HAY

ON

HARMONY OF FORM

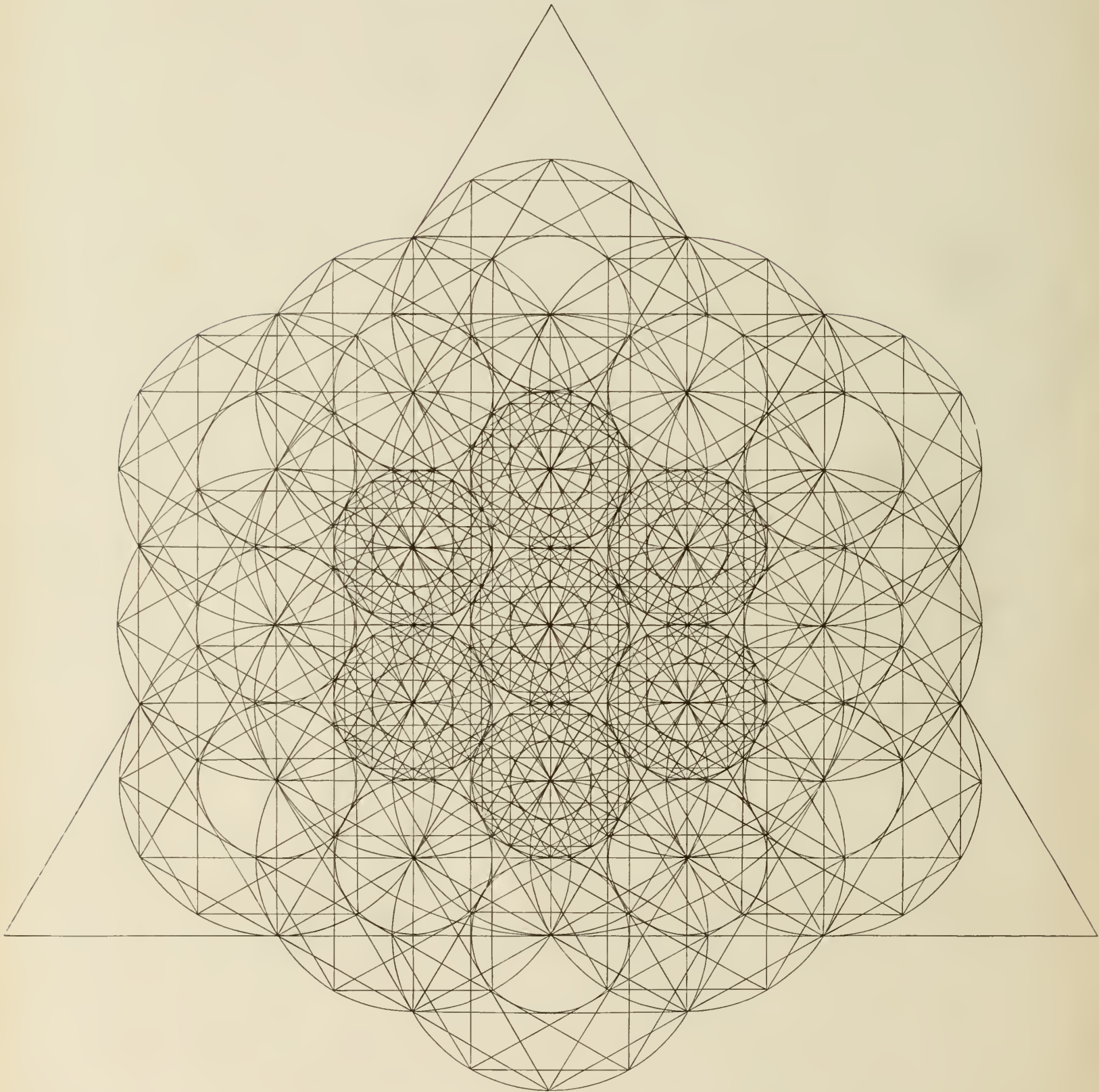## PRICE FIFTEEN SHILLINGS

CONCENTRATED DIAGRAM

of the
NATURAL SCALE OF FORMS

THE

NATURAL PRINCIPLES AND ANALOGY

OF

THE HARMONY OF FORM.

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"WHEREVER THE BEST TASTE DIFFERS FROM THE WORST, I AM CONVINCED THAT THE UNDERSTANDING
OPERATES, AND NOTHING ELSE."—BURKE on " The Sublime and Beautiful."

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INTRODUCTION.

It will not be disputed that the effect of forms upon the eye is either harmonious or discordant, agreeably to certain modes of arrangement of the lines which circumscribe them, or divide their parts. All writers on taste, architecture, landscape-gardening, and other subjects where discussions on the beauty of form are necessarily introduced, admit this fact. At the same time it is allowed, that as yet there has existed no system, or development of fixed principles, by which forms may be harmoniously arranged, but that judgment in such matters depends upon an abstract idea of beauty not easily defined. One of the latest and best writers upon taste says—" In the greater part of beautiful forms, whether in nature or art, lines of different descriptions unite. The greater part of the forms of

nature and art possess an union, or composition of uniformity and
variety, of similarity and dissimilarity of forms.   But were such a
combination in itself beautiful, it would necessarily follow, that, in
every case where it was found, beauty would be the result.   This is
not the case, however."[1]   And in support of this fact, the author in
question quotes Mr Alison, who says—" Every one knows that the
mere union of similarity and dissimilarity does not constitute a beau-
tiful form;" and proceeds to say, that it is only when we perceive
or imagine a correspondence among the parts—a relation and har-
mony—that we are enabled to say, " that nature has been kind in
combining different circumstances with so much propriety for the
production of one effect."

One of the latest and most eminent writers on architecture
observes, in an excellent essay upon that subject, that—" It may be
asked what standard of beauty there is in this art on which taste may
be formed; though it must be obvious, that like other children of
the imagination, such as poetry and music, no other can be assigned
than such compositions and modes of arrangement as, by their har-

mony and simplicity, attract the attention of the rudest mind, which is pleased without being conscious why, and of the most learned or practised, which discovers in them those proportions and peculiarities of form which always produce the most pleasing impression, and appear to be dictated by nature."[2] Quotations to a similar effect might be given from innumerable works; but the above are considered sufficient to prove, that our general knowledge of the important subject of the harmony of form is open to improvement. If, therefore, it can be shown, that the impressions made upon the eye by forms are really founded on natural principles, and that the proportions and peculiarities of form which produce the most pleasing impressions, are in reality, as well as appearance, dictated by nature, being a response to these principles in the human mind, a desideratum in the arts will be obtained. And further, if it can be shown that, agreeably to the boundless analogy by which the sciences and arts are connected, forms are in all respects analogous to sounds, and that consequently a system of linear harmony can be established, similar to that which regulates the arrangement of musical notes, a know-

ledge of this important branch of art may also become a part of elementary education.

There can be no doubt that the effect produced by the harmony of sound, colour, and form, are equally the result of a susceptibility of the human mind, which renders it capable of appreciating an adherence to certain natural principles by which harmony in every case is produced. These principles are clearly understood in regard to the harmony of sound, from its having occupied the attention of the most eminent natural philosophers in all ages. Colours, likewise, since the discoveries of Sir Isaac Newton, have in their combinations been reduced to something like system. But the harmony of form has been left out of those enquiries, as a matter depending upon opinion alone, unless in regard to architecture, where the works of the ancients have in some measure supplied the want of general principles.

As a knowledge of the natural principles which regulate the arrangement of musical sounds tends to improve the general understanding and practice of that particular art, without producing a musical ear, or enhancing the pleasure derivable from an intuitive

perception of " the melody of sweet sounds ;" so may a knowledge of the natural principles of harmony in form improve our judgment in architecture, sculpture, and painting, without rendering us fit to follow any of those arts as a profession, or enhancing the pleasure conveyed to the mind by the visual organ.

A person is said to have an ear for music, in the ratio of the sensibility of that organ to the relative gravity and acuteness of sounds ; and when this is accompanied by an intuitive appreciation of the natural principles which regulate their combination, he will, according to the extent of this talent, have a genius for musical composition. So, likewise, in the ratio of the sensibility of the eye, and intuitive appreciation of the natural principles of form, will an individual possess a facility in producing harmonious arrangements, independently of any other knowledge of these principles. Thus works of art in all ages have occasionally displayed the most perfectly harmonious combinations of form. These are, however, of rare occurrence, being the works of men of great genius ; and although they may be models for the careful study of those who follow such

arts professionally, they cannot supply the place of natural prin-
ciples in forming the public taste.   Had the arrangement of musical
sounds depended, like that of forms, upon the works of the ancients,
without a knowledge of the natural principles upon which the excel-
lence of these works depends, music could not have become a part
of polite education.

It is not, therefore, assumed that this attempt to develope the
principles of linear harmony, whatever its success in other respects
may be, can have any effect in raising the standard of excellence,
by improving the practice of professors of genius in the various arts
which owe their excellence to beauty of form.   Its object is more the
improvement of the public taste in judging of such productions ; and
it is believed the fact will be readily admitted that such an attempt
is not uncalled for.   Neither can a knowledge of these principles
tend, in any way, to add to the number of professors of the arts of
design : it will rather lessen it ; for as the public taste improves,
untalented pretenders in all such professions will be detected, and
sterling genius will meet the encouragement it alone deserves.

THE

NATURAL PRINCIPLES OF HARMONY IN FORM,

AND

THEIR ANALOGY TO THOSE OF SOUND AND COLOUR.

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THAT form, in its effects upon the eye, is analogous to sound in its effects upon the ear, has been generally admitted.

There appears to be three different kinds of harmony in sound; or rather, that the mind is, through the ear, addressed in three different ways. This organ is generally as susceptible of the intonations of the voice of the orator, as it is of the meaning conveyed by his words. It is more powerfully affected, in point of harmony, by the artificial tones of the vocalist; and to a still greater degree, by the more powerful, though still more artifi-

cial, effects produced by the combination of vocal and instrumental music.

The first of these effects is a mere auxiliary to the meaning conveyed by the oration of the speaker; and it is a powerful one—as the response in the mind to the natural principles which regulate all sounds accompany the words, which address themselves at the same time to the judgment. In vocal music, the effect of the melody is generally fully as powerful as that of the meaning contained in the words which accompany it; and although the combination of this with instrumental music is perhaps more artificial, it is still more comprehensive, by the variety and power with which such a combination can address the ear.

Forms are also made to address themselves to the eye in three ways, quite analogous to those in which sound is made to address the ear. The simple though expressive combinations of form in architecture, like the harangue of the orator, addresses itself more to the judgment than the senses; the more artistical combinations of the sculptor not only tell a story, but do so in a way which is

capable of exciting the feelings to the highest pitch to which expression, combined with form, can carry them; and there are also the still more artificial, though more comprehensive, effects produced upon the eye, by the combination of expression, form, and colour, in the works of the historical painter.

Colours, when unaccompanied by form, are somewhat like instrumental music, in which an understood feeling may be conveyed to the mind, depending on the mode of combination, which can only be appreciated by a correct eye in the one case, and a musical ear in the other. Colour has its three effects of harmony; the effect of the three neutrals, white, grey, and black, which are capable of conveying much meaning in the effects of light and shadow, and thereby addressing their effects more immediately to the judgment; the subdued and beautiful effects which accompany the delineation of natural objects in the landscape; and the more striking, though still more sensual, effects of the brilliant hues of the positive colouring displayed in flowers and the plumage of birds.

Forms are therefore analogous to sounds and colours in their

effects upon the senses, and through the senses upon the mind. But
the proving of this analogy would do little in the formation of an
intelligible system of harmony of form: it must be shown that a per-
fect analogy also exists in the component parts producing these effects.

It has already been observed that the science of acoustics has
engaged the attention of the most eminent natural philosophers in
all ages; and that, by their experimental enquiries, they have shown
that fixed principles exist in nature which regulate the effects of
sound upon the ear. Of the result of these enquiries a short account
will here be given, as a means of making more clear to the generality
of readers what follows in regard to form.

Sounds are produced by an elastic body being put into a state of
vibration, which thereby puts, within a certain space, the air that
surrounds it into a state of agitation or undulation, producing a
corresponding effect upon the ear. This vibratory or elastic body
may be a distended string or wire, a drum, a bell, a gong, or any
other such body. Sounds are likewise produced by a portion of the
air itself being put into a state of vibration, and causing a cor-

responding undulation in that which surrounds it, and thereby producing the same effect upon the ear. This is the cause of the sound produced by an organ-pipe, a trumpet, or by an explosion of lightning or discharge of fire-arms.

The sensation thus produced upon the ear will be sonorous or acute, according to the rapidity of the vibration, the greater number producing the more acute sound; and it has been ascertained, that as the ear is limited in the range of its perception, scarcely any audible sound is produced until these vibrations reach about 30 in a second. It has also been proved, that at the 9th octave of the musical scale, in which the vibrations are 8192, human perception almost ceases, and scarcely any more acute sound than it can be produced. Those sounds produced by an elastic body acting on the surrounding air, as they die away become more acute, while those produced by the vibration of the air itself become more grave. The variety of tones in this wide range of perception, would at first sight appear to be equal to 8162; but it is not so. The experimental enquiries of those great men who have investigated the subject,

prove that this science is extremely simple in its primitive parts; indeed that they are the lowest number capable of uniting in variety, harmony, or system—namely, three; and that their relative acuteness or pitch is, invertedly, in proportion to the vibratory body employed in producing them.

These three sounds are respectively called the tonic, the medient, and the dominant. The first of these may be any given sound, and the other two must bear a certain proportional relation to it. Suppose this given sound to be produced by a bell or gong 12 inches in diameter, and that when struck it gave 256 vibrations in a second, the sound would correspond to the note called middle C on the pianoforte. Let another bell be struck whose diameter was 6 inches, and, if it were in every other respect the same as the former, it would give 512 vibrations in a second, and the sound it would produce would correspond to the octave or eighth note above middle C, being, although doubly acute, the same sound as that produced by the larger bell; and this will be the case so long as the relative sizes are as 1 to 2. The same result would occur from an extended string,

or any other elastic body. There can, therefore, exist no greater variety in sound than what is found between the tonic and its octave. This octave is therefore the first homogeneous sound, and always occurs when the vibrations are as 2 to 1. The next sound of a distinctive character is called the medient, or third to the tonic, and occurs when the number of vibrations are relatively to it as 5 to 4. The dominant is the third homogeneous or primitive sound, and occurs when the vibrations are to those of the tonic as 3 to 2. These notes are not, like the octave to the tonic, the same sound, although more acute, but are of a distinctive character relatively to it ; at the same time combining with it in harmony, producing together the most perfect consonance.

