the players. Mr. Benjamin Wells was very successful in his efforts on the bass flute, but I think they found it very difficult to find any-one else to produce a good tone on the same instrument. I think composers would very much like to have a more complete scale in the flute family, they would certainly be ready to make use of it.

Dr. BRIDGE.—The old set of recorders which is now in Grosvenor Museum, Chester, is really a set of old flute instruments. I have heard them played, and my brother has lectured on them once or twice.

The CHAIRMAN.—Some old song books have pictures of flute quartets.

Dr. BRIDGE.—“O Mistress Mine” was arranged by Morley in one of his six books for these instruments, if I remember rightly. The flute part is in the British Museum; but this is not the melody, but is an inner part, the melody being played by the viol.

Mr. CUMMINGS.—That flute was of course the *flute-à-bec*.

The CHAIRMAN.—It had its own tablature, which I may say shows it must have been in common use.

Mr. WEBB.—They were used very much in Germany. At the Military Exhibition there was one over five feet high, of about the fifteenth century.

The CHAIRMAN.—I am afraid Dr. Maclean's paper will frighten some young students by letting them see what a heavy amount of work is now required in modern music, and the enormous amount of resources there are in colouring.

A vote of thanks to Dr. Maclean was then passed unanimously.