THE

THEORY

OF

HARMONICS:

OR,

AN ILLUSTRATION

OF THE

GRECIAN HARMONICA.

IN TWO PARTS:

I. As it is maintained by EUCLID, ARISTOXENUS, and BACCHIUS SENIOR.

II. As it is eſtabliſhed on the Doctrine of the RATIO: in which are explained the Two DIAGRAMS of GAUDENTIUS, and the PYTHAGOREAN Numbers in NICOMACHUS.

With PLATES, an INTRODUCTION to each PART, and a General INDEX.

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M.DCC.LXXXIV.

INTRODUCTION.

I HAVE no other excuſe for troubling the Public on a ſubject that has already been treated of by ſo many learned writers, than the certainty of having made ſome diſcoveries, which may, in part, remove the great obſcurity that has ſo long attended the moſt curious and diligent enquiries after the true principles of the ancient Grecian Harmonica. The advantages I have received in my profeſſion from that doctrine, would never have been a ſufficient temptation to appear as a writer, particularly on a ſubject ſo difficult to be explained, ſo little qualified as I am to do juſtice to it, were I not in hopes that the knowledge of it may be very uſeful to profeſſors, by the great advantages they may receive from the true and unerring principles of

Science. To explain the ancient doctrine of the Harmonica, and the ſeveral parts into which it is divided, and to reconcile it to modern theories, is the great object that has engaged me in this purſuit; and however conſcious I am of my own inabilities, yet truth, diveſted of ornament, cannot fail of meeting with indulgence from the Public, eſpecially when it leads to uſeful diſcoveries.

Nothing contributes ſo much to the encouragement of Study, as the knowledge of ſome governing and leading principle; ſome viſible and faithful guide, that will conduct us through the mazes of Science, and teach us to love and obey her laws. It is this that warms and animates our endeavours in the arduous purſuit, and in the end rewards our labours with ſucceſs.

This governing principle ſhews itſelf in no part of human learning ſo much as in the various operations of numbers; whoſe powers, by a kind of magic, have greatly contributed to the many diſcoveries and improvements that have been made in all arts and ſciences; nor can it be otherwiſe, while

while Truth is the great object to which thoſe powers are directed.

Where the variety of proportion and its different relations conſtitute the beauty and harmony of parts, from which the great perfection of any art or ſcience is derived, the application of ſome branch of the Mathematics is indiſpenſibly neceſſary, ſince without its friendly aid we muſt wander in obſcurity and uncertainty.

From this great ſource the firſt principles of Muſic were diſcovered; and from the ſame fountain others muſt be drawn, if we would be led by the moſt unerring guide towards perfection, to which point the efforts of the profeſſor, however weak, are directed.

The uſual method of treating this ſubject has been ſuch, that without a profound knowledge of the Mathematics, together with the finer and more ſublime parts of Geometry, he is excluded from the advantage which the writings of ſo many learned authors would give him, and is left to the uncertain

rules and examples of his practical predeceſſors, with what nature, and his own feelings, will dictate.

In this ſituation there remains no hope but that of uniting the practical with the demonſtrative, the art with the ſcience; at leaſt as far as a perfect knowledge of Harmonics is concerned; leaving the more philoſophical parts to others.

In order to effect this, the operations of numbers muſt be the moſt ſimple, and their application to ſounds the moſt rational and eaſy to be comprehended,

This eaſe and ſimplicity will naturally engage the attention of the profeſſor, who will readily give up ſome part of his time from that more ſevere and laborious practice, which all inſtruments now require, to a ſtudy that will not only leſſen his labours, but at the ſame encreaſe his mechanical powers, and raiſe his reputation on the moſt ſolid and laſting foundation.

Among

Among the theories which have appeared at different periods, thoſe of the Greeks ſeem to have all the advantages that can be wiſhed to lead us to the true knowledge of Harmonics; for as their principles are in nature, they muſt be fixed and immutable.

This appears in no part ſo obvious and certain, as in the formation of their Scales, which, from the impoſſibility of altering their original order, muſt ever remain in the ſame form and proportion in which they have always been; as the different combinations of Time are naturally confined to the two Primes, 2 and 3, or their Multiples, from which there can be no variation.

Hence we may conclude, it is ſcarcely poſſible that this natural and abſolute neceſſity in the order and diſpoſition of Sounds ſhould have long eſcaped the obſervation of the ancients; or that they ſhould not ſoon have diſcovered the principles by which Tune was ſo limited and circumſcribed; eſpecially as their theories were not formed by mere practical muſicians, but by men of learning, who taught them

them publicly in their ſchools, together with other arts and ſciences, proper for the moſt finiſhed education.

But that which confirms this opinion of their knowledge in the Theory of Harmonics, is the ſimplicity of the Tetrachord, which always continued their favourite ſyſtem. For however they diſagreed with reſpect to the neceſſity of meaſuring intervals by the Ratio, yet they were all unanimous in aſſerting the perfection of the Tetrachord, which is evident from its making ſo eſſential a part in all their Diagrams.

That a ſyſtem, ſo ſimple as this, ſhould continue for ſo many ages without the leaſt alteration, is not only a proof of the perfection of its compoſition, but that it has its foundation in nature; or in ſuch laws as could not be altered without deſtroying the original harmonious conſtitution of the ſyſtem, and, with it, the order and regularity of the ſcales.

By

By what means it was laid aſide in the tenth century, and ſucceeded by Guido Aretine's Hexachords, (the next ancient ſyſtem) will be obſerved in page 13.

As to the particular time when the Tetrachord was firſt uſed, or by whom invented, it is not very material to enquire, ſince there can be no doubt of its being the moſt ancient muſical ſyſtem in the world, And if we would wiſh to know more with reſpect to the great antiquity of Muſic, the ſacred and prophane writers will abundantly inform us: for as it was very early uſed in religious and other ceremonies, its improvement, in an equal degree with other arts and ſciences, ſeems a natural conſequence.

Ariſtoxenus gives it the higheſt antiquity; where in ſpeaking of the three genders, the Diatonic, Chromatic, and Enharmonic, page 19, he ſays, " The Diatonic is to be placed as firſt and " moſt ancient, and it is that which human nature " firſt receives."

But

But without inſiſting on this, it muſt be granted, that the human voice is tuned by this ſcale or gender, which is univerſally the ſame, at all times, and in all countries; for as this is the ſcale of nature, there is ſufficient reaſon to believe, that the principles of harmony, the number and quality of conſonances and diſſonances, are fixed and determined by certain laws, which therefore muſt remain unalterable, whether they are underſtood in part, or in the whole. Thus, the blood circulated before the great Harvey was born, and the laws of gravity and attraction operated, before that great ornament of this country, Sir Iſaac Newton, exiſted; nor could their diſcoveries make any alteration in thoſe laws of nature, for they were conſtantly and uniformly the ſame, both before, as well as after.

The many wants to which the condition of man is ſubject, contribute by a kind of neceſſity to the improvement of all arts and ſciences, except muſic; but in this, where pleaſure is the end propoſed, we are too impatient to be gratified, and the charm is too powerful to admit of delay from the cold and dry

dry inveſtigation of ſcience. This is perhaps one reaſon why we meet with ſo few theories.

Notwithſtanding the great antiquity of Muſic, we have no writers come down to us prior to the Grecians; and, of theſe, the number is not very conſiderable.

In them there is mention made of earlier writers, of whom a large catalogue may be ſeen in the 3d book of Fabricius's Bibliotheca Græca.

The great and wonderful effects which the Grecian muſicians are ſaid to have had over the paſſions, have inclined the moderns to believe that the art has long ſince been loſt, as we meet with no ſuch effects now; and therefore they conclude we are entirely ignorant of the noble and ſublimer parts, which operated with ſuch an irreſiſtible force.

Some have taken the contrary ſide, endeavouring to prove thoſe extraordinary and wonderful effects to be mere fable, and the invention of the poets. Others have denied that the Grecians had

any knowledge of harmony, allowing them melody only, and limiting their Choruſſes to uniſon or octave; by which they have put their muſic on a level with common ballad-ſinging.

This opinion is principally founded on their Scales or Diagrams, which, if they were ſuch as have hitherto been explained, muſt extinguiſh every ſenſe of muſical feeling, by impoſing a ſeries of ſuch inconcinnous ſounds, as it is impoſſible for the voice to move in, or the ear to approve. The truth of this may be made very evident from tuning a harpſichord by perfect fifths throughout, by which the ſeveral degrees will be tones major and limmas. From this experiment it will be found, that not only harmony, but even a perfect melody, cannot be obtained from principles ſo oppoſite to nature.

Theſe writers, in favour of the moderns, have not been aware of this very great objection; they did not conſider, that if the ſcale contained the true and natural degrees of voice proper for melody, (which they acknowledge the Greeks had improved to the greateſt perfection) it muſt alſo have been proper

proper for harmony; which, agreeably to the laws of ſcience, is rather the Parent than the Offspring of melody, as will appear an undeniable fact in the courſe of this work.

If however the true Diatonic, which is the ſcale, or voice of nature, has not yet been found in their diagrams, it is not impoſſible, but they may admit of ſome other conſtruction, ſome other interpretation, which may lead us to a more certain knowledge of their doctrine, and the true principles by which their Harmonica is to be underſtood.

But before I proceed, it may be neceſſary to take a flight view of the theories formed by the Latins, in order to recover muſic from the obſcurity in which it lay buried for many ages.

This enquiry will be the more neceſſary, as it will lead us to a better knowledge of the Grecian theories, and enable us, in ſome meaſure, to judge how far the Latins deſerve the honour of being not only the reſtorers of muſic, but alſo the inventors of harmony; or, which is the ſame, of uniting

two, three, or more different melodies, agreeably to the laws of harmony: a diſcovery of the greateſt importance, and which by many is ſaid to have been unknown to the Greeks.

Muſic muſt have been in a very weak and infant ſtate among the Latins, if we may judge by their ſyſtems; from which it appears, that the few tracts of the Grecians in their poſſeſſion were of little ſervice to them. For, in theſe tracts, the muſical characters were numerous, and a great variety of diſtinctions was neceſſary to their right application. Theſe, with many other difficulties, were not eaſily got over; and it is not to be wondered, that the Latins choſe to ſubſtitute a part of their own alphabet, rather than continue ſo great a variety of characters, as was uſed by the Greeks: for as the compaſs of their ſyſtem was the ſame, it required only their firſt fifteen letters, from A to P, to be applied from grave to acute to compleat the Biſdiapaſon.