When an elastic body is put into a state of vibration, producing a musical note, which we shall suppose still to be middle C, as this note dies away, the other two notes which make up the harmonic triad are distinctly heard in succession, as the vibrations reach the relative proportional number already alluded to.

These three sounds form the groundwork of all music ; and it has

been satisfactorily proved that the three primary or homogeneous colours, blue, red, and yellow, are analogous to these sounds in every way.

It will now be necessary to show, that harmony of form depends upon three homogeneous parts, and that these parts are analogous in every respect to the three homogeneous primitive sounds, proved by the concurrent testimony of natural philosophers to be the foundation of harmony in music. But before proceeding to actual forms, it will be requisite to make a few observations upon lines; for by these, whether real or imaginary, all forms are represented.

There are only three kinds of lines used in producing forms, and they are—

the straight line,   the crooked line,   and the curved line.

All varieties of form, however complex, all the similarity and

dissimilarity that combine in the harmony of forms, are produced by these simple elements.

The straight line has three positions : it may be—

horizontal,   perpendicular,   or oblique.

The crooked line may be crooked in three different ways : it may produce—

a right angle,   an acute angle,   or an obtuse angle.

The curved line has also its varieties : it may be—

a portion of a circle,   of an ellipsis,   or of a volute.

These are all the varieties of which the three kinds of lines are capable. The straight line, if not horizontal or perpendicular, must

be oblique; for however near it may approach one or other of its two positive positions, so long as it associates with neither of them, it remains still oblique. There is only one positive angle, and that arises out of the two positive positions of the straight line, and that is the right angle; for however near the other two angles may approach this in either direction, they still remain simply acute or obtuse angles. The curved line, in the same way, has only one positive curve, and that is when it forms a segment of a circle; for an ellipsis may have a long or a short centre, but every segment of it will form a portion of an ellipsis. The same of the volute; for no part of it will be found to be a portion of either a circle or an ellipsis, and it may diverge in any degree from its centre, but it is still a volute.

Lines are, however, merely used to show where a form ends, and the space that surrounds it commences, and must now be considered mathematically, that is, as having length without breadth; at the same time they must be used physically, as the only mode of forming the geometrical figures and diagrams that follow.

As in sound and colour, so in form, there are only three simple, primitive, homogeneous parts; and they are—

the circle,   the triangle,   and the square.
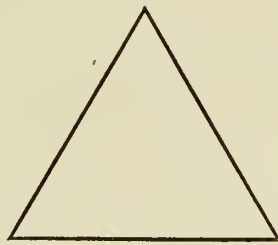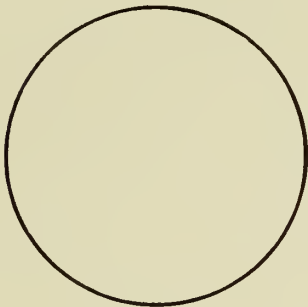
Of these three, the circle is pre-eminent for simplicity, being produced by a single line drawn round a single point.

The equilateral triangle is formed of three lines, or rather of one line formed into three acute angles, the points of these angles being equidistant from a single point, and the sides necessarily equal to one another.

The square is composed of a line formed into four right angles, likewise equidistant from a single point, and the sides of course equal to one another.

These forms are truly homogeneous, for they admit of no change

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in any of their parts without changing their character. The primitive parts of form are thus analogous to the primitive parts of sound and colour in their number; and it will now be shown that they arise out of one another in the same relative proportional quantities.

If the first and most homogeneous of these forms be taken as the tonic of a series, and made to represent middle C on the piano-forte, in the same way that it was represented by the bell or gong in the account given of the laws of acoustics; then its octave will be another circle of only half its diameter, and consequently bearing to it the relative proportional quantity of 1 to 2.—(See Plate I. fig. 1.) There is thus an octave formed; and the other two distinctive forms must occur naturally within it in their relative proportional quantities, in order to make up the harmonic triad, analogous to the musical consonances established by the experimental enquiries of those great men, whose names are too well known to require their repetition in this simple treatise.

It has been shown that the first musical consonance that occurs in ascending from the tonic to its octave, is the third or medient ; and that this sound, in the number of its vibrations in a second, is relatively to the tonic as 5 to 4. In precisely the same proportional quantities to the length of the line forming the tonic, does the homogeneous form, the equilateral triangle, occur invertedly between the two circles. This result arises from dividing the outer circle into the musical semitonic division of twelve, and drawing a line from any one of these points, carrying it across the inner circle three times—(See Plate I. fig. 2.) —thus producing, between the tonic and its octave, the medient. It is so in every respect, not only from being in relative proportional quantity of circumference as 4 to 5, but as dividing the outer circle into three by its points, and the inner circle into the same number of parts, in touching it by its sides. It also, in this capacity of medient, forms, upon the convex surface of the inner circle, the dominant, the next homogeneous form, which is relatively to the outer circle as 2 to 3, and consequently is to the inner circle as 5 to 4, and there-fore, invertedly, its medient. This is accomplished simply by repeat-

ing this medient line from each point round the circle, as shown in Plate I. fig. 3.

The three kinds of line, the straight, the crooked, and the curved, are those which combine in producing linear harmony, or the melody of form, as there are no other kinds of lines in nature. Out of these three kinds of lines it has been shown that three equally homogeneous forms arise, and that they likewise occur naturally in musical consonance, in every respect analogous to that of sound. It will now be shown that their effects upon one another are also relatively analogous, by placing them together in the three positions of the common chord of the musician, and its two inversions.—(See Plates II. and III.)

To show that these forms, in thus arising naturally out of one another, proceed inwardly to unlimited minutiæ, as they do outwardly to magnitude, there has been given in Plate IV. a diagram containing four octaves, to which is added a scale of the relative quantities of line in the tonic, medient, dominant, and octave.

To those unacquainted with music, it may be here necessary to

mention, that the common chord is the simultaneous sounding of a musical note, with its medient and dominant, generally accompanied by the octave of the tonic as a bass ; that its three positions are simply a change in the arrangement of these three notes, the bass remaining the same, and that its inversions produce a change in its construction, as will be seen in the diagrams, Plates II. and III.

The scale of the musician, however, contains, besides those three elementary parts, other four of a secondary or intermediate kind, making in all seven. These are called the supertonic, the subdominant, the submedient, and the subtonic, and act in melody as links to unite the elementary parts ; and they are suitable to this purpose, by the relation they bear, in quantity or pitch, to the notes between which they are placed. In the scale of the colourist, also, there are the intermediate or secondary hues, orange, green, purple, and neutral gray. It will be requisite, therefore, to the completion of this analogy, that forms be found corresponding to these secondary notes and colours.

The forms adopted for this purpose are—

The parallelogram,   the rhombus,
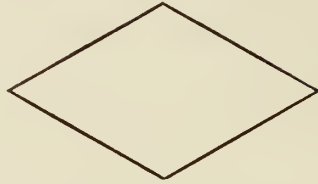
the ellipsis,   and the hexagon.
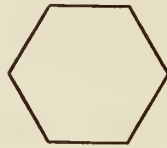
These secondaries differ from the primaries, because they admit of being altered either in their length or width, while their other dimensions remain the same, and they still retain the same name and character of form.

The first of these, the parallelogram, is produced by such of the medient lines as run parallel to one another, and those that form a hexagon within the outer circle.—(Plate V. fig. 1.) This form is properly the secondary to the square, although its proportional quantity, as well as origin, places it between the circle and triangle. It cannot lose its distinctive character until its length be equal to its

width—the proportions of the homogeneous square. Geometricians seem not to have given any fixed rules for the proportions of this particular figure, and consequently various modes have been adopted in forming it—such as drawing a line from the opposite angles of a square, and fixing that as the proper length of a figure of this kind, whose breadth was equal to one of the sides of such a square. But the parallelogram found in the natural key of the circle, by the means explained, seems in every way preferable to this or any other proportion. It stands in the same relative quantity to the tonic, that the supertonic does in the scale of the musician.

The second of these heterogeneous forms is the rhombus. It is found naturally in the intersections of the medient lines, as shown in Plate V. fig. 2. It is the secondary to the triangle, and consequently holds the place of a fourth, or that of the subdominant, in the natural scale of the musician. Its proportional relative quantity to the tonic differs from that scale by about a semitone, as will be afterwards shown. It is truly heterogeneous, by having two acute and two obtuse angles, and it can only lose its distinctive character when it is

shortened until these become right angles, which will not be, as in the case of the parallelogram, until they produce the homogeneous square.

These two secondary forms should probably therefore, in a general series, be placed on each side of the dominant primary, or square, into which they resolve themselves. But the relative quantity in the parallelogram gives it the place of the supertonic. It may here be observed, that the rhombus, thus occurring in the natural or general series, has the same proportion of an acute angle that belongs to the equilateral triangle.

The third of the secondaries is the only form in the seven that does not arise naturally between the circular tonic and its octave. It is the ellipsis, which, although it must have a place in the general series as secondary to the circle, could not in any way occur between that figure and its octave by the lines drawn from the semitonic division producing all the other forms. It might, however, have been left out entirely had this series of forms been confined to a particular key, as will be afterwards shown. Its being formed upon two points renders

it heterogeneous, and these points may be placed near or apart, increasing its relative length or breadth to any given proportions; but whatever these proportions may be, the figure thus formed is still an ellipsis.—(Plate V. fig. 3.) It has been placed in the situation of the submedient, being the only situation left unoccupied by forms arising out of the angles produced by the intersections of the straight line. It will be next used as an archeus or key to the series of secondary as well as tertiary forms. Indeed it would appear that these curvilinear forms have a prescriptive right to this situation; and should the general principles be correct, this, like many other questions arising out of the present enquiry, will be settled by those who can devote more attention to, and employ more scientific knowledge upon, the subject.

The hexagon, although in some measure the most heterogeneous of all forms, being composed of oblique and perpendicular lines arranged circularly round one point, is likewise, from the same cause, a nearer approximation to the homogeneous than any of the other forms; for the multiplication of its parts by two brings it so near the pre-eminent homogeneous form, that at a little distance it can scarcely be distin-

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guished from it. This form arises naturally out of the intersections of the medient line, and it is in some measure like the neutral colour of the chromatist, composed of portions of the three primaries.—(Plate V. fig. 4.)

These seven parts are adopted, as a general series embracing all the requisite varieties of form, and not as those belonging particularly to the circle.

A scale of forms belonging exclusively to the circle will be produced by dividing it into twelve parts, and drawing the two lines 1 to 3 and 1 to 5, thus—
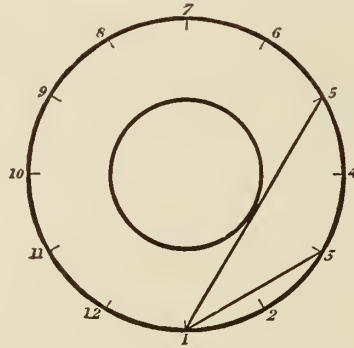
and by repeating them from each division of the circle, the diagram Plate VI. will be formed.

The intersections of these two lines, thus repeated, will produce a series of forms, which, together with the circle itself, will amount to seven. These are given in detail in Plate VII., with a scale of their relative quantities of circumference. By this scale it will be seen, that, leaving out the 7th, or dodecagon, all these forms increase gradually, in the same relative quantities that are termed in the arrangement of musical notes full tones ; but that this 7th form seems to stand halfway between the hexagon and circle. This scale, therefore, differs from that of the musician, in regard to the two semitones that occur in a major key between the third and fourth, and seventh and eighth degrees. The scale of the musician, however, was not always known or adopted in its present state, but appears, in the earlier stages of the art, to have consisted of those notes only which are separated by complete intervals, or whole tones.

It will be observed that the 2d, 3d, and 4th forms proceed directly from the outer circle, the 2d from four points, the 3d from three points, and the 4th from two points.—(Plate VII.

fig. 1.) While the other three, the 5th, 6th, and 7th, are formed upon the surface of the inner circle; the 5th touching it at four points, the 6th at six points, and the 7th at twelve points— (Plate VII. fig. 8.) It may also be worthy of remark, that the 2d, by touching the outer circle at four points and the inner at two, is connected with the tonic and its octave at six points. So also is the medient or 3d, by touching each of the circles at three points, as well as the 4th, which touches the outer circle at two, and the inner at four.

By drawing a line from the 1st to the 2d, and from the 1st to the 4th, thus—
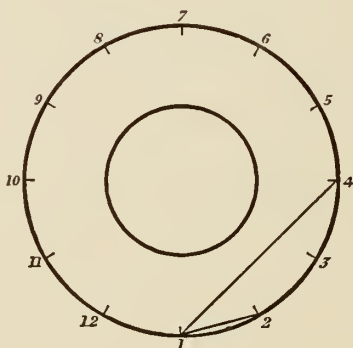
and repeating these two lines from all the divisions, a dodecagon and square are formed within it from these points, as shown

in the diagram.—(Plate VIII. fig. 1.) By these lines the forms will be found to arrange themselves on the inside of the outer circle, in the same order that they are formed by the other two lines on the outside of the inner circle, by the intersections of the medient lines. It will be seen from Plate VIII. fig. 2, that the square thus formed meets the dominant square, by its inner sides touching the outer angles of that form. Fig. 3 of Plate VIII. gives these two series connected by the medient lines.

It would appear from this, as well as from the circumstance of the six distinctive forms arising out of this diagram being divided by full tones, that they may be numbered from the outer to the inner, or from the inner to the outer circle; for the medient will take the place of the dominant, and the dominant that of the medient, thus :
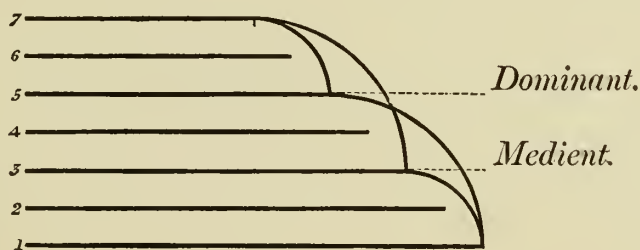
There is another very striking musical analogy in the situations of

the intersections, which produce those forms within the diagram of the circles. If the space between the circles be divided into the semitonic or musical division of twelve parts, by circular lines formed round the same point, the seventh of these lines from the outer circle will pass through the intersections of the medient lines that produce the dominant. At this point, also, the intersections of the larger square, formed by the lines drawn from the 1st to the 4th, have produced a dodecagon, the most consonant form to the circle in the series. The same takes place on the third line from the outer circle, corresponding to the minor third of the musician : and this occurs exactly where the oblong intersects the medient lines. It will also be observed from the diagram, Plate IX., that the lines being drawn from twenty-four points, the equilateral triangles or medients intersect themselves at the fourth circular division from the outer circle. The consonances thus occurring amongst these forms are quite apparent in the diagram.

The scale arising out of the secondary forms in the general series now claims attention. The ellipsis must take the place of the circle,

the rhombus that of the triangle, and the parallelogram must become the dominant. The kind of harmony produced by this class of forms is of a more subdued and pleasing kind than that produced by the primaries. The ellipsis being a compound form, and not occurring, like the other two secondaries, in the original diagram of the circle, its proportions should be those of the parallelogram, which necessarily inscribes it, as dominant.

In adopting this form as a tonic, (Plate X. fig. 1,) it will be found that, by drawing medient lines between it and its octave, the proper medient and dominant are formed, (Plate X. figs. 2, 3;) but that the latter is in relative proportional quantity about a semitone further from the outer ellipsis, and therefore about as much nearer the inner ellipsis, than in the series of the circle; consequently, in counting the ascent of the forms in the ratio of the number of vibrations that produce sounds, instead of the size of the bodies that vibrate, this form would hold the situation of a minor third, or medient. This, as well as the other trifling discrepancies noticed, is not attempted to be reconciled in this elementary treatise; it is enough in it to show that

these secondary forms have the elements of harmony, although that harmony be of a different kind from what is produced by the combination of the primary forms. In Plate XI. there is given the four forms, which may be called the secondaries in this series. In this diagram of the secondaries, the intersections of the lines drawn from the 1st to the 3d and 5th divisions produce a perfect square, and the lines from the 1st to the 4th, two perfect equilateral triangles, besides a rhombus and hexagon of the same proportions as those in the circular diagram, in addition to those forms more peculiarly belonging to itself. The manner in which these occur is shown in Plate XI. figs. 2, 3, and 5.

Thus the primaries seem to accompany the secondaries in their formation, as the secondaries did the primaries. No other proportion of ellipsis would produce this result, as will be shown in the diagram of the third class of forms. It may, therefore, be assumed to be correct in its proportional relation to the circle, the pre-eminently homogeneous form.

In Plate XII. the secondary forms arranged as the common chord,

with its positions and inversions, are given. For the musical notes corresponding to these, reference may be made to Plates II. and III., as it is not intended to go into the subtleties of musical transposition.

In the primary series of forms arising from the intersections of the lines drawn between the circles, from the 1st to the 3d and 5th, the parallelogram, or second of the series, is that which gives the proportions of the curvilinear form, which produces the secondary series. So, likewise, in this secondary series, there occurs another parallelogram, (Plate XI. fig. 1,) which is used in proportioning an ellipsis, which acts as tonic to give a third class of forms of a still more subdued and pleasing kind, as in the general character of their horizontal curves and angles they approach nearer that of nature. Of these forms a general diagram, with the medient and dominant, is given in Plate XIII., without going into further details, as they are regulated by similar laws to those which govern the primaries and secondaries.

It will now be necessary to notice the harmony of succession, or the melody of form. In music the simple air to be performed is the melody, and is, of course, regulated by the relation which musical notes have

E

to one another, when produced singly to the ear; not simultaneously, as in the harmony of combination. Colours have also a somewhat similar relation in succession, as noticed by Field in his excellent and truly philosophical works on chromatics.

The melody of form, or it may be termed linear harmony, is easily defined. It is simply the general outline—the manner in which the straight line in either of its two positive positions, the crooked or angular line, and the curved line, follow one another. This is very important in architecture and sculpture; the compositions of those arts being in most cases liable to be viewed against a light sky, in which situation the melody of form alone is appreciable.

In music, the rules of melody are quite correlative to those of harmony, the general outline of an air being the component parts of the common chord in some of its positions or inversions; whatever filling-up is used to connect those parts, will be regulated by the nature of the subject and consequent effect intended to be produced upon the ear. So also must the three kinds of lines or forms which they inscribe, be employed in the outline of every

composition of architecture, in all cases where it alone may meet the eye; and the effect will be doubly enhanced when the combinations which it inscribes are apparent and equally harmonious.

In combined harmony, notes at considerable intervals may be produced simultaneously, and a perfect consonance of sounds produced; but in melody the passage from one part to another, must in general be gradual and connected. This is precisely the case in regard to form, and appears to have been a rule observed in all the best architectural productions of the ancients. Indeed it appears very evident, that something like the musical arrangement of sounds had been adhered to in the linear harmony of those great works.

The melody of an edifice may enter into combination with surrounding objects, or the ground upon which it is placed, or it may form an independent melody of its own.

Architecture, in its original productions, is not an imitative art, like sculpture or painting, and must therefore depend exclusively on natural principles for its effect. The five orders evidently owe the varied excellence of their proportions, and indeed their existence, to

an adherence, intuitively or by acquirement, to those principles on the part of their originators, otherwise they could not have afforded models of study to all succeeding ages. But as nature surpasses in an immeasurable degree all works of imitative art, so do natural principles, in the inexhaustible variety they present, the works that mankind have formed upon them.

The most perfectly harmonious production in architecture that exists, is, by the concurrent opinion of the best judges in all ages since its production, the Parthenon at Athens. Whether this structure owes its perfection to an acquaintance with a particular system of applying the natural principles of form to architecture, lost to succeeding ages, or to the natural genius of the designer alone, is a matter of doubt, and may ever remain so. But whether the knowledge of the artist was acquired or intuitive, it must be admitted that the elements of harmony are transcendently displayed in this great work.

The melody or general outline of the temple itself seems to enter into combination with the hill upon which it stands, and thus to make

up the harmonic triad of the third class of forms.   This is endeavoured to be shown in Plate XIV.   In the centre of the diagram formed by the repetition of the line 1st to 5th, within the ellipsis, it will be observed that the component parts of the temple occur, as marked by the strong line.   These being removed from the harmony of combination to that of succession, the curve of the ellipsis becomes its fundamental bass, and the temple itself supplies the other two component parts of a melody.

This melody is only appreciable at such a distance as allows the general outline of the temple, in combination with the hill upon which it was placed, to be encompassed by the eye of the spectator ; consequently when he ascended the Acropolis, the curvilinear forms, which at a distance made up the harmonic triad, disappeared. Instead of which, however, the most beautiful harmony of combination was presented to his view, accompanied, as has been proved by late investigations, with an equally perfect harmony of colour. The curvilinear form, so amply supplied in the distance, which, like cool colours in nature, always predominate in the most pleasing

combinations, he now finds in equal proportionate quantity, not only in the horizontal and perpendicular lines of the columns, but in the exquisite bas-reliefs which embellish the frieze and tympanum. The taste and knowledge of the artist is further displayed; for that there might be no harsh or sudden transition from the curved to the perfectly straight line, the architrave, frieze, and cornice approach the tympanum by an almost imperceptible curve.[3]

In thus gliding, by an imperceptible gradation, from one component part of harmony into another, a facility easily attainable in form, but which can only be attained in music by the human voice, is made available.

The portico or front elevation of this temple, from the base of the columns to the extreme point of the pediment, is inscribed by the parallelogram, adopted in this treatise as the second of the general series of forms. It has been already observed, that geometricians have given no definite rules for the proportions of this particular form; but that in question has peculiarities which are worthy of remark in this place.

It is the only rectilinear form that is not produced by the inter-section of the medient line, drawn from the first to the fifth division of the circle, therefore requiring in its formation the second line, which is drawn from the first to the third division. Neither the equilateral triangle, the square, nor the rhombus, can be reproduced by any smaller number of forms of a similar kind and proportion to themselves than four; and it takes the same number of parts to reproduce a parallelogram of any other proportions; but this can be reproduced by three, and also by four. If its length be divided into the semitonic division of twelve, its breadth will be seven of those divisions; consequently, when three are placed together perpendicu-larly, their length will be collectively twenty-one of those divisions.

In this triple capacity it seems in the present case to be employed, and its shortest dimension is therefore divided, as shown in the scale Plate XV. The subdivision of the parts of this unequalled structure are, agreeably to this scale, as follows .—

The perpendicular and obviously curvilinear portion ends, and the horizontal or rectilinear portion begins, on the seventh semitonic

division of the parallelogram, the perfect 5th or dominant of the present scale of the musician. The horizontal or apparently rectilinear part ends, and the oblique or angular part commences, on the next musical consonance, the 6th or submedient of the same scale. —(Plate XV.)

Taking the dimensions from the elevation of the portico as given in Stuart's Athens, the minute groove cut below the capital of the column is one of these semitonic divisions. From centre to centre of the columns, on each side of the middle space, is three of those divisions, and this is continued, with a slight deviation, till the last division, which must include the outer column. The space which includes the columns is exactly the proportion of the second parallelogram produced within the ellipsis, as the first was within the circle. If this be divided into twelve parts, the capital will be found to be one of these in height, and the triglyphs one of the same in breadth. But these matters can only be properly investigated by the architect, whose education enables him to enter into details with which the unprofessional are necessarily unacquainted.

Amongst the architectural remains of ancient Rome, the Pantheon is perhaps one of the most perfect specimens of harmony; especially its interior, in which there appears an evidently musical arrangement of parts, ascending in full tones agreeably to the series of forms that belong to the circle.—(Plate XVI.)

From the peculiar construction of the interior, there seems to have occurred some difficulty in harmonizing its outline, which, however, has been obviated by the angular work which unites the curve of the dome to the perpendicular line of the exterior wall. This angular form acts as a medient, and completes the harmonic triad. The geometrical elevation of the wall is the first parallelogram, and the portico is composed of this and the first rhombus.—(Plate XVII.)

This structure being upon a level base is perfect in its outline, independently of situation, having within itself the three elements of harmony.

In the street architecture of Rome, perhaps the most perfect specimen is the Farnese Palace. Here no general outline is required; but the combination and arrangement of its parts display a perfect

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and most beautiful arrangement of the three component parts of linear harmony, in the judicious admixture of the curve, the angle, and the straight line.—(Plate XVIII.)

In conclusion, the scale of forms adopted in this treatise as the elements of harmony, and the lines by which they are produced, are, in the same plate, brought into comparison with the scales of the musician and colourist, in order to make it more clear that form, like sound and colour, has its three primaries; and that consequently there can be no perfectly harmonious combination of forms in which one of these is wanted; and that the distinctions of harmony, like those of sound and colour, depend upon a predominance of one, and a subordination of the other two, in the composition.

NOTES AND APPENDIX.

NOTE 1.—Page 2.

An Essay on Taste by Sir Thomas Dick Lauder, accompanying the Third Edition of " Sir Uvedale Price on the Picturesque," 8vo. Edinburgh: 1842.

NOTE 2.—Page 3.

A Treatise on Architecture by William Hoskins, F.S.A., Architect, 4to. Edinburgh : 1835.

There are many excellent observations on the harmony of form in this treatise, of which the following are a few :—

" Simplicity and harmony are the elements of beauty in architecture; simplicity in the general form and arrangement of a subject, and harmony in the collocation and combination of its various parts." *   *   *

" Harmony in architecture is that agreement which exists between its various parts, as in the relation of a column to its entablature and stylobate, in the accordance of a cornice with the elevation it crowns, and in the coherence of one part of a composition with another.   It is that which exists in the common tendency of the leading lines of a structure ; and it is that which blends the straight and circular in enrichment and decoration." *   *   *   " A degree of harmony must exist, too, between the solids and vacuities of an edifice."

These facts the author in question exemplifies by referring to various architectural details, which must be of great value to students in that particular art; and concludes :—

" Thus, harmony has reference to comparative magnitude, strength, decoration, disposition, and proportion.   To acquire a knowledge of all these sufficient to produce a worthy result, a long course of study and careful observation are

necessary : but such can only be necessary to the architect ; it is enough for the general student to be able to appreciate them when present, and to detect their absence." The Author of the present Treatise, in attempting to point out the natural principles of harmony in form, and their application to architecture, aims at the latter result alone.

Mr Hoskins also gives some excellent observations on the " Principles of Architectural Composition," in which he shows that, although these must be different in the widely differing species of horizontal and vertical architecture, still the elements of architectural beauty must be the same in all. This will be found to be precisely the case with the forms produced between the curvilinear tonic and its octave. The depressed obtuse-angled triangle, produced by mixing the rhombus with the parallelogram horizontally, is, when the parallelogram stands vertically, replaced by an acute-angled triangle, from the rhombus being necessarily mixed with it in a vertical position.

NOTE 3.—Page 38.

Colonel Mure of Caldwell, in a note to his excellent " Journal of a Tour in Greece," mentions that, during his residence at Athens, a Bavarian architect, by a series of observations carried on with great nicety through every portion of the Parthenon, had ascertained that there was not a straight line of any considerable length in the whole extent, with the exception of those of the pediments. The horizontal lines of the basement, architrave, frieze, and cornice, he found to be curved upwards, but in so slight a degree as not to be perceptible unless on very accurate inspection ; and that these observations were said to be verified by several other members of the same profession. Colonel Mure also mentions, that in a letter from Athens, read by W. Hamilton, Esq., to the Royal Society of Literature, on the 13th of March 1840, it is stated that the same peculiarity is also observable in the Theseum.

APPENDIX.

IN the progress of this enquiry many observations of apparent interest suggested themselves, the introduction of which into the body of the treatise might have rendered it more tedious and obscure than it is in its present state, and it therefore has been thought better to add them in this form.

Combinations of lines seem to have their discords as well as concords. A straight line placed perpendicularly upon an oblique line, thus—
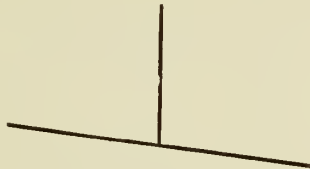
is discordant, for the former will appear to lean towards the upper end of the latter. Therefore no vertical form ought to be placed upon an inclined base, without the intervention of a horizontal line. A straight line placed horizontally upon, and in contact with, a curved line, thus—

is likewise discordant, as it will appear curved, but in the opposite direction.