Hence it appears, that the Grecian doctrine muſt have been very ill underſtood, if a ſyſtem of ſo little meaning could be adopted, whoſe great imperfections

fections required alteration. Accordingly, Pope Gregory, ſome time after, diſcovered that the whole was no more than a conjunction of two octaves, and that the return of the tones and ſemi-tones in the acute, was in the ſame poſition as in the grave; and therefore he reduced the whole ſyſtem to a Hepta-chord, (a ſyſtem of ſeven ſounds) to which he applied the firſt ſeven letters of the alphabet, in the following order, to diſtinguiſh the Grave, the Mean, and the Acute.

A.B.C.D.E.F.G. ‖ a.b.c.d.e.f.g. ‖ aa.bb.cc.dd.ee.ff.gg.

This Gregorian ſcale continued without any material alteration till about the eleventh century; when Guido Aretine, a Benedictine Monk, formed a new ſyſtem compoſed of three Hexachords, each conſiſting of ſix ſounds, which he called by the names of the B quadro Hexachord, the natural Hexachord, and the B flat, or moll, Hexachord.

The graveſt ſound of the B quadro was our G, which is a tone lower than the loweſt in the Grecian Diagram, and which he called for that reaſon by the name

name of Hypoproſlambanomenos, and diſtinguiſhed it by the Greek letter Gamma, probably to perpetuate his improvement on their Diagrams.

The natural Hexachord had our C for its graveſt ſound, a fourth above Gamma or G, and the Moll, which had F for its graveſt ſound, was a fourth above C; and when either of theſe Hexachords was found one or more octaves higher, the ſame name was continued, as being only a repetition of the former; to which the ſeven Gregorian letters were added as before, except the Gamma, which was applied to the graveſt ſound G only. But as theſe letters were not ſufficient to diſtinguiſh the mutations of the Hexachords, which were now to ſucceed in preference to the Tetrachords of the Greeks, ſomething more was neceſſary to be done. For this purpoſe Guido added ſix ſyllables, taken from the firſt ſtrophe of a hymn to St. John Baptiſt, beginning *Ut queant laxis*, &c. from which he ſelected the following ſyllables, and applied them to each Hexachord: Ut, Re, Mi, Fa, Sol, La. Of theſe, the Mi and Fa always diſtinguiſhed the place of the ſemitone, and the other intervals, from Ut

to

to Re, and from Re to Mi, Fa to Sol, and Sol to La, were always tones; but whether major, or minor, was not determined.

The Bb, or Moll Hexachord, is no new diſcovery, as it is formed on the ſame principles, and for the ſame purpoſe, in the Synemmenon Tetrachord of the Greeks.

The major mode, or ſcale, is principally deſcribed by this ſyſtem of Guido; and the minor is rather implied than determined by any ſeparate laws proper for a diſtinction of ſuch great importance; and the whole ſeems calculated for the conduct of a voice in the firſt rudiments of ſinging, rather than a diſcovery of any one principle which can lead us to a knowledge of Harmony.

There is one diſcovery which muſt not be paſſed over, as it does Guido great honour, and has contributed much to the improvement of practical muſic.

It

It muſt be remembered, that the Gregorian letters, and the ſyllables which Guido added to them, were the only muſical characters to determine the difference between acuteneſs and gravity. To prevent therefore the confuſion which this muſt occaſion, he is ſaid to have placed ſeveral parallel lines at a ſmall diſtance from each other, on which, and the ſpaces between, he marked little dots or points, by which the ſeveral degrees, from the moſt grave ſound to the moſt acute, were ſoon diſcovered; but as he found, that the extent of the natural voice could not be brought within the limits of four, five, or ſix lines, and that there were at leaſt three ſpecies of voices, he applied the ſame number of lines and ſpaces to each, together with proper marginal characters or cliffs, to diſtinguiſh one from the other. Thus the graveſt or baſs voice was repreſented by the F Cliff, which confined it within the proper number of lines; the mean, or C Cliff, was placed a fifth higher than the former, and its limits were equal to that ſpecies of voice; and, laſtly, the moſt acute or treble voice, which placed the notes a fifth higher than the mean, or C Cliff, was called the G Cliff.

By

By theſe improvements not only the acute, mean, and grave ſounds were eaſily diſcovered, but alſo the ſpecies of voice to which they belonged.

Another part of his doctrine related to the mutations of the Hexachords, which depended principally on the poſition of the ſemitone. This interval was a material part in the Grecian Tetrachords, and by it they were conjoined to each other.

Theſe are the chief parts of Guido's ſyſtem; and, as they are to be met with in almoſt every writer from his time, and are ſo well known to profeſſors, it is needleſs to be more particular.

He wrote a book, which he called Micrologus, to explain his doctrine; but, as I have never ſeen it, I can only obſerve, that if there had been any thing very material with reſpect to Harmony, the many writers in his favour would not have omitted to have taken proper notice of it; eſpecially, as they have done him the honour of ſtiling him the Reſtorer of Muſic, and the Founder of the modern harmonic ſyſtem.

But how three ſimple Hexachords, or their Octaves, unſupported by the fundamental baſſes, (for as the writers ſince Guido take no notice of them, we muſt conclude they made no part of the theory, notwithſtanding they are applied by the moderns;) how, I ſay, theſe Hexachords, whoſe intervals were undetermined by the ratio, could form a ſufficient number of ſcales neceſſary for the mutations, together with a ſeries of flat and ſharp Dieſes, proper to determine the place and magnitude of every interval neceſſary to perfect the moſt remote tranſpoſed ſcales, either major or minor, ſeems no leſs ſurprizing, than that of limiting the theories of the Greeks to a ſimple melody only of two Tones major and a Limma to each Tetrachord.

The truth is, we are convinced by demonſtration, that Harmony has been diſcovered for ſome centuries paſt, but by what means, or by whom, is not ſo eaſily determined.

Vicenzo Galileo, who wrote A.D. 1581, ſays, page 80, that the diſcovery of compoſing or uniting ſeveral melodies was not more than 150 years prior to that

that time, which does no very great honour in reſpect to harmony to the ſufficiency of Guido's ſyſtem, which was in general uſe for ſo many years before.

Now, if Guido's theory was not capable of demonſtrating the true principles of Harmony, to what ſhall we aſcribe them that will not give the Grecians as good, if not a better, claim to the diſcovery, eſpecially if we conſider their great ambition of carrying every art and ſcience to the higheſt perfection; amongſt which, Muſic was highly favoured, and men the moſt eminent for their learning made it an object of their ſtudy, and a part of the moſt finiſhed education of their diſciples.

I have now gone through the principal parts of Guido's ſyſtem of Hexachords, which would have made no part of this work, had it not been with a view to ſhew how far his claim to the invention and improvement of Harmony can be admitted; or whether, by an impartial and candid examination of the doctrine of the Grecians, they may not be found to have a better claim. This will beſt appear by their theories, which, as it is not poſſible to explain

without the aſſiſtance and application of harmonic principles, (the only criterion by which we can judge) we muſt have recourſe to harmonic principles, and thence may conclude in favour of the Greeks, by having the only proof on our ſide of which the nature of the ſubject is capable.

THE

THE

THEORY

OF

HARMONICS.

PART THE FIRST.

THE following treatiſe being deſigned to illuſtrate the doctrine of the Grecians relative to the Harmonica, and to prove their claim to the true Principles of Harmony, it will be neceſſary to mention the Authors who have profeſſedly written on the ſubject. They to whom I refer have been collected by the learned Marcus Meibomius, who has given an edition in Greek, with a Latin tranſlation, and notes. [Amſt. 1652, Elzev.]

Ariſtoxenus,

Ariſtoxenus, a diſciple of Ariſtotle, the moſt ancient of theſe, has written three books, which he calls The Elements of Harmonics.

Euclid, the author of the Elements of Geometry, has written an Introduction to Harmonics.

Nicomachus, a Compendium of Harmonics; wherein he promiſed to explain himſelf more fully in his Commentaries. If he performed his promiſe, the loſs of that work, among the ſeveral loſſes of the works of antiquity, muſt be regretted.

Alypius has written an Introduction to Muſic, and gives the various ſigns or characters by which the different degrees of tune were marked, peculiar to the ſeveral modes.

Gaudentius, the Philoſopher, a favourer of the Pythagorean doctrine, has written an Introduction to Harmonics; in which are contained the two Diagrams that make the foundation of the ſecond Part of this work, in which the Ratio will be applied to the Intervals.

Bacchius ſenior has written a ſhort Introduction on the Art of Muſic, by queſtion and anſwer.

Ariſtides Quintilianus treats both of the Harmonica and Rythmica.

Theſe ſeven authors may be divided into two ſects; the one following Pythagoras, in determining the difference of ſounds,

in

in muſical intervals, by the Ratio ; by which is diſcovered the exact magnitude of each interval, conſonant or diſſonant ; the other, in oppoſition to the Ratio, making the Ear the ſupreme judge, as being more immediately concerned in the perfection of all muſical intervals, and their ſucceſſion.

As the phyſical properties of ſounds, and the ratio of intervals, make no part of the theory of Ariſtoxenus, it is no wonder that the majority of ſucceeding writers embraced his doctrine in preference to that of Pythagoras ; and it is to this cauſe we muſt aſcribe many difficulties we meet with in their works.

It required the moſt judicious and maſterly contrivance to unite the different parts into which Ariſtoxenus's theory was unavoidably divided, and which were mutually to depend on each other, ſo as to eſtabliſh a Theory independent of the Ratio, and at the ſame time capable, from the firſt definition of a ſound, to comprehend and deſcribe all the vaſt variety of intervals, which the different Syſtems, Genders, Tones, and Mutations demanded ; for, a deficiency in either of theſe eſſential parts would not only have deſtroyed the whole, but at the ſame time have fixed the Pythagorean doctrine on the moſt ſolid foundation.

The ſucceſs which attended this oppoſition to the Ratio will beſt be underſtood from the principal rules laid down by theſe authors, which I ſhall collect and apply, without any forced conſtruction, to the harmonic parts they were intended to explain. I proceed, therefore, to the Seven Parts into which the Grecian Harmonica was divided.

Euclid

Euclid gives this definition of Harmony; [p. 1.] that "It is "a ſcience which contemplates the theoretical and practical "nature of a modulated ſeries." He adds, "A modulated "ſeries is compounded of ſounds and intervals, keeping a "certain order, and its parts are ſeven; of Sounds, Intervals, "Genders, Syſtems, Tones, Mutations, and the Melopœia."

For the better underſtanding this general definition, I ſhall explain each part ſeparately, with ſuch obſervations as the ſeveral articles may require.

I. Of SOUND.

"Sound is a pitch of the voice in one tenſion; [Ariſtox. p. 15.] or, as Nicomachus ſays, p. 24, "An indiviſible voice."

The ancients conſidered the voice as capable of two different ſpecies of motion. Euclid, [p. 2.] calls one, "the Con-"tinued, proper for Diction;" the other, "the Diaſtematic, "(divided by intervals) proper for Melody."

II. Of INTERVALS.

Bacchius ſenior [p. 2.] ſays, "An Interval is the difference of two ſounds, diſſimilar in acuteneſs and gravity." Ariſtoxenus [p. 15.] deſcribes it to be "the ſpace between two ſounds, "not having the ſame tenſion."

Ariſtoxenus and Euclid give, though in a different order, theſe five diviſions of intervals:

The

"The firſt, by which they differ among themſelves in magnitude; the ſecond, by which the conſonant differ from the diſſonant; the third, by which the compounded differ from the uncompounded; the fourth, by gender; and the fifth, by which the rationals differ from the irrationals." Ariſtox. p. 16.

"The difference by magnitude (according to Euclid) is when ſome of the intervals are major and others minor." Thus, ditone has a greater magnitude than trihemitone, and tone than hemitone or dieſis: but diateſſaron is leſs than diapente or diapaſon, and the like.

The difference by conſonance and diſſonance is, that "the conſonant intervals are formed by an agreeable mixture of the acute and the grave, but the diſſonant refuſing to mix, hurt the ear with ſome harſhneſs." Euclid, p. 8.

This mixture of ſounds, ſinging as conſonance or diſſonance, is a proof at leaſt of two melodies or voices being united in the ſame ſong.

The difference of the compounded from the uncompounded is, that the compounded are ſuch intervals as may be divided into leſs parts, ſuch as the tone into two hemitones in the chromatic gender, and the hemitone into two dieſes in the enharmonic; but in the diatonic gender, neither the tone nor hemitone can be divided, and are therefore uncompounded intervals.

There are, as Euclid obſerves, ſome intervals that partake of the nature of compounded and uncompounded; as thoſe from the hemitone to ditone: for hemitone in the enharmonic is compounded, becauſe it may be compoſed of two dieſes, but in the chromatic and diatonic it is uncompounded; the tone in the chromatic is compounded, but in the diatonic is uncompounded. Beſides theſe, there are other intervals which partake of theſe two oppoſite characters, by being applied to different genders.

"The difference by gender is, when ſome of the intervals are diatonic, ſome chromatic, and others enharmonic."

"The difference of the rational and irrational is, that the rational are thoſe whoſe magnitude can be given, as tone, hemitone, ditone, tritone, and the like; but the irrational are thoſe that vary theſe magnitudes, more or leſs, by ſome irrational magnitude." [Euclid, p. 9.]

The preceeding definitions of intervals are rather too general to give that ſatisfaction which ſo intereſting a ſubject requires; yet as they introduce the genders, in which the number and magnitude of all intervals leſs than the fifth or diapente, will be particularly deſcribed, they have their uſe, and prepare us to reconcile thoſe judicious remarks and diſtinctions we ſhall meet with in the genders.

From theſe five diviſions of intervals I ſhall proceed to the genders, to ſhew by what rule theſe intervals are to be diſcovered, and their different magnitudes determined; for although the

the ear had before been declared the ſupreme judge, yet in ſome inſtances it was not ſufficient; as Ariſtoxenus owns, in ſpeaking of the enharmonic dieſes, [p. 19.] where he ſays, "the ear ſcarce accuſtoms itſelf to this interval, even with much labour."

III. Of the GENDERS.

The genders will be particularly deſcribed by the number of parts into which Ariſtoxenus and Euclid have divided the tetrachord; by which diviſion the magnitude of each interval is fixed and determined, according to the gender in which it is placed. And thus, not only all the imperfect concords, but even the ſmalleſt dieſes, are diſcovered to have their particular magnitude within the limits of the tetrachord; together with thoſe intervals which are proper for combination, and thoſe which can be uſed only in ſucceſſion.

The Tetrachord, not only from its great antiquity, but from the ſimplicity of its parts, is the principal foundation of the genders. Its compoſition conſiſts of hemitone, tone and tone aſcending, and the contrary deſcending. [Euclid, p. 3.]

By this definition we diſcover, that the hemitone is ſubſtituted in the place of the limma, which neceſſarily alters the two tones major into minor and major, which is truly diatonic.

That this may be better underſtood, it muſt be obſerved, that the compoſition of the tetrachord is limited to four ſounds,

or three intervals, the extremes of which make the interval of a fourth or diateſſaron, and are always in the diatonic gender fixed and immovable; but the two intermediate ſounds are to be moved and altered, according to the gender that is to be formed. As theſe alterations will conſiſt in making the middle ſounds graver in one diagram, and acuter in the other, the modern characters of ſharp and flat muſt be applied with the ſame effect, and in the ſame manner as the ancient dieſes. Theſe will be extracted in proper order from the ſeveral ſcales or diapaſons, which form the modes, and will be placed next each other as a ſcale, to diſtinguiſh and repreſent the ſpiſs intervals, which though not proper for melody in that form, yet are abſolutely neceſſary to divide the tetrachord into a certain number of parts, to determine the abſolute magnitude of different intervals proper for each gender, and to form the different ſcales.

Euclid ſays, [p. 9.] that "Every melody is either diatonic, "chromatic, enharmonic, common, or compounded of them." And he adds, [p. 10.] "The mixt is that in which are per-"ceived the characters of two or three genders; of the diatonic "and chromatic, or diatonic and enharmonic, or chromatic "and enharmonic; and even of the diatonic, and chromatic "and enharmonic; and that the difference of genders is made "by moveable ſounds." He multiplies theſe three genders into ſix, and adds, that "Colour is a ſpecial diviſion of the "gender, and that the rational and known colours are ſix; viz. "one of the enharmonic, three of the chromatic, and two of "the diatonic." And after enumerating the particular compoſition of each, he tells us, [p. 11.] "that theſe colours are "all ſhewn in numbers. The tone is ſuppoſed to be divided "into

" into twelve very ſmall parts, each of which is called the " twelfth part of a tone; and by the ſame method as the tone, " the other intervals are divided; viz. a hemitone into ſix of " thoſe twelve parts, the quadrant dieſis into three parts, the " triental into four, and the whole diateſſaron into thirty. " Therefore the enharmonic will be ſung by the magnitude of " three of thoſe twelve parts, and three, and twenty-four. " (3 + 3 + 24 = 30.)"

" The chromatic moll, by 4 and 4 and 22," = 30.

" The ſeſquialter chromatic, by $4\frac{1}{2}$ and $4\frac{1}{2}$ and 21," = 30.

" The toniæum chromatic, by 6 and 6 and 18," = 30.

" The diatonic moll, by 6 and 9 and 15," = 30.

" The diatonic ſyntone, by 6 and 12 and 12," = 30.

In order to explain this part of Euclid's doctrine, I muſt refer to Plate IV.

In this Plate the ſeveral intervals in each gender are regulated, and their magnitude determined, by the number of ſpiſs or ſmall intervals, contained in each, of which the following is an explanation.

Plate IV. K is compoſed of two tetrachords conjoined, to which the note of disjunction, marked by a ⊣, is added to compleat the diatonic octave.

L contains the ſpiſs or ſmall intervals, each being diſtant from the next, as directed by Euclid, three parts of twelve; which divides the tetrachord into thirty ſuch parts.

N con-

N contains the enharmonic gender; in which, after the two dieſes are taken out of the tetrachord, of the magnitude of 3 and 3, the uncompounded ditone (conſiſting of twenty-four ſuch parts, which are equal to the major third, an imperfect concord is added, and completes the tetrachord in its proportion of thirty parts.

P is the ſeſquialter chromatic; but $4\frac{1}{2}$ and $4\frac{1}{2}$ are intervals not to be found in a continued ſeries of 3; the interval, however, of ſeven dieſes, or twenty-one parts, completes the tetrachord, and is an incompoſite interval equal to a deficient fourth; which is an acquiſition of great conſequence, where all ſpecies of muſical intervals are to be diſcovered and limited to their ſeveral magnitudes.

R, the toniæum chromatic, is compoſed of a ſemitone major and a ſemitone minor, to which an uncompounded interval, equal to a minor third, an imperfect concord, is added, which completes the number of parts equal to the tetrachord.

S is the diatonic moll; in which the two firſt intervals form the ſyſtem of the deficient third, and the laſt uncompounded interval is the ſuperfluous ſecond. This gender, directed by a ſkilful compoſer, is very pathetic and ſentimental.

T is the diatonic ſyntone. This gender is the ſcale of nature, conſiſting of ſemitone, tone, and tone. The perfection of this gender is ſuch, that all, who ſing, even without any knowledge of muſic, will ſing their different melodies in this gender.

gender. It is not only the foundation of all the others, but by a judicious mixture with them forms all the colouring, or light and dark ſhades of muſic; and without this, viz. the diatonic ſyntone, the other genders would rather diſguſt than pleaſe.

W, the chromatic moll, is involved in the ſame difficulties with the ſeſquialter chromatic; for as neither 4, nor $4\frac{1}{2}$, are aliquot parts of 30, ſo no interval of theſe magnitudes can be found to have a place among the ſpiſs, which are in a continued ſeries of 3 equal to 30; and as no additional note can be placed among the ſpiſs without exceeding the number limited by Euclid, and increaſing the number of modes, which would confound and diſorder the whole of their doctrine, ſo no alteration whatever can be made in the preſent number and order of the ſpiſs; and as the ratio was not admitted in Euclid's Introduction to Harmony, the difference of a comma cannot be applied on the preſent occaſion, conſiſtent with principles in oppoſition to the ratio.

For theſe reaſons I omit any farther enquiry concerning the intervals at P and W; particularly as thoſe already diſcovered ſupply us with all the variety which every ſpecies of muſical compoſition can want, either in ſucceſſion or combination. For ſucceſſion, we have the enharmonic dieſes, the ſemitone minor, and deficient third; and for combination, we have three ſpecies of 2ds, three ſpecies of 3ds, three of 4ths, three of 5ths, three of 6ths, and three of 7ths, with their reſpective octaves. Theſe intervals are expreſſed at X and Z, Plates IV and V, and we diſcover in each (the one being an inverſion of the other) three

intervals

intervals proper only for ſucceſſion, and ſeventeen, including the octave, for combination.

Thus the great end of the genders is in all reſpects anſwered, which was to fix and determine the magnitude of all ſpecies of muſical intervals; which could not be found in diagrams, compoſed only of tones major and limmas. But excluſive of theſe very great advantages, the genders contribute in a wonderful manner to the pleaſure of thoſe at all acquainted with them, by diſtinguiſhing the phraſe, and giving a certain colouring to heighten and ſupport the ſentiment, and adding to the powers of mutation, in a more extenſive manner than the diatonic alone can ever arrive at.