Oblique lines can only produce pleasing forms where their obliquity is in the same degree, thus—

for this

or any other such combination of the oblique and straight line, is inharmonious.

Curved lines can only combine harmoniously with straight lines when they
meet them at right angles: thus—
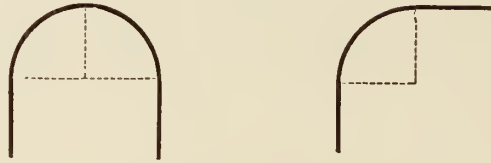
are harmonious; while such combinations as

are discordant.

The circle, as being the most simple of the primary forms, has been adopted
as a key or tonic to what may be termed the natural scale of forms. It is the
more fitted to hold this situation from its being the form of the eye itself, and
having, when made to represent an octave of form, by inscribing another circle
of the relative proportion of 1 to 2, a peculiarity exclusively belonging to that
organ. The inner circle, agreeably to the analogy attempted to be established,
cannot be increased beyond this relative proportion; but it may continue to be
diminished in the ratio of 1 to 2, until it arrives at inappreciable minutia, as
shown in the diagram, Plate IV. In like manner, the pupil or inner circle of
the eye cannot approach the iris or outer circle nearer than a certain distance;
while in viewing minute objects it seems to have the power of contraction to
an extent similar to this diagram.

It has been observed that the series of forms in which the ellipsis takes the
place of the circle, exercises a softer influence on the eye; and that the combina-
tions of those forms are more natural, and the harmonics they produce more
pleasing, than those arising out of the combinations of the forms which have the

circle for their key. This would, at first sight, appear quite paradoxical. But it must be taken into consideration that we are made to view nature with two eyes, whose rays traverse or cross each other horizontally; and that, consequently, any object of a horizontally elongated kind can be more easily encompassed by the visual rays than any of the more primary or homogeneous forms. The eye in this double capacity associates its rays at once with the forms in which the three elements—earth, air, and water—are generally presented to our view, and in which, consequently, the landscape-painter generally transfers their effects to his canvass.

Landscape composition has its linear harmony as well as architecture, sculpture, or historical painting; and it likewise consists in the judicious arrangement of the three elementary parts of form—the straight line, the angular line, and the curved line. In this, as in every case where various forms are combined, there can be no perfect composition, unless the harmonic triad be present. But the parts of this triad must not be jumbled promiscuously together, however irregular the general character of the subject may be; for if linear harmony exists, there must be system in it, as there is in every other kind of harmony; and this system must consist in certain geometrical rules. Such a system is attempted to be developed in the foregoing treatise; and it is assumed that it has the leading features of a natural theory in the extreme simplicity of its elementary parts, and the endless variety of combination of which they are susceptible.

The harmony of forms depends much on the propriety of their position, and a strict adherence to the key or tonic in a composition. The three primary forms—the circle, the triangle, and the square—have each only one proper position. The first, indeed, can take no position but one, while the secondary and tertiary forms have two proper positions, the horizontal and vertical. These positions must be strictly adhered to; for obliquity in this case is inadmissible, and, as already shown, can only be employed to produce angular forms. When the circle is the key or tonic adopted, the square and equilateral triangle will

be the leading features of the forms introduced into the composition. When the ellipsis is the tonic, their leading features will be the parallelogram and rhombus, whether the composition be horizontal or vertical. There can be no properly harmonious composition in which this classification is not attended to. No doubt men of great genius can do this intuitively, and to such, a knowledge of rules is superfluous. But rules are requisite to enable the generality of man- kind to appreciate judiciously the works of men of genius. Indeed it is presumed, that the dissemination of a general knowledge of the fundamental principles of art, would in this way do more to its advancement than any system of tuition directed immediately to the improvement of its students. Real genius cannot lie dormant—it will shine forth independently of schools and academies— it has done so in all ages, and only requires to be known and encouraged when it appears. But it never can be properly fostered while the public are unable to distinguish it from mere pretension or humble mediocrity. The greater the amount of money expended nominally in the advancement of art, if not strictly and judiciously confined to its legitimate object, the greater will be the mischief done. It is well known in the cultivation of the fruits of the earth, that were the useless weed fostered along with the useful plant, it would soon choke and extinguish it. In like manner will pretension and mediocrity in the arts, if equally fostered, choke and extinguish the efforts of real genius, by withdrawing from its roots that nourishment which it alone has a right to receive.

In investigating the effects of vibratory bodies upon the air, and the manner in which these effects act upon the ear, it appeared to the author very probable that atmospheric air is composed of three different kinds or forms of particles, quite unappreciable to the senses in any other way than by these effects. To suppose this requires no great stretch of the imagination. It is a well-established fact, that the rays of the sun, which appear to us quite colourless, are composed of three distinctly different colours—blue, red, and yellow—which, by refraction,

are made to appear distinctly visible to the eye, accompanied by other four intermediate hues. If, therefore, a substance so subtle and impalpable as light has been proved to be composed of three primary parts, the supposition here advanced is worthy of some attention. The only means, it is believed, by which the variety in the elements that compose white light can be made apparent to the eye, is by refraction ; and that these primitive elements can never be made by such means to appear unaccompanied by the other two in combination, because (as the Author has elsewhere stated*) they seem to have an affinity to one another that prevents their actual analyzation. When, therefore, it is found that there are only three primary sounds produced by the agitation of the air, as the three colours are produced by the refraction of light ; that these three sounds have, too, their corresponding secondaries ; and that no sound can be thus produced unaccompanied by the other two which make up the triad of harmony —it would appear that these mediums of communication between external nature and the senses correspond in their component parts. The author has been confirmed in this supposition by such experiments as he has had an opportunity of performing, and which he thinks it apart from the object of this treatise at present to publish. He may, however, remark, that it appeared clear to him that a certain number of vibrations in a second affected a certain class of those particles particularly, while the other two were affected subordinately, producing the harmonics, and that the secondary or intermediate notes were produced by two of these classes of particles being simultaneously and equally affected. These particles may be supposed to be circular, angular, and rectilinear, and to correspond to one another in the relative proportional musical quantities or intervals. They may also be subject to horizontal compression in proportion to the density of the atmosphere, in which case they would become

* Laws of Harmonious Colouring, 4th edition.

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horizontally lengthened, and in the same ratio vertically shortened, thus bringing distant objects more distinctly into view, and conveying distant sounds more distinctly to the ear. But this supposition is advanced with much diffidence.

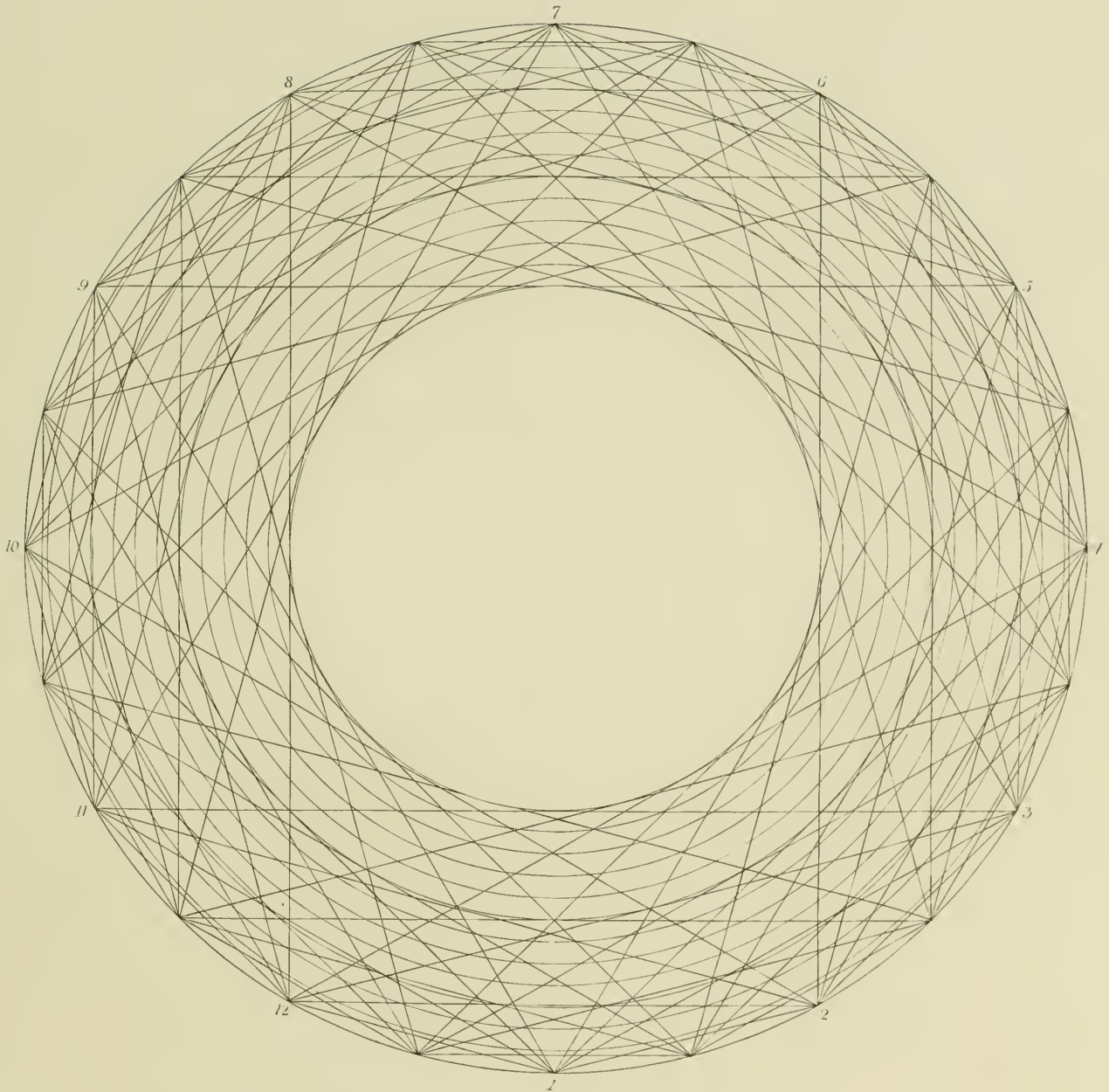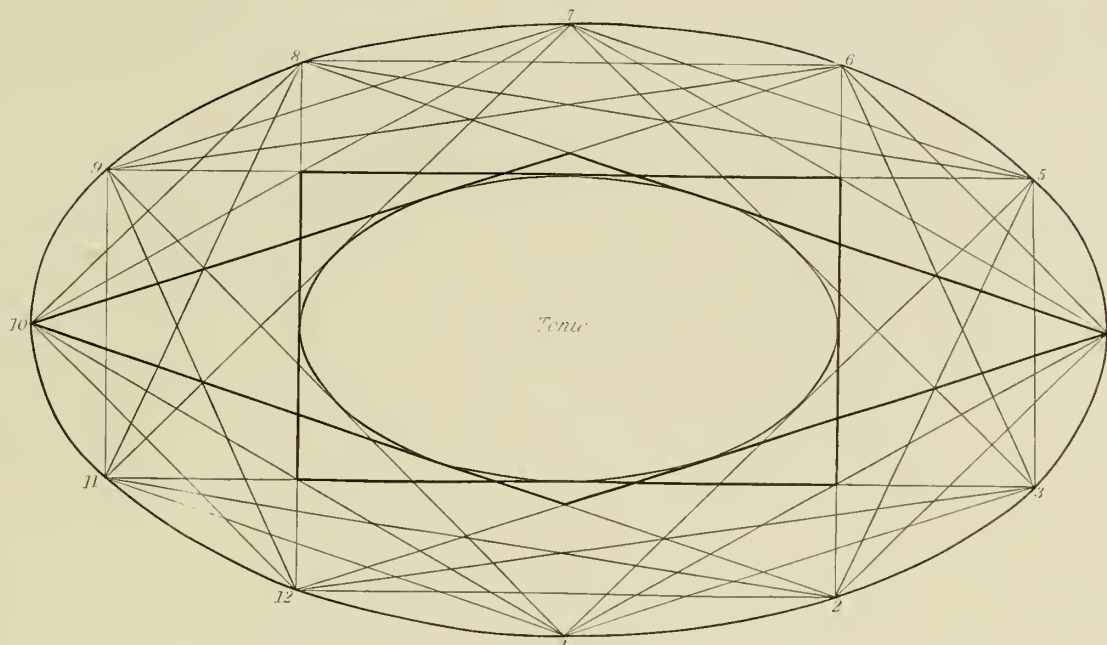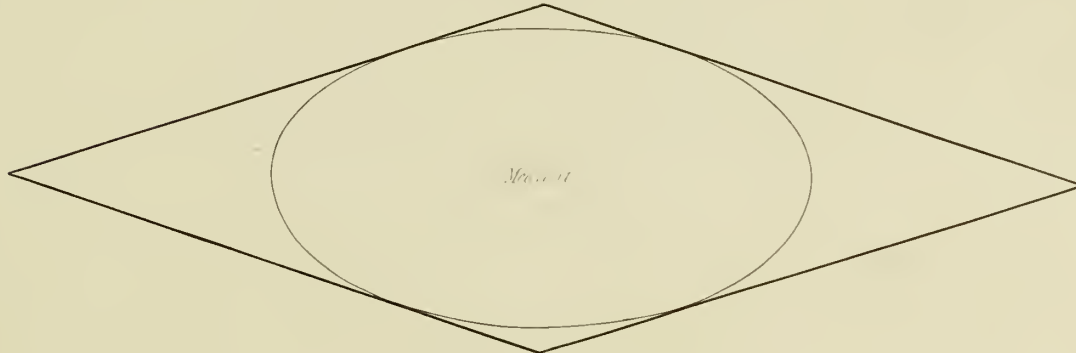ERRATUM—for *Medient,* read *Mediant.*
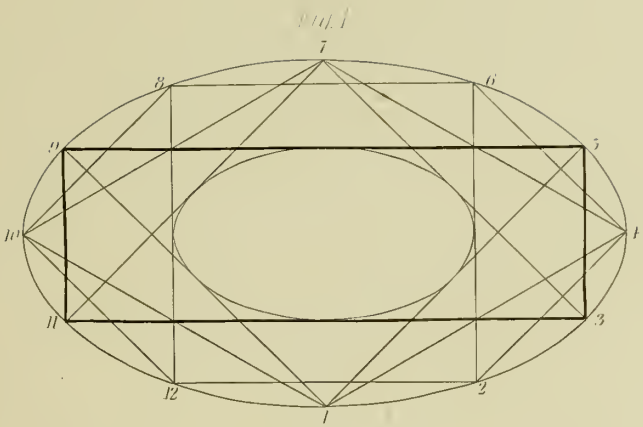
PLATE I.