I cannot leave this ſubject without obſerving, that the great objection made by all writers to the Grecian theories has been, that they had only the perfect conſonances, but that the imperfect made no part of their doctrine, and conſequently it was impoſſible for them to have harmony or muſic in two or more parts, moving agreeably to the laws of harmonic combination.

This objection was founded on the conſtruction of their diagrams, which were compoſed of tones major and limmas, intended by the Grecians to be applied in a very different way than in later times has been imagined; and while that application remained undiſcovered, the objection was not only true with reſpect to harmony, but was alſo true with reſpect to melody; for ſuch an untunable ſcale cannot be applied to either with any effect.

This

This great and univerſal objection will be removed when I conſider thoſe diagrams, and is at preſent in part removed by a right explanation of the genders; an eſſential part of the Grecian harmonica, which can admit of no other conſtruction, and has not only determined the magnitude of all the perfect and imperfect conſonances, but of all the diſſonances that can be diſcovered, or applied to muſical compoſition.

IV. Of SYSTEMS.

It has already been remarked that any two ſounds differing in acuteneſs and gravity form an interval; that intervals are varied according to the gender; and that genders are limited by the tetrachord to three intervals or four ſounds; by which limitation the magnitude of each degree is determined.

Thus in the diatonic the natural degrees of voice proceed from grave to acute by hemitone, tone, and tone, or the contrary; and the whole compoſition of intervals forms the ſyſtem of tetrachord.

Ariſtoxenus [p. 15.] and Euclid [p. 1.] agree "that a ſyſtem is compoſed of more than one interval." As this ſeems to be a definition of the ſmalleſt ſyſtem, it follows that the two ſpiſs intervals of the enharmonic and the chromatic muſt be ſyſtems; and that the two ſpecies of thirds in the diatonic and chromatic may be made ſyſtems, by inſerting a note between the extreme ſounds of each third, as C D E, or D E F.

There are many ſpecies of ſyſtems deſcribed by the ancients, which, though they make a very conſiderable part, yet alone are not ſufficient to ſupply the vaſt varieties of modulation. In aid therefore of this ſtreight line of ſyſtem, they have placed the uncompounded, or diaſtematic, intervals. By this method we diſcover two motions of voice; the firſt paſſing through the ſeveral degrees which form the ſyſtem, and the other paſſing from one extreme of a ſyſtem to the other, leaving out the intermediate degrees. Hence the diateſſaron is of the ſame magnitude when a ſyſtem, as it is when a diaſtem; and the only difference is that one is compounded, and the other uncompounded: therefore every interval in the diatonic, as diapente, diapaſon, and the like, which admits of a compoſition, may be a ſyſtem with, or a diaſtem without, ſuch compoſition.

Syſtems then being a modulated ſeries from grave to acute, or the contrary, are diſtinguiſhed by Euclid [p. 12.] in the following order:

" There are ſeven differences of ſyſtems; four of them are " in the intervals; namely, the difference of magnitude, of " gender, of conſonance and diſſonance, of rational and irra- " tional. There are three peculiar differences of the ſyſtems; " that of ordinate and prepoſterous, of conjoined and disjoined, " of immutable and mutable."

The difference by magnitude and gender has already been treated of. The next difference, of conſonance and diſſonance, is diſtinguiſhed by a compariſon of the firſt ſound with the laſt, which

which terminates the whole, and may be ſometimes conſonant, and ſometimes diſſonant.

There are ſix conſonant ſyſtems deſcribed by Euclid, [p. 12 and 13]. The firſt three are ſimple, as diateſſaron, diapente, and diapaſon; the next three are compounded of diapaſon and diateſſaron, diapaſon and diapente, and bis-diapaſon, which is the greateſt and moſt perfect ſyſtem, containing all the leſs. He alſo mentions a ſeventh and eighth ſyſtem, viz. compounded of bis-diapaſon and diateſſaron, and bis-diapaſon and diapente. Which ſhews that the limits of their ſcale were not ſo much confined as has generally been imagined; for it wants but one note only (the hypoproſlambanomenos) to be of the ſame extent with that of Guido.

But Ariſtoxenus goes much further; for he ſays [p. 21.] that "A triple diapaſon ſymphonizes, and a quadruple, and "even a greater magnitude."

Each of the firſt three ſyſtems is divided into different ſpecies or figures, by which, though their magnitude is the ſame, the parts of their compoſition are varied. This variation of the ſpecies is occaſioned by the different poſition of the hemitone.

In the diateſſaron it has three places, as BCDE, CDEF, DEFG; in the diapente it has four, as EFGAB, FGABC, GABCD, ABCDE.

The ſeveral ſpecies or figures of the diapaſon are not only diſtinguiſhed by the poſition of the two hemitones, but by the disjunction of the tetrachords.

Euclid [p. 14.] has been careful in diſtinguiſhing theſe different ſpecies. Thus from barypycni to the next barypycni above, or from B to E, is the firſt ſpecies of the diateſſaron, [Plate I.] whoſe hemitone is in the grave. The ſecond ſpecies of diateſſaron is the meſopycni, or from C to F, whoſe hemitone is in the acute. The third ſpecies is the oxypycni, from D to G, whoſe hemitone is in the middle, conſiſting of tone, hemitone, and tone.

In this manner the three ſpecies of ſyſtems are explained; but as the extremes are all of the ſame magnitude, we can have but one diaſtem in the ratio of $\frac{4}{3}$ to each, or from one extreme to the other. After theſe follow the four ſpecies of diapente, thus deſcribed by Euclid, p. 14, 15.

" The firſt, that which is contained in the barypycni, " whoſe tone is firſt in the acute, and is from hypate meſon " to parameſe; the ſecond, that contained in the meſopycni, " whoſe tone is ſecond from the acute, and is from parypate " meſon to trite diezeugmenon; the third, that contained in the " oxypycni, whoſe tone is a third from the acute, and is from " lichanos meſon to paranete diezeugmenon; the fourth, that " contained in the barypycni, whoſe tone is a fourth from the " acute, and is from meſe to nete diezeugmenon, or from " proſlambanomenos to hypate meſon. Alſo in the diatonic " gender, that is the firſt ſpecies (of diapente) whoſe hemitone " is

" is firſt from the grave; that the ſecond, whoſe hemitone is
" firſt from the acute; that the third, whoſe hemitone is
" ſecond from the acute; that the fourth, whoſe hemitone is
" third from the acute."

To theſe the ſeven ſpecies of diapaſon (mentioned by Euclid, p. 15 and 16 compared) ſucceed. They are called Tones or modes, very probably from the tone of disjunction, whoſe different poſition makes one of the principal diſtinctions of the ſeveral ſpecies; and as they are compoſed of the two foregoing ſyſtems of diateſſaron and diapente, the two ſemitones muſt have their place in each.

[Plate I.] " The firſt is that contained in barypycni, from
" hypate hypaton to parameſe, (or from B to B) whoſe tone of
" disjunction is the firſt from the acute, and whoſe hemitones
" are firſt from the grave and fourth from the acute."

" The ſecond ſpecies is contained in meſopycni, (or from
" C to C) whoſe tone (of disjunction) is the ſecond from the
" acute, and whoſe hemitones are the third from the grave,
" and the firſt from the acute."

" The third ſpecies is contained in oxypycni, (or from D
" to D) whoſe tone (of disjunction) is the third from the acute,
" and whoſe hemitones are the ſecond from the grave, and the
" ſecond from the acute."

" The fourth ſpecies is contained in barypycni, (or from E
" to E) whoſe tone (of disjunction) is the fourth from the
" acute,

" acute, and whoſe hemitones are the firſt from the grave, and " the third from the acute."

" The fifth ſpecies is contained in meſopycni, (or from F to " F) whoſe tone (of disjunction) is the fifth from the acute, " and whoſe hemitones are the fourth from the grave, and the " firſt from the acute."

" The ſixth is contained in oxypycni, (or from G to G) " whoſe tone (of disjunction) is the ſixth from the acute, and " whoſe hemitones are the third from the grave, and the ſecond " from the acute."

" The ſeventh is contained in barypycni and apycni, (or " from A to A) whoſe tone (of disjunction) is firſt from the " grave, and whoſe hemitones are the ſecond from the grave, " and the third from the acute."

Theſe ſeven ſpecies of diapaſon are without doubt of the greateſt importance. Euclid is not ſatisfied with deſcribing them by the tone of disjunction, but goes over them a ſecond time [p. 16.] to fix the poſitions of the two hemitones peculiar to each ſpecies. See Plate II. where the hemitones are deſcribed by the black notes, and the tone of disjunction is marked thus $\frac{+}{|}$.

One tetrachord may ſucceed another by conjunction or diſjunction.

The

The conjunction is made by a ſound which is common to two tetrachords, and is the moſt acute of one and the moſt grave of the other.

The magnitude of this conjoined ſyſtem is a heptachord or ſeventh, as from B to A, and conſequently is a diſſonant ſyſtem from one extreme to the other. [Plate I.]

The disjunction is made by a tone, which ſeparates the moſt acute of one tetrachord from the moſt grave of the other, and its magnitude is diapaſon, as from E to E, Plate I.

" There are (as Euclid obſerves, p. 17.) two perfect ſyſtems; " the one leſs, the other greater."

" The leſs is by conjunction, from proſlambanomenos to " nete ſynemmenon, containing three conjoined tetrachords, " hypaton, meſon, and ſynemmenon, beſides a tone from proſ- " lambanomenos to hypate hypaton, (or A to B in the grave) " and is finiſhed by the conſonance diapaſon and diateſſaron :" From A to the ſecond D, or from the firſt to the ſecond apycni, which he has made the limits of this leſs ſyſtem. [Plate I.]

" The greater ſyſtem is by disjunction, from proſlambano- " menos to nete hyperbolæon; and it contains four tetrachords, " disjoined by pairs conjoined together; namely, hypaton, " meſon, diezeugmenon, and hyperbolæon; and two tones " beſides, one from proſlambanomenos to hypate meſon, and " the other from meſe to parameſe, and is included in the con- " ſonance of bis-diapaſon, (from A to the ſecond A) or from

" the

" the firſt to the third apycni, which are the limits of the " great ſyſtem." [Euclid, p. 18.] The great extent of this ſyſtem diſcovers, that the ancients were not confined to the limits of diapaſon, as has been imagined.