Fig. 1.
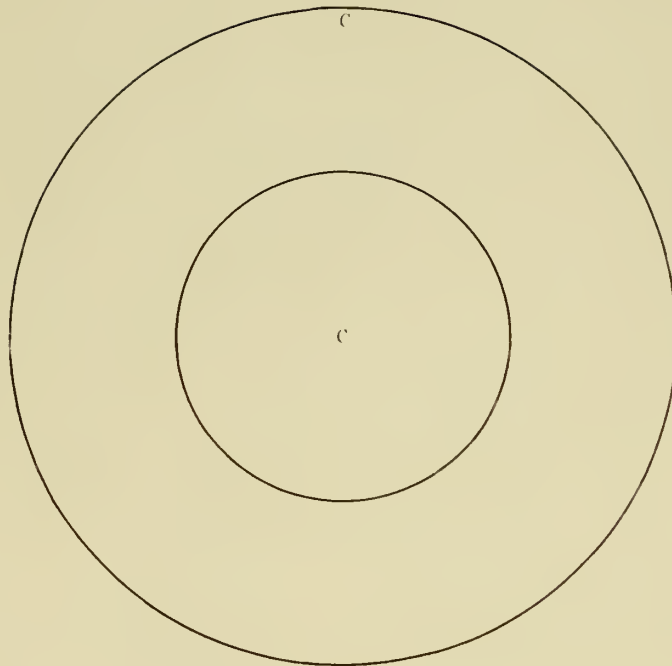
Fig. 2.
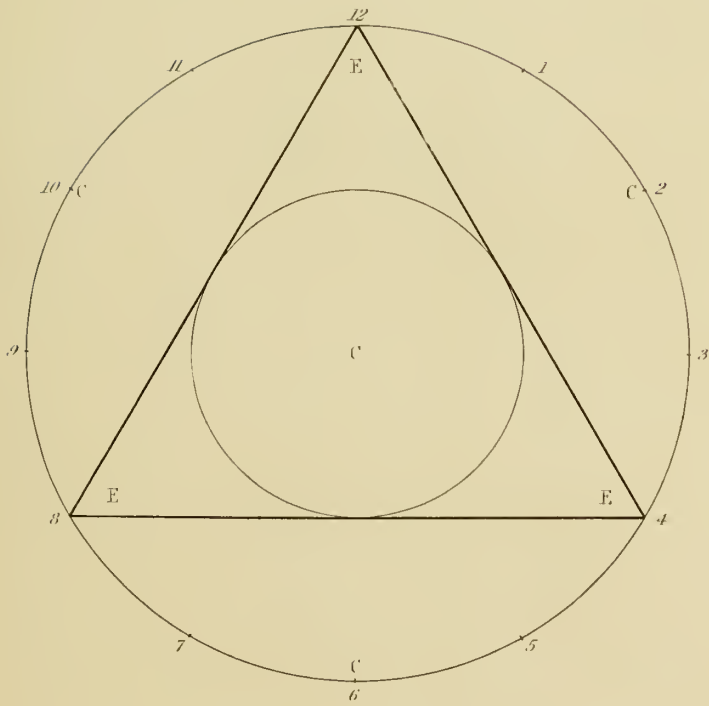
Fig. 3.
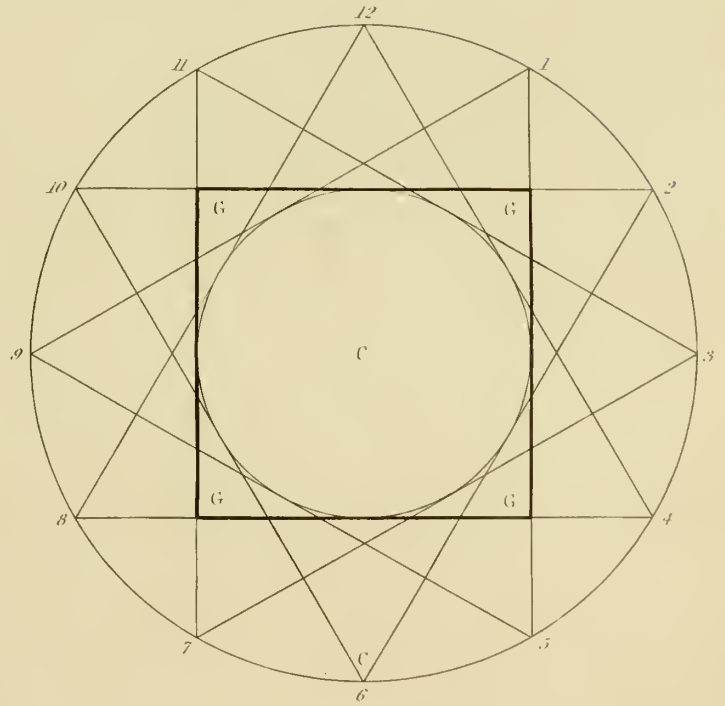
PLATE II.

Fig. 1.
1st position of the common chord.
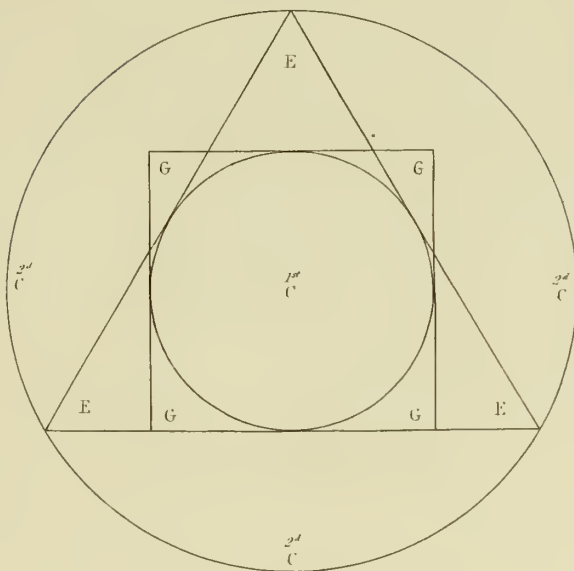
Fig. 2.
2d position of the common chord
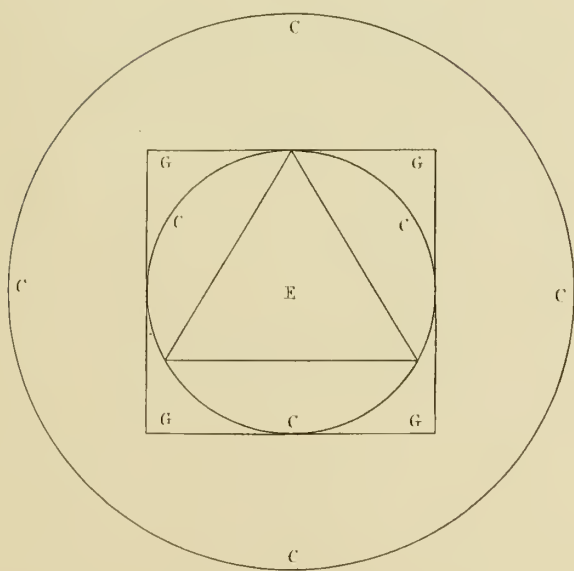
Fig. 3.
3d position of the common chord
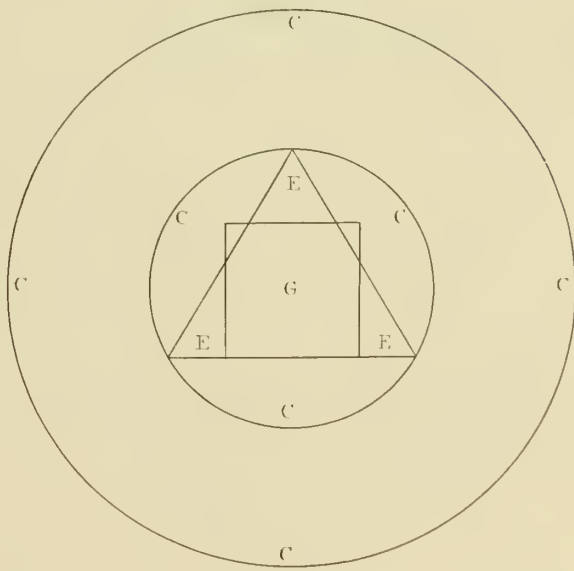
PLATE III.

Fig. 1
Original chord
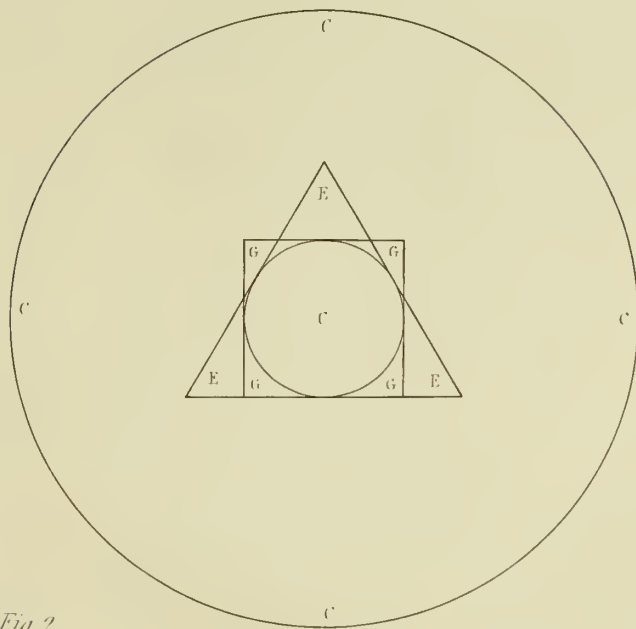
Fig. 2.
1st Inversion
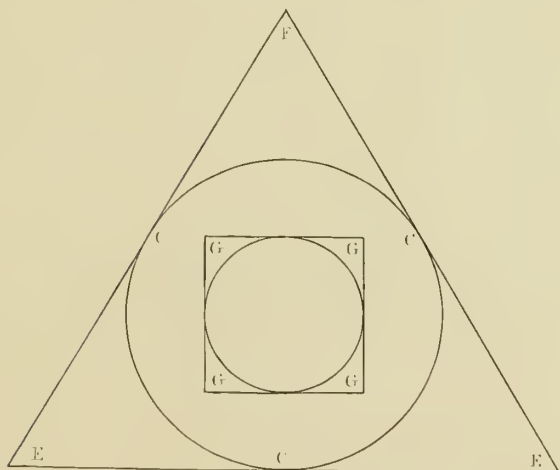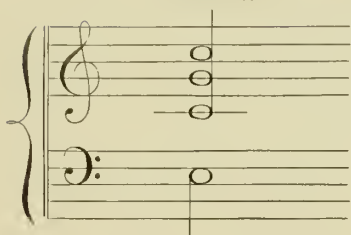
Fig. 3.
2d Inversion

PLATE IV.

C — Tonic

G — Dominant

E — Medient

C — Tonic
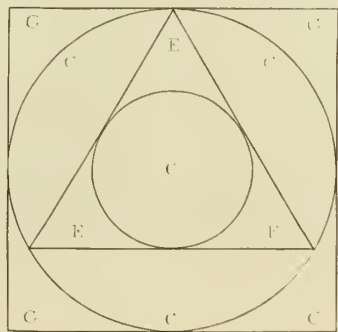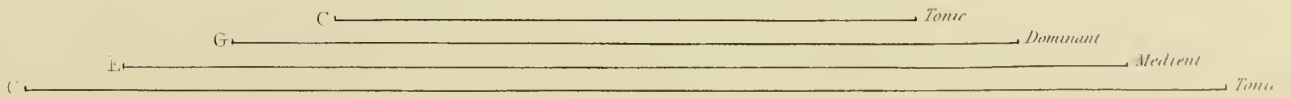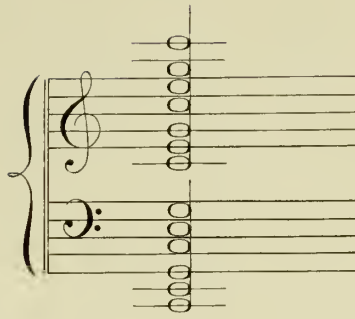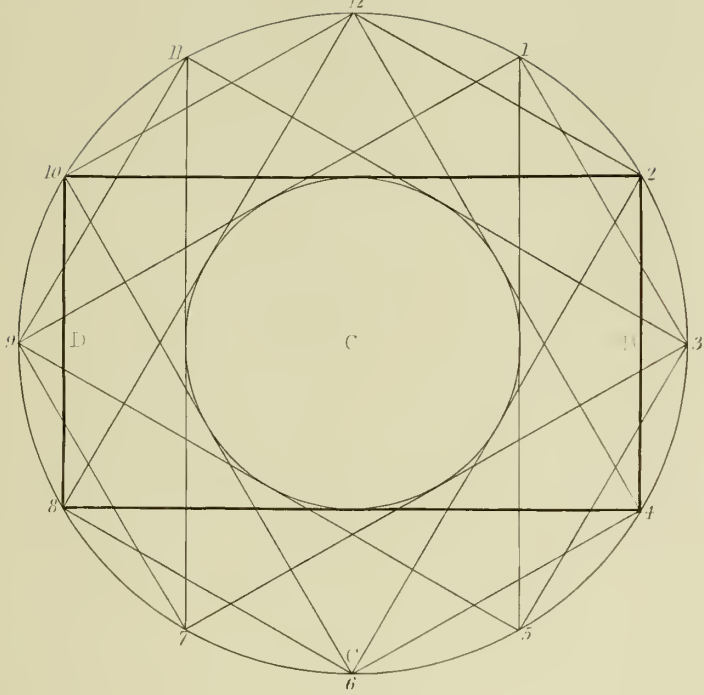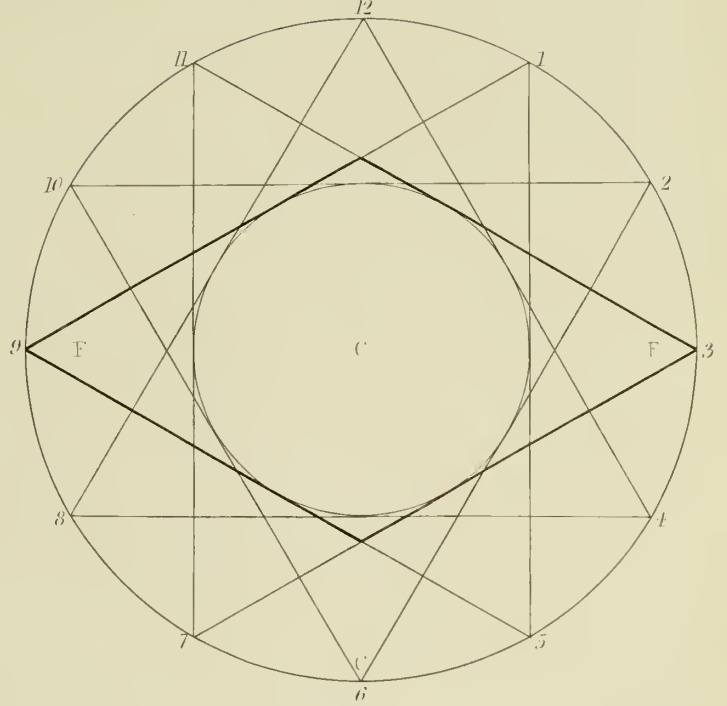
PLATE V.
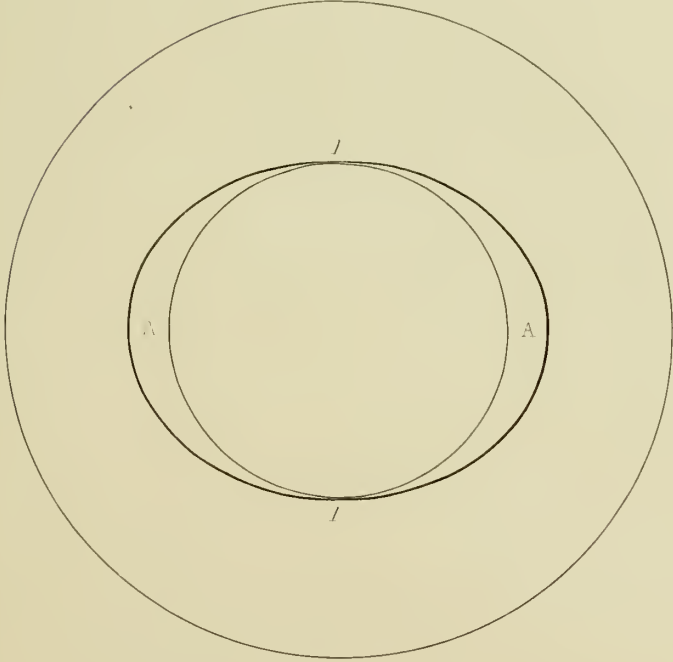
Fig.1.