It appears by the doctrine of the ancients, that the voice had two principal motions; one, the diaſtematic or harmonic, when the ſounds ſucceed each other by an uncompounded interval, as a 4th, 5th, or 8ve, and the like, proper for the fundamental baſs; the other motion of voice was by degrees or ſyſtems, which being more natural and better adapted to the ſinging of the voice, from their great variety, required a more critical deſcription.

The diaſtematic motions are the only perfect intervals that can be diſcovered in a ſcale or diagram of tones major and limmas; and as it is impoſſible to form a tunable ſyſtem out of ſuch a ſcale, it follows, that theſe uncompounded intervals are the true and original fundamental baſſes, and cannot be applied to any other part of a theory. As to the ſecond motion of voice, in which the degrees or ſyſtems are formed, they are the products of thoſe fundamental baſſes, by whoſe harmonic power the tetrachord conjoined, or diſjoined, and all other ſyſtems are formed and regulated. See Plate III. and VII. in which meſe, or the tone of disjunction, is marked thus +.

I muſt obſerve that all theſe ſyſtems are formed by the tetrachords, and not from the diagram of tones major and limmas; for Euclid, p. 8, and Ariſtoxenus, p. 20, ſay, " that all inter- " vals leſs than the fourth, or diateſſaron, are diſcords."

This

This is very true if applied to the diagram of tones major and limmas, in which no conſonant ſyſtem can be found; but with reſpect to theſe tetrachords, which are all truly diatonic, it cannot be applied to them. In order to remove this ſeeming contradiction of intervals, or even ſyſtems, leſs than the diateſſaron being diſcords, and to give all poſſible ſatisfaction on this ſubject, I muſt obſerve, as before, that the Grecian theory was divided into two parts. The firſt and principal was the perfect ſyſtem, or diagram of tones major and limmas; from which ſyſtem all harmony with its roots or fundamental baſſes ariſes. The ſecond part related to melody, which is connected with, and inſeparable from, the fundamental baſs. Thus the ſcale of tones major and limmas appears to be expreſsly formed to regulate the fundamental baſſes, and cannot be applied as conſonant ſyſtems, like the tetrachords, nor indeed to any other part of their theory.

The harmonic parts, from whence melody has its original, are found in the tetrachords, ſyſtems and genders, &c. and are the products of the fundamental baſſes. For a full explanation of which ſee pages 50, 51, &c.

In the ſcale of tones major and limmas, the only conſonant ſounds to be found are the diapaſon, diapente, and diateſſaron. Theſe three conſonances have a very diſtinguiſhed character by being applied to each tetrachord as fundamental baſſes; for they not only diſcover their true and harmonic powers in forming the diatonic octave or ſcale, (all of which may be extracted from among the harmonics, and reduced to a ſyſtem of degrees) but the name of the ſcale or key-note, when formed, will

have the ſame name as the principal conſonance, or diapaſon. This concord is not only the original of the other two, by including them within its limits, but is ſuperiour to either by being the final note of cadence, and all other perfect terminations. The diapente is more limited in its powers as a fundamental baſs in this reſpect, that it forms the imperfect repoſe, and is neceſſary to lead to the final by forming the cadence.

The Diateſſaron is one of the primary fundamental baſſes, and contributes with the other two to form the ſcale, or diatonic octave, but is incapable of forming any termination; it has however one character peculiar to itſelf, that of being the firſt and original diſcord, as its relation to diapente is tone major; yet, with this application, it becomes an harmonic ſound, as all original diſcords are, and not a fundamental baſs.

Having diſcovered the great importance of the ſcale of tones major and limmas, in being the original of the three fundamental baſſes applied to each tetrachord, I ſhall now diſtinguiſh them in another point of view, in order to facilitate their uſe. I ſhall place them as antecedent, mean, and conſequent, or as firſt, ſecond, and third terms. In this form, the diateſſaron, or fourth, will be the firſt; the diapaſon and moſt perfect conſonance will be the key note, or ſecond term; and the diapente, or fifth, will be the third term, attended with their reſpective harmonics of an octave, fifth, and third. It muſt be remembered, that all ſyſtems have their foundation in theſe three terms, and that as they will be frequently applied in explaining the tetrachords, it is unneceſſary to add more here. I will therefore proceed to explain one of the moſt curious and

intereſting

intereſting particulars diſcovered in the whole theory of harmonics, namely, an inverted ſyſtem, which will be found of the greateſt conſequence; for, by the inverſion of the firſt diagram a ſecond is diſcovered.

Euclid [p. 15 and 16.] places his ſeven modes in the following order, and Bacchius Senior [p. 12.] places his ſeven in a contrary or an inverted order, and the ſame names are applied to each.

Euclid.	B	Mixolydian	F	Bacchius Senior.
	C	Lydian	E	
	D	Phrygian	D	
	E	Dorian	C	
	F	Hypolydian	B	
	G	Hypophrygian	A	
	A	Hypodorian	G	

Though this inverſion of the diagram may appear at firſt ſight to be of little conſequence, yet it has engaged the attention of many writers, and occaſioned as many different opinions, without producing any thing deciſive; for whether the diagrams are to be read backwards deſcending, or the contrary, or whether the grave ſounds are called acute in one age, and the contrary in another, is of very little conſequence, where an art is to be improved, or the ſecrets of ſcience to be diſcovered. But I ſhall paſs by theſe and other favourite opinions, which have only ſerved to perplex the ſubject, without leading us to any uſeful diſcovery.

To procure, however, all the advantages this doctrine can give us, a mufical conſtruction, ſupported by other parts of the Grecian harmonica, will ſhew its real importance. In order to demonſtrate this I ſhall obſerve, that the ſeven ſpecies of diapaſon [Plates III. and VII.] include all the tetrachords in their different poſitions, whether conjoined or disjoined, and alſo the hemitones, tones, and all other neceſſary diſtinctions proper for harmony or melody; which will be explained in the next or fifth part, in which the modes or tones will be particularly conſidered. At preſent, therefore, I will offer a few obſervations, previous to my entering on ſo intereſting and difficult a ſubject.

I obſerve firſt, that every ſyſtem of diapaſon is called a tone or mode by Euclid and Bacchius, and that the firſt letter of that diapaſon is placed near the name, which is given to the mode.

Secondly, That Euclid places the mixolydian at hypate hypaton, (or B) in the grave, and aſcends by degrees till he arrives at meſe, (or A) in the acute; whereas Bacchius places his firſt, or mixolydian mode in the acute, (or at F) from whence he deſcends by degrees to the grave (or G); and each author diſtinguiſhes every ſucceeding mode by the very ſame names, but in an inverted order; as in the preceeding example, at page 43.

Thirdly, That in comparing Euclid's diapaſons with thoſe of Bacchius, the intervals are all the ſame; that is, the tones hemitones, and tone of disjunction, are in the ſame poſition in each, except being in a contrary direction. See Plate VI.

Fourthly,

Fourthly, That Euclid, [p. 19.] (according to Ariſtoxenus) affirms, that "the number of tones or modes are thirteen," but that number cannot be ſupplied, unleſs they are diſtinguiſhed as two ſeparate ſcales; the firſt aſcending from grave to acute, the ſecond deſcending from acute to grave.

Fifthly, That, agreeably to the poſition of the ſeven ſpecies of diapaſon, at Plates II. and III. we diſcover all the ſharps in a numerical order from one to ſix.

Sixthly, That the ſame ſeven ſpecies of diapaſon being inverted, we have all the flats from one to ſix. See Plates VI. and VII.

Seventhly, That theſe ſharp and flat dieſes form the ſpiſs intervals, the minor and major ſcales, the genders, the mutations, and divide the tetrachord into thirty parts, as directed by Euclid.

Laſtly, That the fundamental baſſes, or three terms before mentioned, applied to each tetrachord, form a moſt ſweet and perfect harmony.

Theſe are the great outlines of a moſt extraordinary theory, which will be explained and applied in the next or fifth part of the harmonica; in which the tones and number of modes will be more particularly conſidered.

V. Of

V. Of the TONE or MODE.

This part of the ancient doctrine has been found the moſt obſcure and myſterious. The many learned writers and commentators, who have attempted to explain it, have diſagreed in many eſſential parts, whilſt others, from the variety of opinions, deſpaired of ſucceſs, and gave up the enquiry. The truth is, the wonderful and extraordinary accounts we meet with in ancient and modern writers, of the ſurprizing effects produced by the mutations of mode and gender, and other parts of the Grecian harmonica, have raiſed expectations in many, not to be ſatisfied with any thing leſs extraordinary than the effects ſaid to be produced. Whereas, had they firſt conſidered what were the eſſential parts of practical muſic, and adapted them to the ancient theories, without expecting any thing almoſt ſupernatural, they would have found the agreement between the ancient and modern methods of treating the ſame ſubject ſo perfectly correſponding in the moſt eſſential parts, that nothing could be diſcovered in one, that would not be wanted and abſolutely neceſſary in the other.

If a practical muſician were to be limited to the four parts already explained, he would find a great deal wanting to enable him to exerciſe the full powers of his art. He would be greatly diſtreſſed in his operations, whilſt confined to thoſe ſounds only which have been diſcovered. It is true, the genders have explained the diviſion of the hemitone and tone, and other muſical intervals, but have given no rule to apply thoſe diviſions to any other part than the two moveable or middle ſounds of the tetrachord.

trachord. Something more therefore is neceſſary for a general application of thoſe diviſions, by which modulation may be carried to its greateſt perfection, without any alteration or injury to the tetrachord. And if that which is ſo indiſpenſably neceſſary for modulation can no where elſe be found but in the doctrine of the tones and modes, and if there is no other part of practical muſic to which they can be applied, let us not reject ſo intereſting a part of ancient theory, without at leaſt trying how far it will carry us.

Euclid [p. 19 and 20.] gives four different definitions of the word *Tone*.

He ſays, "It is taken for ſound;" as a ſweet or harſh tone or ſound.

Secondly, "It is taken for interval; as from meſe to para-
"meſe (or from A to B) is the interval of a tone."

Thirdly, "It is applied to the place of the voice, when
"we mention the dorian, lydian, or any other tone."

Fourthly, "It is taken for intenſion or remiſſion, when a
"perſon uſes an acute, or grave, tone of voice, or between
"both."

The third definition, or "the place of the voice," is the ſubject of the preſent enquiry.

All

All authors agree, that the ſeven ſpecies of diapaſon are the foundation of the doctrine of the tones or modes, and that the tones to which they refer are not to be underſtood in the limited ſenſe of ſound, interval, or intenſion, but as a certain compoſition or conſtitution of harmonious ſounds, proper for the place of the voice in the moſt extenſive ſenſe; provided the two hemitones and the tone of disjunction are placed according to the method deſcribed by Euclid in treating of the ſyſtem of diapaſon.