Fig.2.

Fig.3.

Fig.4.
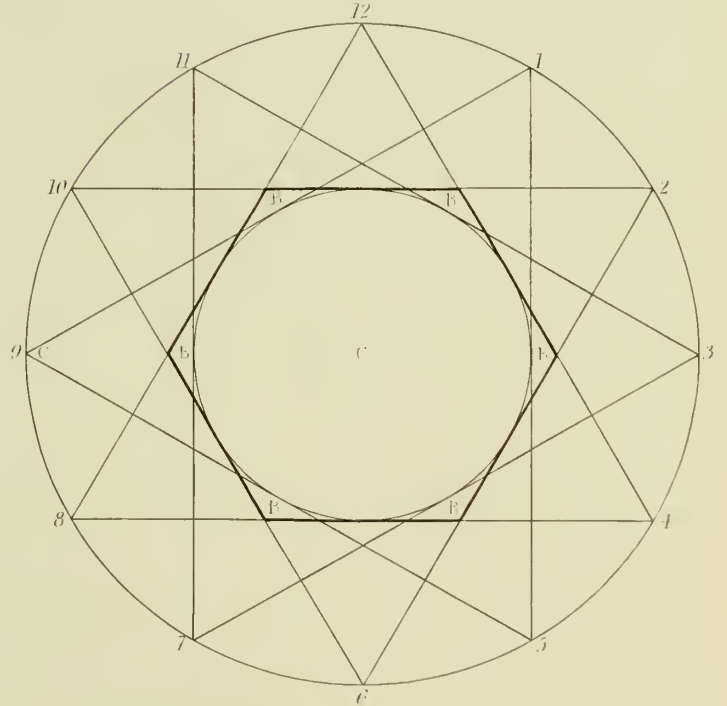
PLATE VI.

Diagram containing all the forms that arise within an octave of the circle.

PLATE VII.

Fig. 1.

Fig. 2.

Fig. 3

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7

Fig. 8.

Scale shewing the circumference in each of the above forms
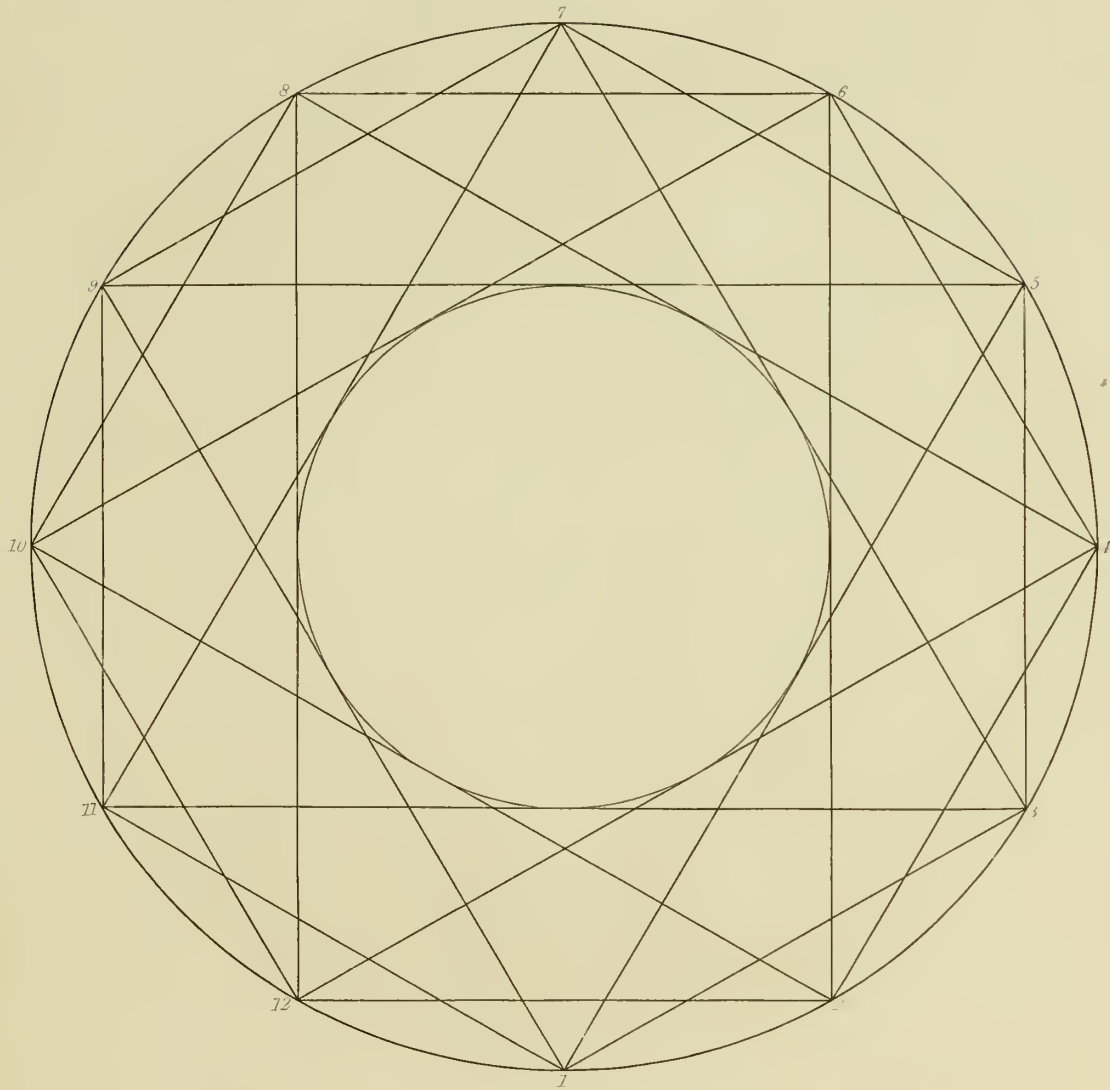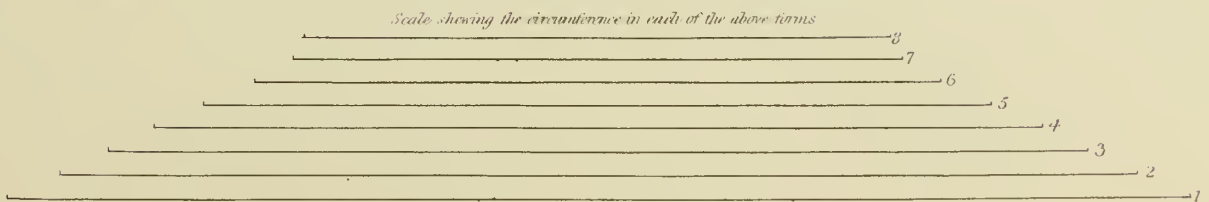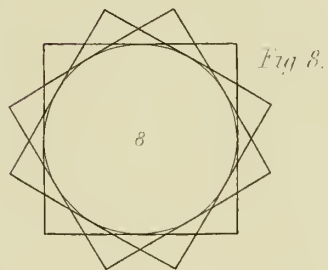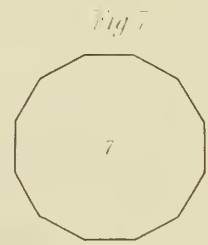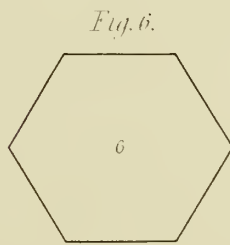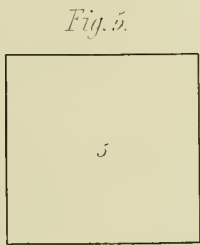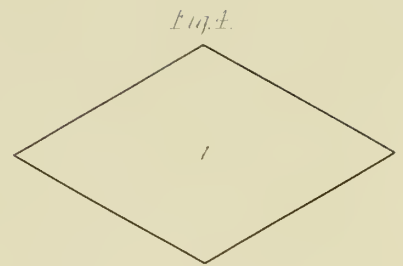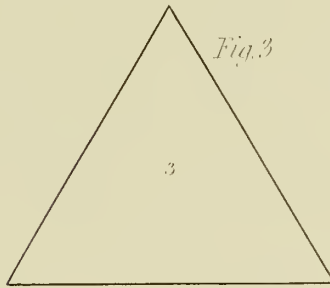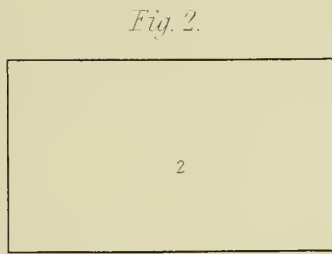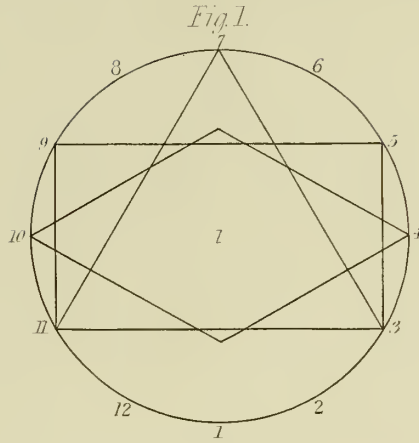
PLATE VIII.
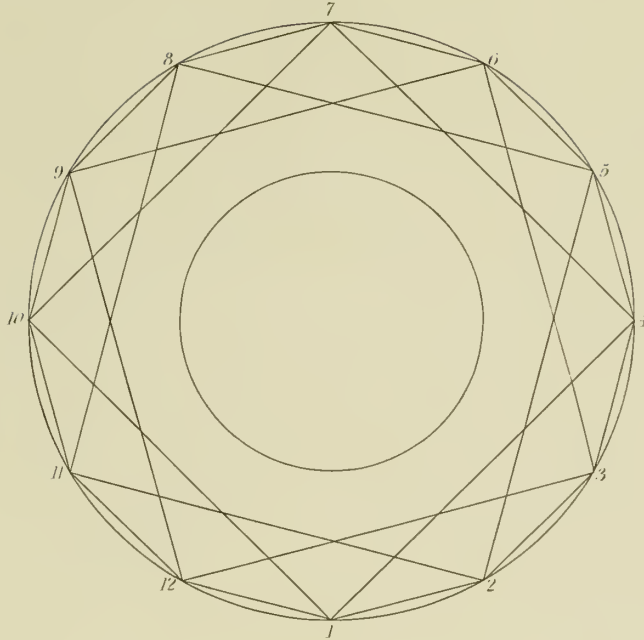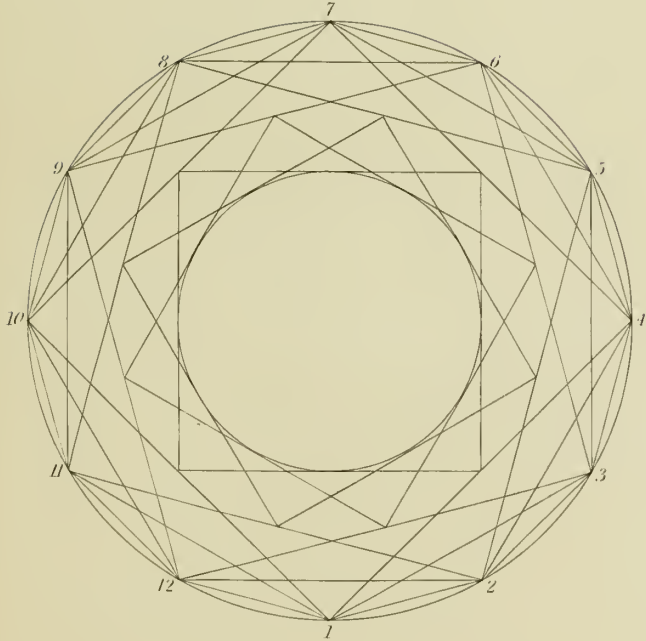
Fig. 1.

Fig. 2.

Fig. 3.
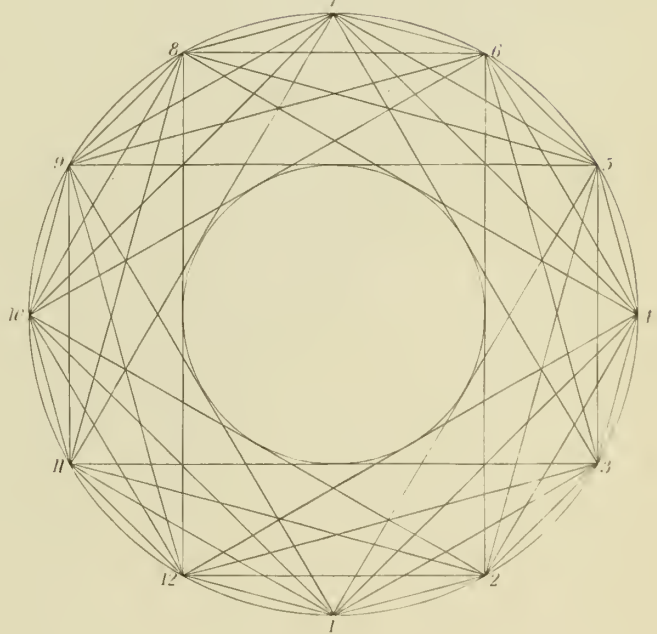
PLATE IX

PLATE X.

Diagram showing the forms that arise within an octave of the Ellipsis

Fig 1.

Fig 2.

Fig 3.

PLATE XI.
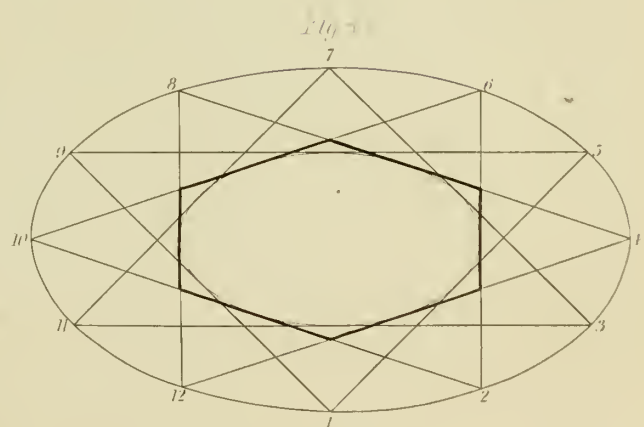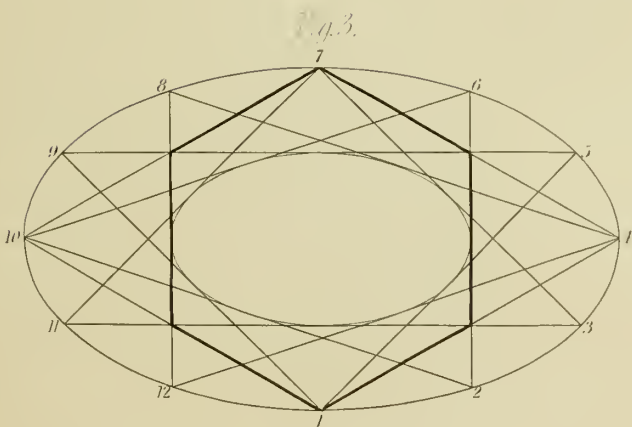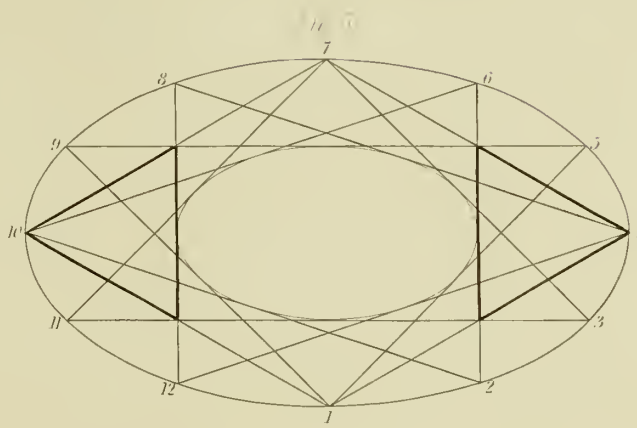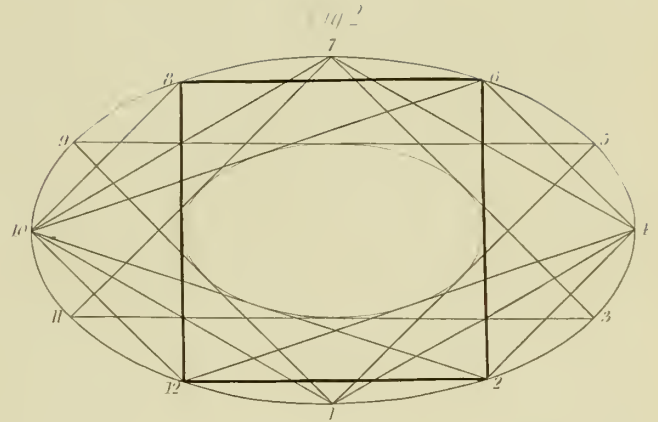
PLATE XII.

Fig. 1.
1st position of the common chord
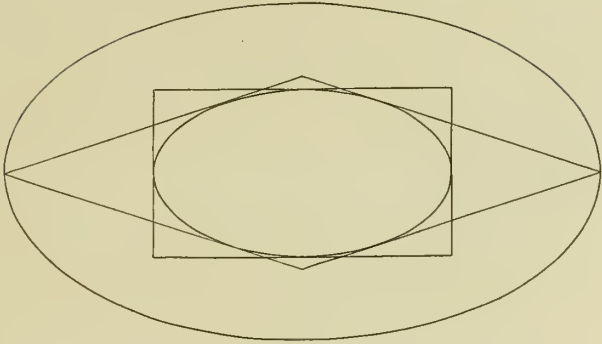
Fig. 2.
2d position of the common chord
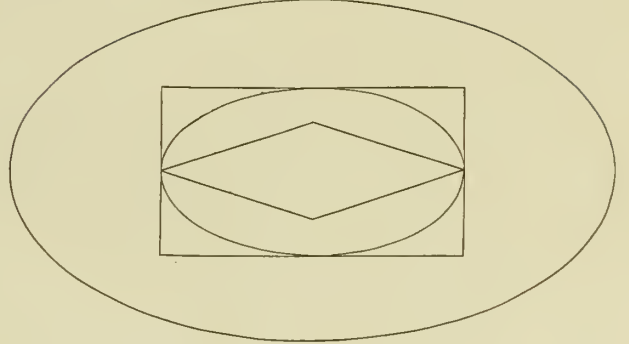
Fig. 4
1st inversion of the common chord
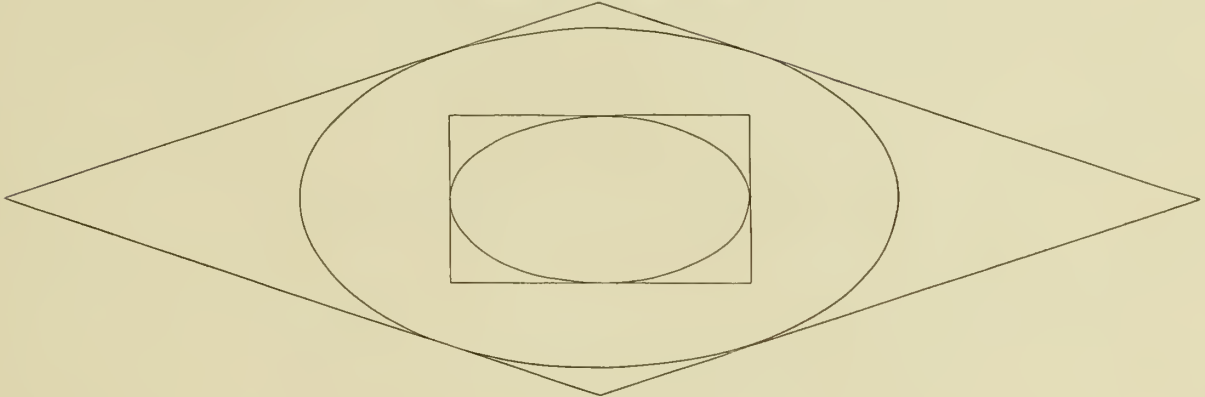
Fig. 3
3d position of the common chord
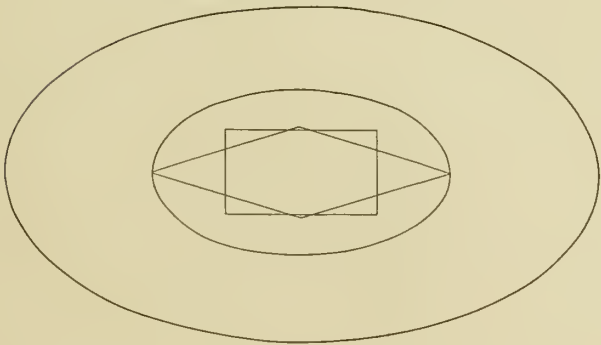
Fig. 5
2d inversion of the common chord
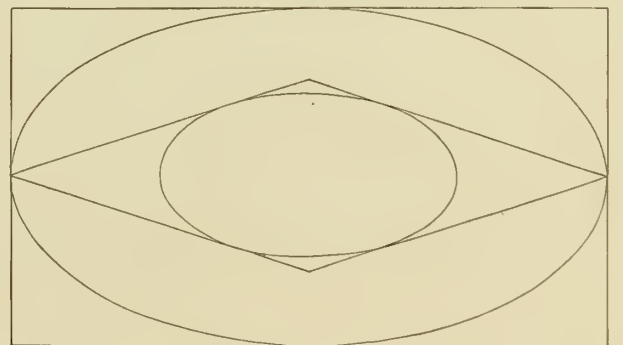
PLATE XIII.

Diagram of the tertiary forms.

Tonic

Mediant

Dominant
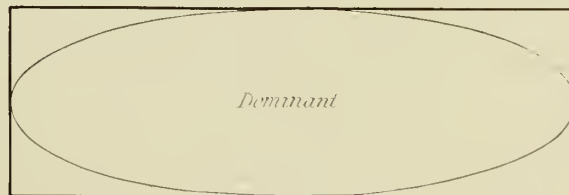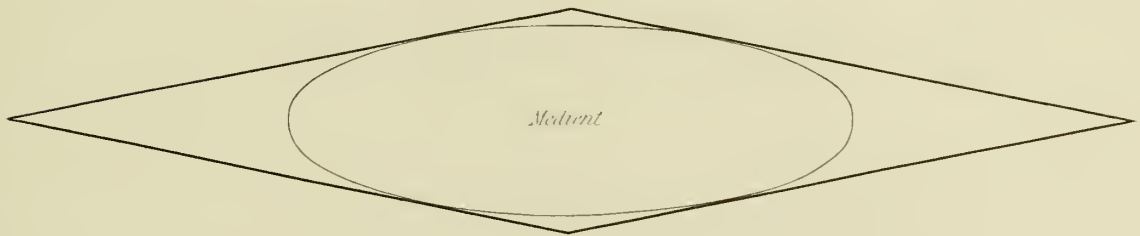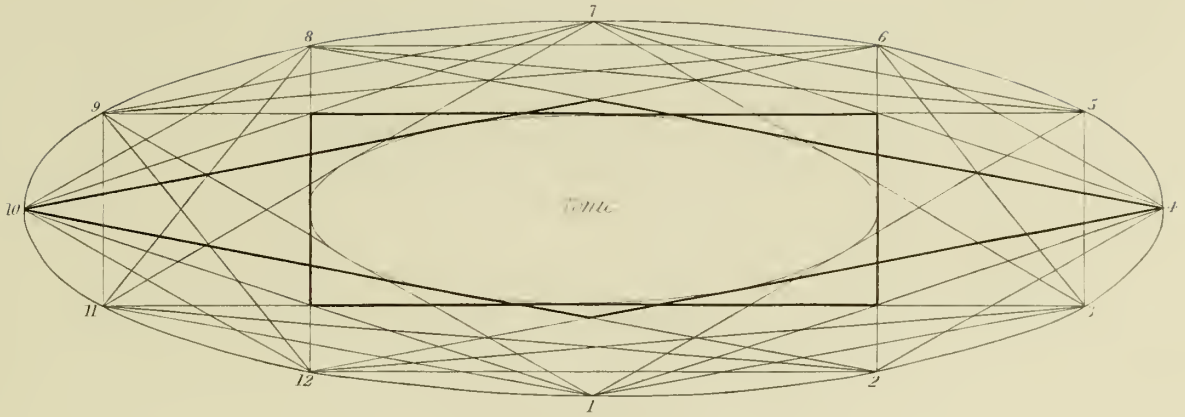
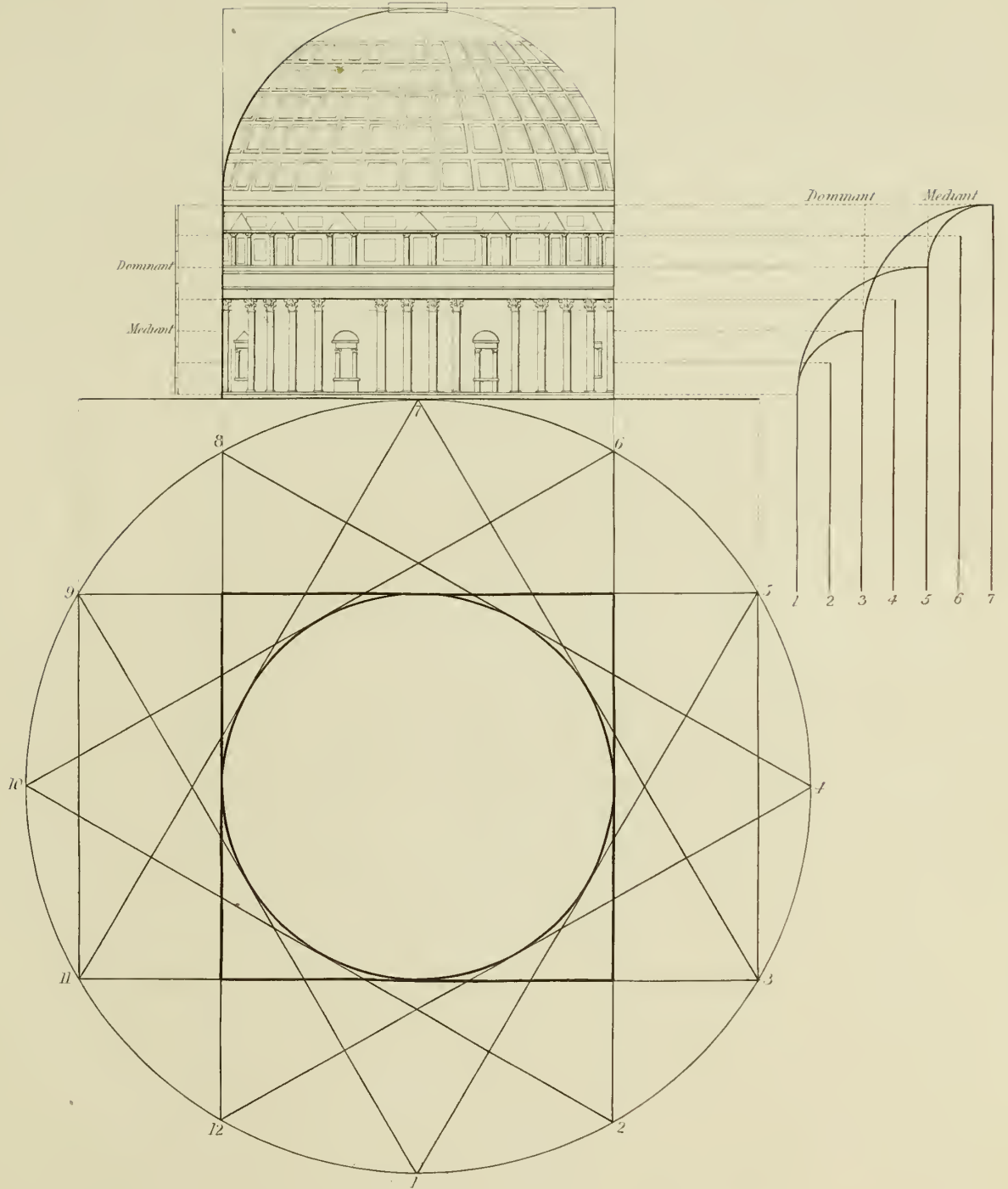PLATE XIV