That this method may be more clearly underſtood, I have (at Plate II. fig. 1.) formed the ſeven tones or modes, agreeably to the different ſpecies of the diapaſon, in which the poſitions of the two hemitones are diſtinguiſhed by being black notes, and the tone of disjunction by the croſs, marked +, between the two disjoined ſounds. The tetrachords are alſo diſtinguiſhed by the curve line, which encloſes the whole, with the extreme ſounds, and the provincial name is annexed to each tone, as mentioned by Euclid.

In examining theſe conſtitutions, which are the foundation of the modes, we find the poſition of the two hemitones and the tone of disjunction the ſame *in each with reſpect* to acuteneſs or gravity; that is, from B to C, and from E to F, are, in all of them, the places of the hemitones, as from A to B is alſo that of the disjunction. Now, as *the different poſition* of theſe intervals ſhould make the eſſential parts of modulation, which notwithſtanding are the ſame in each, to which of the remaining parts of theſe compoſitions muſt we turn our attention to diſcover ſomething characteriſtic, and expreſſive of the different

different relations, in which one tone or mode ſtands to another? Not in the ſeveral limitations of the diapaſon; for that will be a poſitive contradiction to a former part of the doctrine, which gives a minor ſyſtem, conſiſting of a diapaſon and diateſſaron, and alſo a major ſyſtem, compoſed of twice diapaſon. Now, if a voice has liberty of motion through all, or a great part of this major ſyſtem, what end can it anſwer to confine it to half that compaſs? or, what new variety of modulation will it procure, which we had not in a much greater perfection before? But this is not the only objection; for the ſynemmenon tetrachord, which gives a hemitone from meſe to trite ſynemmenon (or from A to B♭) in a different poſition from the two former, is abſolutely excluded from a place in each of theſe ſeven ſpecies of diapaſon.

However great theſe contradictions may ſeem, they ought not to be imputed to the ancients, unleſs it ſhall appear that theſe ſeven ſpecies of diapaſon can admit of no other conſtruction.

But the contrary of this will be evident, if we attend to the definition which Euclid has given; [p. 2.] wherein he tells us, that "tone is a place of the voice, capable of ſyſtem "without latitude."

This definition is very important; for it not only determines as many different places of the voice as there are ſyſtems of the diapaſon, but alſo that each ſyſtem is without latitude. Thus it appears, that the diapaſon is no otherwiſe neceſſary with reſpect to the limits of the ſyſtem, than its firſt formation,

by which the two hemitones and the tone of disjunction, have each their particular positions; for these are the only essential differences of the seven systems or places of the voice, after which the systems are without latitude; that is, the systems may extend beyond the limits of diapason, either to the grave or the acute, provided that the positions of these intervals are the same in the respective diapasons, above and below; for the order and composition of the first diapason being once fixed, determine all others belonging to the same tone, and are properly that which Euclid calls "the tone or place of the voice "capable of system without latitude;" because every tetrachord found in this composition refers to one particular sound or tone, which forms one scale only, and no other.

After this explanation it remains to shew, how these seven places of the voice may be discovered agreeably to these directions; and how such discovery can encrease the powers of modulation, by disposing of the two hemitones, and tone of disjunction, in seven different places with respect to acute and grave.

To make this easily understood, I have, at Pate II. fig. 2. placed the seven species of diapason in the upper stave, each species rising a degree in the order as before, at fig. 1. in the same plate, and immediately under these I have placed seven others, at H, I, K, L, M, N, and P, whose compositions are in all respects the same, except that of being formed from one common sound, instead of rising a degree, as those above.

This

This common ſound is B, the firſt of the graveſt tetrachord, and in that reſpect has a preference to any other. From this conſtruction we have a variety of hemitones diſtributed throughout, not diſcovered before; and as theſe intervals are the ſame with thoſe in the ſtave above, the ſharp, which is a modern character, is applied not only to fix the poſitions of the tones and hemitones peculiar to each mode, but alſo to ſhew their relation to each other, in order to perfect their mutations; without which the whole theory would have been imperfect.

Thus after the natural ſyſtem at H, we have an increaſing ſeries of ſharps from one to ſix. The firſt ſharp is F, the fourth ſpecies of Diapaſon at I; we have two ſharps, F and C, in the ſeventh ſpecies at K; and at L we have three ſharps, F, C, and G, which is the third ſpecies; and at M, the ſixth ſpecies, we have four ſharps, F, C, G, and D; alſo at N, the ſecond ſpecies, we have five ſharps, as F, C, G, D, and A; and at the fifth, or laſt ſpecies of diapaſon, at P, we have ſix ſharps, viz. F, C, G, D, A, and E.

In comparing theſe ſeven ſpecies of diapaſon, aſcending from one pitch or common ſound, with each other, we have five tones, each of which is divided into a greater and leſs hemitone; alſo one hemitone, divided into a hemitone minor, and an enharmonic dieſis; the firſt from E at H, to E ♯ at P; and the ſecond from E ♯ at P, to F at H, in the firſt ſpecies. With reſpect to the other hemitone, from B to C, it could not, according to this method, be divided, becauſe B is the pitch, or common ſound; but this is not material, as we ſhall, in another place, find it divided in the enharmonic gender, Plates IV. and V.

Theſe different poſitions of the two hemitones and the tone of diſjunction give every diapaſon a new and diſtinct character; which, with the other advantages before enumerated, explain the ancient doctrine of the tones or modes in the moſt ſatisfactory manner; and, by their agreement with Euclid's definition, leave no doubt that "the tone, or place of the voice, capable "of ſyſtem without latitude," is found in each of theſe ſeven ſpecies of the diapaſon; becauſe, the conſtitution of the diapaſon being once formed, may be extended to the acute or grave in the ſame order, without latitude.

By this conſtruction the moſt important part of the harmonica, with reſpect to modulation, is reconciled with the doctrine of the ancient modes, in a manner the moſt natural and uſeful to a practical muſician.

The Tone of Diſjunction, ſo often mentioned by the Grecians, and found in every diapaſon, comes next to be conſidered, in order to diſcover its character and uſe in this theory.

If we examine the ſeven ſpecies of diapaſon, where this interval is marked with a croſs, we diſcover very little that can make this diſtinction neceſſary, except that of fixing the limits and order of the tetrachords; but as this ſeems of too little conſequence for ſuch a diſtinction, if confined to a ſimple melody, we muſt look for its true character and importance in harmony.

To ſhew this in the cleareſt light, I have (at Plate III.) repeated the ſeven ſpecies of diapaſon, formed from one common ſound,

found, as before; and have placed under each note its principal or fundamental baſs at R and S.

I obſerve at R, the firſt ſpecies of the diapaſon, we have two tetrachords conjoined, and the tone of disjunction ſucceeds. That each of theſe tetrachords has three baſſes; the firſt has E, A, and D; the ſecond has A, D, and G; and finiſhes at D baſs. After which we are prevented from advancing to the tone of disjunction, unleſs the baſs, and its harmonics at D, move firſt to thoſe of A; then the tone of disjunction and its baſs ſucceed. It appears alſo, that every baſs in this diagram muſt have a minor third for one part of its harmony; in conſequence of which, the B, in the firſt tetrachord, will be of a different ſpecies from that in the ſecond; for the firſt tetrachord begins with a B natural, and the ſecond demands a B flat, to be a minor third to G, the third baſs.

From this obſervation we diſcover that theſe tetrachords are formed ſo as to partake of two diſtinct ſcales; as it is impoſſible to have a natural B and a flat B in the ſame diapaſon. Thus by applying the fundamental baſſes and their harmonics we diſcover that the true character of the tetrachords has its origin in harmony, by which their formation and connection appear rational and agreeable to the beſt theory; which will be more fully explained when we conſider the Mutations.

The tone of disjunction diſtinguiſhes the termination of the laſt tetrachord, in which B was neceſſarily flat, and reſtores us to the firſt ſcale, in which it was natural; but in order to prevent the diſagreeable effect, from too quick a ſucceſſion of a B

flat

flat and a B natural, the intervention of an additional baſs and its harmony is required, as marked at 8, (between the two fifths at R) previous to the disjunction; this not only conducts us to the alteration of the ſcale, which is here intended, but prevents the conſecution of two fifths, which in no caſe can be admitted. See Plate III. at R.

From theſe obſervations we diſcover the real importance of the tetrachords; that they are not to be conſidered merely as ſimple ſyſtems, but as ſyſtems connected with, and dependent on, the laws of harmony.

I ſhall now compare the ſame ſpecies of the diapaſon at R with thoſe at S, in the ſame plate.

In theſe two examples we find no alteration whatever in the ſyſtems; for the two hemitones, the conjoint tetrachord, and the tone of disjunction, are the ſame in each; and the only difference diſcovered is in the baſſes, which is undoubtedly a very material one with reſpect to modulation.

To underſtand this it muſt be obſerved, that the ſyſtems now before us at S are not tetrachords, but are a ſpecies of the diateſſaron; for the true poſition of the tetrachord, in a major mode, muſt be in all reſpects an inverſion of the minor; which Euclid has before told us is hemitone, tone, and tone; agreeably to which, the hemitone muſt be in the acute in the major ſcale, as it is in the grave in the minor.

If

If we compare theſe ſyſtems at S with the tetrachords at R in the ſame diagram, or thoſe at U with T, Plate VII. we ſhall find that two fundamental baſſes are ſufficient for theſe ſyſtems, but that the tetrachords require three.

This diſtinction would have been of very little conſequence, if the formation of the ſcale did not depend on the harmonious conſtitution of the tetrachord, which cannot be extracted from the harmonics of two fundamental baſſes, but is the product of three; for they are placed in this order not by accident, but to ſhew that the ſame melody may have two diſtinct characters, by being formed from different fundamental baſſes; and that without their application the minor and major ſcales muſt remain undetermined.

It has before been obſerved, that the baſſes at R required minor thirds; but theſe at S, on the contrary, do demand major thirds. This variation of the thirds occaſions one of the moſt remarkable revolutions to be found in harmonics, and is the original cauſe of the mutations from minor to major ſcales, or the contrary. As to the difference of tone major and minor, which may be found in theſe ſyſtems, the ratio making no part of the Ariſtoxenian doctrine, I ſhall reſerve my remarks on that ſubject for the Second Part of this work.

With reſpect to the ſyſtems now before us, we find but two baſſes to each at S, inſtead of three, which are neceſſary at R; likewiſe that the tone of disjunction at S requires an intermediate baſs, D, to prevent the ſucceſſion of two major thirds, equally to be avoided with the two fifths at R; beſides which, the

the major third applied to this, and to the other intermediate baſſes at S, marks the change of the ſcale occaſioned by the diſjunction.

I have now gone through my obſervations on theſe ſeven ſpecies of diapaſon, ſo far as they relate to the explanation of the tones or different places of the voice. Their connection with harmony, and their mutations are ſupported by the fundamental baſſes, and an increaſing ſeries of ſharps; and the diſtinctions of tetrachords conjoined, or disjoined, are made manifeſt, and ſupported by the moſt unerring laws of harmony.

The advantages ariſing from an increaſing ſeries of ſharps are, it muſt be owned, very great; yet a Theory would be very imperfect if it ſhould ſtop here and leave out the flats, which are equally neceſſary for the completion of the whole.

The flats being of a contrary nature to the ſharps, require the whole order of ſyſtems to be inverted; but nevertheleſs the place of the tetrachords, the hemitones and tone of diſjunction, muſt be preſerved in the ſame poſitions before deſcribed, except that of moving in a contrary direction: but as this will beſt be underſtood by the muſical notes, I ſhall refer my reader to Plate VI. fig. 1. and 2. in which the two diagrams are formed on this principle of inverſion.

The firſt, which has already been explained, moves in an aſcending, but the ſecond in a deſcending, direction; placing the hemitone in the acute, from whence the tetrachord begins in a major ſcale.

In

In comparing their intervals, and other parts, we find a mutual agreement throughout the whole.

The ſeven ſpecies of diapaſon, extracted from the ſecond diagram, have their beginning at fig. 3. Plate VI. and are continued till all the ſeven are formed.

Each diapaſon in the upper ſtave deſcends a degree to the next; but thoſe immediately under are fixed to one common pitch at F; but in all other reſpects the intervals are the ſame with thoſe above, and move in the ſame direction. Hence we have an increaſing ſeries of flats from one to ſix, which fixes and determines the poſitions of the hemitones, tone of diſjunction, and the tetrachords, extracted from this ſecond diagram; and the whole agrees with the firſt diagram before explained, whoſe common pitch was B, from whence this inverſion is taken. See fig. 4. Plate VI. which exhibits the ſeven ſpecies of diapaſon belonging to each of the diagrams, above and below; the flats ſucceed and increaſe in the ſame order below, as the ſharps do above. Example.

Sharps.	F♯,	C♯,	G♯,	D♯	A♯,	E♯,
	1,	2,	3,	4,	5,	6,
Flats.	B♭,	E♭,	A♭,	D♭,	G♭,	C♭.

The reaſon why B♯ and F♭ are not placed here will be given towards the latter end of the Mutations.

From the great advantages procured by the conſtruction of theſe two diagrams we have all the materials neceſſary to complete the ſeven parts, into which the Grecians divided the harmonica:

monica: at the ſame time the powers of harmony operate ſo univerſally throughout the whole theory as to explain many parts which could never be underſtood upon any other principle. Among which are the conjunction and disjunction of the tetrachords, with the major and minor harmonics applied to each tetrachord, or ſyſtem, of the ſecond diagram, at Pl. VII, fig. T and U. The ſeven ſpecies of diapaſon, formed under each of theſe letters have their fundamental baſſes to which they ſeverally belong, with the major thirds to the firſt at T, and the minor thirds to thoſe at U. The tone of disjunction is diſtinguiſhed in each by an additional baſs as a temperament, not only to prevent the conſecution of two eighths at T, and two minor thirds at U, but alſo that the fundamental baſs ſhould not move by degrees or partake in any reſpect of the nature of the ſyſtem, which is ſet apart, and appropriated only to the melody. The additional baſs at U generates a diſcord at the diſjunction with the upper ſound: but this ſhall be explained in the Second Part, when I treat of Diſcords.

From the principles already explained of the harmonica of the Grecians, it appears that the great variety of intervals, their relation, and the different orders of their ſucceſſion, together with their particular application to muſical compoſition, are the principal objects intended to be regulated by theſe ſeveral parts of their doctrine.

With theſe materials I proceed to the Mutations, which is the ſixth, and moſt intereſting, as well as the moſt difficult, part of the harmonica. The principles laid down by Euclid

Euclid will conduct us through all their charming varieties: at the ſame time the formation and number of modes will be diſcovered, which could not be explained ſo well before, as they depended much on the mutations. We ſhall then be convinced, by the moſt indiſputable evidence, of the agreement between the ſeveral parts which compoſe and perfect this wonderful theory.

VI. Of the MUTATIONS.

To explain how the Mutations are to be made, it will be neceſſary firſt to diſcover their object, and then the method by which they may be effected, ſo as to produce what Ariſtoxenus declares mutation to be, "A kind of pathos, occurring in the "order of modulation." [p. 38.]

In explaining the tetrachord on harmonic principles, it has been found that the ſeveral ſounds, ſelected from the harmonics of a tetrachord and placed as a ſyſtem, form the diapaſon; that they are a ſcale of ſounds, peculiar to that tetrachord, and are not found in any other; and that whatever flat or ſharp dieſes are uſed in the tetrachord, the ſame are abſolutely neceſſary for the formation of the ſyſtem of the diapaſon, or ſcale.

The ancients very judiciouſly placed the mutations in the change of the tetrachord; not only becauſe the ſeveral genders would be better underſtood, when applied to that ſmall ſyſtem, but becauſe of its harmonic principles, (before explained); which they knew comprehended the whole ſcale or diapaſon, by

ſelecting its ſeveral harmonic parts, and forming them into one ſyſtem.

By this harmonic conſtruction of the tetrachord its great importance is diſcovered: and if compared with that deſcription which we meet with in all authors who have written on this ſubject, we ſhall find every part unlike, except a ſimple ſyſtem of four ſounds, unconnected with harmony, and independent of every principle that can lead us to the knowledge of it. No wonder therefore that their diagrams have been exploded and their theories condemned.

If we examine the two tetrachords in the firſt ſpecies, and thoſe which make a part of the other ſpecies of diapaſon, (at Plate III. fig. R and S) they, by having major or minor thirds to their reſpective baſſes, contribute to form different ſcales. By theſe different ſpecies of thirds we diſcover their genius and character to be very unlike. The firſt at R gives two ſcales with minor thirds, becauſe each tetrachord forms a ſcale from among the harmonics peculiar to itſelf. Notwithſtanding the intervals of the diapaſon are in appearance the ſame in each at R and S, yet the harmonics are in all reſpects very different by the application of the fundamental baſs, which not only forms two ſcales of different ſpecies of thirds, but alſo fixes their diſtance from each other to be a minor third, with the ſame number of dieſes, either ſharp or flat.

With reſpect to theſe ſcales, every one has a principal, or governing note, to which all the other ſounds refer, and ſtand in a particular relation.

This

This principal note regulates the intervals, poſition, and motion of all the other ſounds in that ſcale; and, by a kind of attraction, draws them to itſelf, or its harmonics, to finiſh the termination on the final place of repoſe.

This principal note is diſtinguiſhed by the moderns as the key-note, or the tone; and ſometimes in a more enlarged ſenſe, both by the ancients and moderns, the Mode. But in order to be better underſtood in this very difficult part of the harmonica, I ſhall apply the words key-note, or tone, to the principal note of a ſimple ſcale; and the word *Mode* to comprehend ſeveral ſcales, whoſe ſituations, or relations, to the firſt or governing ſcale are ſuch as open a ready and eaſy communication for the mutations; which are made by ſubſtituting one ſcale in the place of another, or by moving from the principal to any of the relative ſcales, or the contrary: by which means the ſentiment is continually varied, and the ſame thought appears in a new light by being removed into a different ſcale.

Thus theſe additional ſcales, ſubject to certain limitations with reſpect to the principal or governing ſcale, conſtitute a mode, in the moſt extenſive ſenſe of the word; for as all the ſounds in a ſcale refer to, and depend on, the principal ſound, ſo all theſe ſecondary ſcales in like manner refer to, and depend on, the firſt, as a principal or governing ſcale. And in this ſenſe every principal ſound of the different ſcales in each diagram may, by a like addition of ſecondary ſcales, be formed into a mode; and although this mode is deſcribed by the principal ſound of the firſt ſcale, as D major, D minor, &c. yet all the ſecondary

ſcales

ſcales are underſtood to be connected with it, in as ample a manner as if they had been ſeverally named. In order therefore to diſcover this principal note, the following obſervation will ſerve as a rule:

The fundamental baſs to the laſt note of each tetrachord is the principal note: and the moderns call the ſcale by its name.

Thus in the firſt diapaſon at R, (Plate III.) we finiſh the firſt tetrachord at A, the fundamental baſs; and therefore the whole compoſition of that tetrachord forms the ſcale of A, as the next tetrachord does that of D ſcale.

The diſjunction, or conjunction, makes no other difference than that of obliging us to continue the names of the notes in the ſame order till the whole tetrachord is completed; and under the laſt note we find the baſs, which gives its name to that ſcale.

Thus at the ſecond ſpecies of diapaſon at R, the note after the diſjunction begins the tetrachord at A ♯, and though B is the laſt note of that diapaſon, yet it is not of the tetrachord; and therefore to find the principal note we muſt return to C ♯ and D ♮ in order to finiſh the tetrachord; and the baſs G ♯ is found under the laſt, or D ♮, and is the principal found which gives its name to that ſcale.

But

But that this may be better underſtood, I will examine and make ſome obſervations on the harmonic conſtitutions of the tetrachord in the minor and major ſcales, as formed by the fundamental baſſes in each diagram.

W. B, C, D, E, 1ſt Tetrachord.
G, A, A, A,
E, E, F, E,
Roots E, A, D, A.

X. F, E, D, C, 2d Tetrachord.
C, C, B, C,
A, G, G, G,
Roots F, C, G, C.

In each of theſe tetrachords we find that in four combinations the fundamental baſs, which gives its name to the key or ſcale, is uſed twice in each, viz. the ſecond and laſt baſs at A in the firſt, and the ſame at C in the ſecond tetrachord; beſides which, a repetition of the ſame key-note is diſcovered among the harmonics in three combinations out of four, in order that the impreſſion of the principal ſound and its harmonics, with which the ear ſhould be moſt familiar, may predominate, and be preſerved without any improper mixture of other ſounds.