Melody of the Portico of the Parthenon.

PLATE XV.

Tonic   8ᵗʰ degree 12

Leading note or subtone   7ᵗʰ degree 11

      10

Sub Medient   6ᵗʰ degree 9

      8

Dominant   5ᵗʰ degree 7

      6

Sub Dominant   4ᵗʰ degree 5

Medient   3ᵈ degree 4

      3

Super Tonic   2ᵈ degree 2

      1

Tonic   1ˢᵗ degree
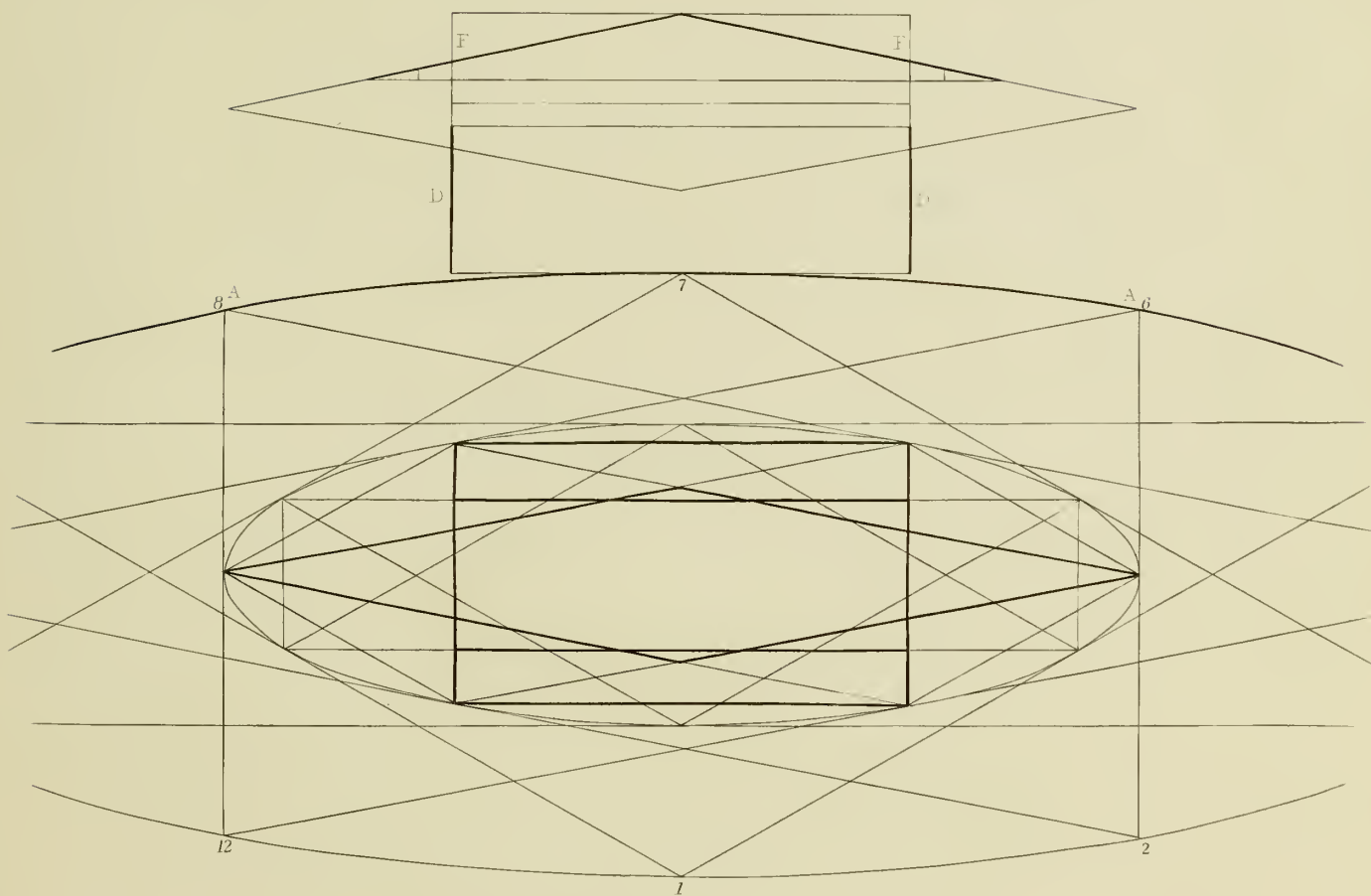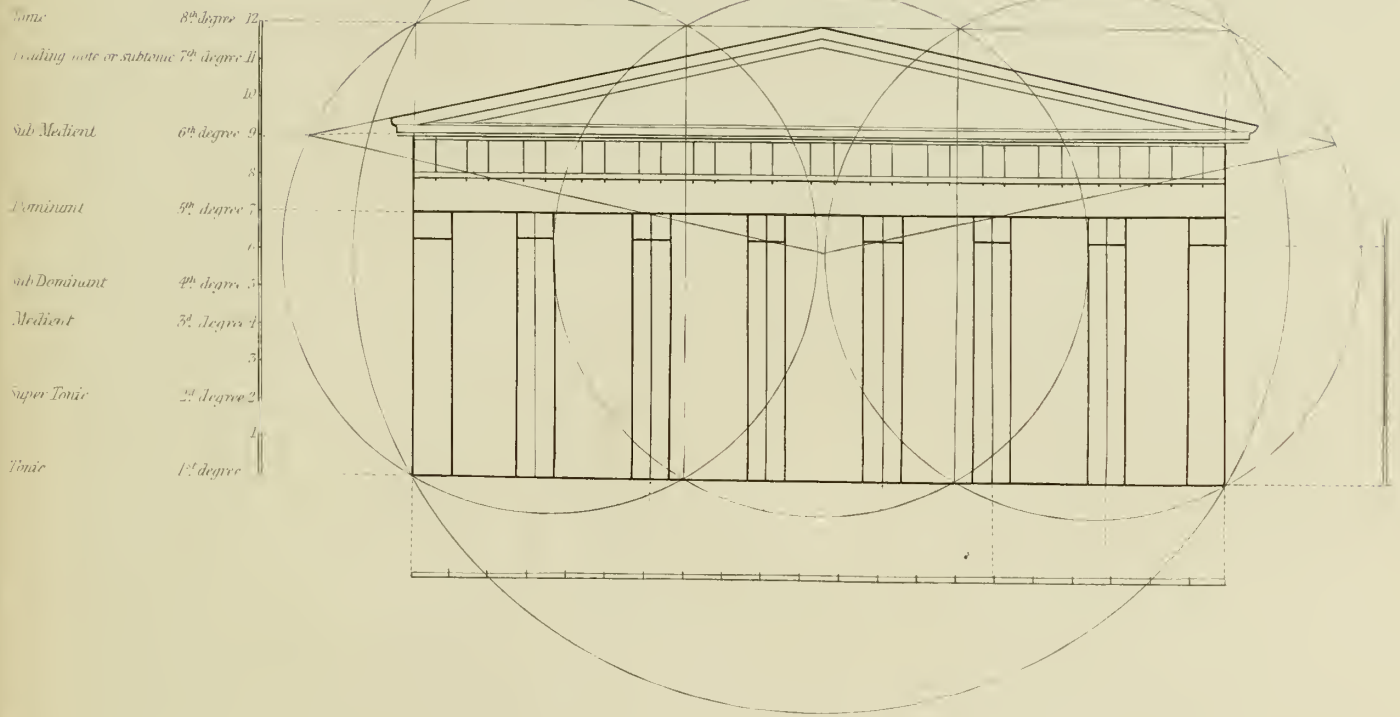
PLATE XVI.

PLATE XVII.

Melody of the Pantheon Rome
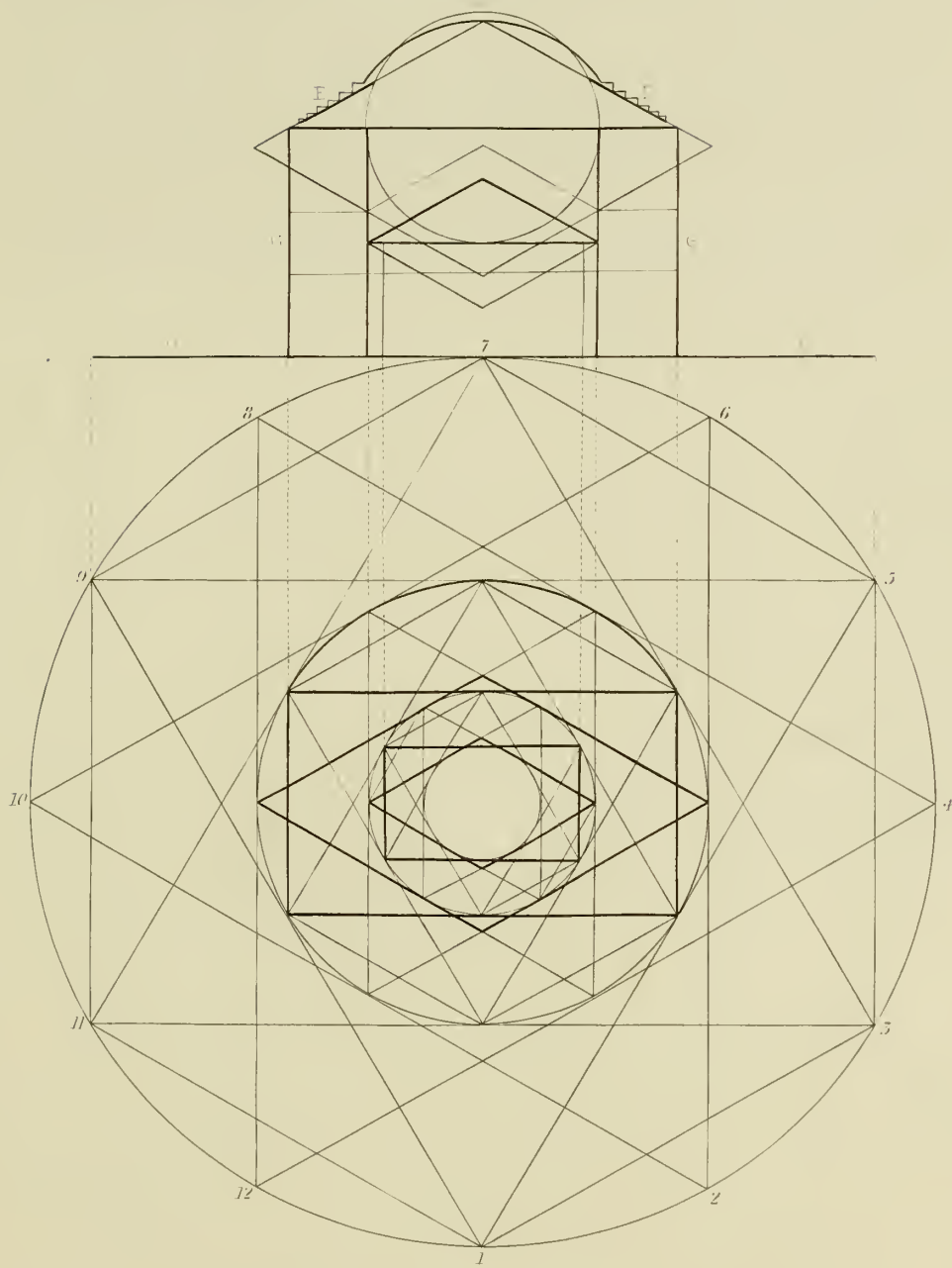
PLATE XVIII.
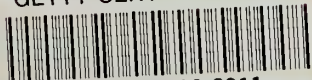
FARNESE PALACE – ROME.

Blue   Purple   Red   Orange   Yellow   Green   Neutral   Blue