From theſe two tetrachords B, C, D, E, and F, E, D, C, the minor and major ſcales are extracted: and, except the difference of the pitch, the intervals are the ſame in each, without any ſharp or flat dieſis, or any diſtinction to ſupport the idea of minor and major ſcales, till we apply the fundamental baſſes as above; which is the only rule or criterion by which we can judge of the difference: for the ſame melody or ſyſtem may be formed in either ſcale, by applying different roots. See Plate III. at R and S, where the roots at R have minor thirds, and the ſame ſyſtem at S has major thirds to each root. This, together

together with other inſtances, proves that the theories of the Grecians were founded in harmony; without which their minor and major ſcales muſt have remained undetermined. The two tetrachords at W and X are in their harmonic parts moſt unlike; for, excluſive of the obſervations already made, it appears that A, the principal or governing note of the firſt tetrachord at W, is uſed but once at X in four combinations, and is then a major third. In like manner it appears that C, the principal or governing note of the ſecond tetrachord at X, has only one place at W in four combinations, and is then a minor third. Theſe alterations preſerve the character of each, and remove every poſſibility of miſtaking one for the other; and at the ſame time diſcover the great order in which theſe operations are conducted, and the different effects they produce. If the Ariſtoxenians had not excluded the ratio from their theory, the difference of the major and minor tone, and other intervals, would have been explained by them. But this will be conſidered when we come to treat of the Ratio in Part II.

All tetrachords are formed on the ſame principles as thoſe above, and their ſeveral poſitions, as at Plates III. and VII. diſcover the increaſe of the flat and ſharp dieſes, neceſſary to perfect every ſcale, even in the moſt tranſpoſed poſition. And hence we may conclude that the ſeven ſpecies of diapaſon, which are the foundation of the modes, could not be intended, as ſome imagine, to diſcover new ſcales of a different conſtitution, but only to change the poſition of thoſe already exiſting, in order to improve and perfect the mutations. It is true that the enharmonic and chromatic dieſes are deſcribed in their genders; and by particular diviſions of the tetrachord their

magnitude

magnitude is aſcertained; but as this alone was not ſufficient, where ſo extenſive a diſtribution of intervals is wanted for the formation of ſo many ſcales, ſomething more was neceſſary to increaſe thoſe animating powers, eſſential to the mutations.

The different ſpecies of diapaſon, as before explained, anſwer this great end in every reſpect; for the formation of all ſcales out of the natural not only depends on the application of a flat or ſharp dieſis to alter ſome note a ſemitone higher or lower, but as we proceed with the diapaſons, the number and poſition of the dieſes, or flats and ſharps, are fixed and determined from one to ſix in each diagram. By this method the major or minor ſcale is known the inſtant the number of dieſes is diſcovered, and the abſolute pitch of the key or tone naturally follows. But that this may be attended with as little difficulty as poſſible, I have formed all the ſcales from the two natural at A and C to the greateſt number of ſharp and flat dieſes that can be wanted to complete the modes, even in their extreme poſition, by which all poſſible mutation is perfected. See Plates VIII. and IX.

In examining theſe ſcales we diſcover that both the ſharp and flat dieſes increaſe in a numerical order by a ſeries of fifths from the natural ſcales A and C, extracted from the firſt ſpecies of diapaſon; and that as the ſharps aſcend by fifths from theſe natural ſcales, ſo the flats deſcend in a contrary direction by fifths; and as there are major and minor ſcales peculiar to each dieſis, they are encloſed in a bracket in the margin, together with the names of the ſcales, the number of dieſes neceſſary for their formation, and the ſpecies of diapaſon from whence they are extracted. The three terms, or fundamental baſſes are alſo

placed at the end of the ſcales, as being the foundation from whence they are formed. The compoſition of the tones and ſemitones is the ſame in all the major ſcales. The minor ſcales compared with each other have the ſame compoſition; but if compared with the major, there is a very eſſential difference in the poſition of the tones and ſemitones: the firſt is diſtinguiſhed by being open notes, and the ſecond by being black in all theſe ſcales.

There is alſo another difference with reſpect to the aſcending or deſcending of the major or minor ſcales. In the firſt there is no alteration in moving either way; but in the ſecond there are two accidental major ſounds aſcending, which are not neceſſary in deſcending. The preſerving of a diatonic ſucceſſion occaſions this difference in deſcending and aſcending in the minor ſcales.

Theſe ſcales being explained, I proceed to their uſe and application, by which that moſt captivating part, the mutations, will be better underſtood.

The words tone and mode have by ſome modern authors been uſed as ſynonymous terms; but, as I have obſerved before, Euclid tells us, [p. 2.] that "tone is a ſyſtem without latitude;" that is, that the ſame ſyſtem may move to the acute or the grave, without any limitation, provided the tones and ſemitones ſucceed in the ſame order, as in the firſt diapaſon or original ſcale.

From

From this definition it appears that every ſcale may be a tone, and have its principal note or key as marked in the margins of Plates VIII. and IX. but with reſpect to a mode, it is formed of ſeveral of thoſe ſcales, ſubject to certain laws and limitations, as has been obſerved before; without which it would be impoſſible to have either a conſonant or diſſonant mutation, or any other, agreeable to the directions of Euclid; who, after enumerating four ſorts of mutations, ſays [p. 20.] "the mutation by tone is when we make a change from dorian "to phrygian; or, in general, from any one of the thirteen "tones into any other; and theſe mutations are made beginning "from hemitone to diapaſon."

From this deſcription of the mutations, proceeding from hemitone to diapaſon, it appears that when the diapaſon, or principal tone of the mode, is formed, the mutation is made by an addition or ſubſtraction of one dieſis from the original number. Hence we diſcover that the mutations depend on the increaſe or decreaſe of the dieſes. If we examine the ſcales at Plates VIII. and IX. it appears that any number of dieſes forms two ſcales; one with a major and the other with a minor third. In conſequence of this we have a choice in fixing the principal tone of a mode in either of theſe ſcales; and though the number of relative ſcales will be the ſame in each, yet thoſe of the ſame ſpecies of third with the principal tone of the mode muſt, as being primary ſcales, have a preference in the mutations to thoſe of a different ſpecies, which are of a ſecondary nature, and are uſed in a tranſient way, to give a colouring, and vary the lights and ſhades of the mutations

As three terms in the major ſcale have the ſame ſpecies of thirds, they determine the names of the three primary ſcales of the mode, one of which is a fifth above, and another a fifth below the governing or principal tone. The other three fundamental baſſes, which have a different ſpecies of thirds, deſcribe the names of the ſecondary ſcales of the ſame mode. We diſcover from hence that every mode is, or may be, compoſed of ſix ſcales; viz. three with major, and three with minor, thirds; and that the pitch of the governing or principal tone is the name of the mode, and includes its five auxiliary ſcales, from which the mutations are made.

The harmonious conſtitution of a mode being thus explained, it is proper to obſerve that from the number of ſcales we may fix the principal tone or pitch of the mode higher or lower, in order that every ſpecies of voice and inſtrument may be accommodated to move within the limits beſt adapted to its natural powers. But this makes no alteration in the compoſition of the mode, whoſe harmonic parts, as well as the auxiliary ſcales to the principal tone, are the ſame.

The inverſion of the tetrachords in the ſecond diagram, Plate VII. being explained in a former part, and ſeveral obſervations made on the conjoined and disjoined tetrachords, I proceed to examine the extenſive powers of the fundamental baſſes taken from the great and unchangeable ſyſtem, which is the foundation of the tetrachords, and all other ſyſtems.

The principal motion of the fundamental baſſes is the interval of a fifth, of which the fourth is the inverſion; it being the ſame

ſame whether we move from C to F five deſcending, or four aſcending, as ſhall be moſt convenient in writing to bring them to their neareſt degrees.

It has been found that every ſyſtem of the tetrachord is the product of three terms or fundamental baſſes; and on examining the motion of the baſſes it appears that two of the harmonics move with the baſs, and the third harmonic is common to two baſſes, and is a ligature; but of the two ſounds that move, one is always a tone, and the other a ſemitone. See p. 63.

This is the harmonious conſtitution of the tetrachord; and the diatonic ſcale, or ſyſtem of the diapaſon, peculiar to that tetrachord, is formed by extracting from the harmonics ſuch ſounds as are proper for a ſcale when brought to their neareſt degrees.

The name or pitch of this ſcale is next to be diſcovered. In every tetrachord there are four combinations which occaſion a repetition of one of the baſſes; the name of the ſcale is always the ſame as the note repeated.

I muſt here obſerve that the inverſion of the firſt diagram has not only diſcovered a new creation of ſounds, but that the ſynemmenon tetrachord, from whence Guido formed his moll hexachord, is found in the fourth ſpecies of the diapaſon at the ſecond tetrachord, formed by the firſt flat dieſis. [Plate VII.] As this tetrachord had no place in the firſt diagram, it confirms the neceſſity of the inverſion, without which the mutations in C and B♭ modes would have been imperfect, by not having the auxiliary ſcales of a fifth lower or higher to move to. The ſame defect would have precluded this tetrachord from being a

principal

principal tone of a mode, ſupported with all its relative ſcales proper for the mutations. Notwithſtanding theſe great diſcoveries, we find only two original ſcales, the one with a minor third, and the other with a major third next the principal fundamental baſs or tone; and that this original harmonious conſtitution of the tetrachord may be moved higher or lower in the mutations, by the uſe of ſharp or flat dieſes, in order to ſupport every muſical expreſſion proper for every ſpecies of voice; ſo that the ſolemnity of the grave, the ſprightlineſs of the acute, together with the ſweetneſs of the mean between the two extremes, may move within the compaſs of their natural powers. For that theſe conſtitutions or ſcales were diſtinguiſhed by Euclid [p. 2.] as tones, or "a place of the voice capable of ſyſtem " without latitude," cannot be doubted: and when theſe ſcales are uſed ſucceſſively, according to the order of the mutations, which admits of the increaſe or decreaſe of one dieſis, the mode is then formed, with its five auxiliary ſcales added to the principal tone. For as every ſcale or tone has its principal or governing note, ſo every mode has its principal or governing ſcale, to which the other five auxiliary ſcales refer. And though we are not obliged to uſe them all, yet it is neceſſary to know how far their powers extend in the mutations, that a proper keeping with the governing ſcale may preſerve its firſt impreſſion on the ear. For this purpoſe one dieſis more or leſs than the original number of the governing ſcale is the limitation of a ſimple mode.

From theſe principles we may form a perfect conſonant mutation of a fifth higher or lower, or an imperfect mutation of a third higher or lower than the original pitch of the mode; or

we

we may, from among the different ſcales, form a diſſonant mutation of a tone higher, or lower. Theſe mutations are not difficult, if we attend to a very ſimple rule, which is, that after the pitch of the governing ſcale is known, we proceed to form a ſyſtem of ſix degrees from that pitch or tone; and if it has a minor third, we muſt deſcend from the tone, but if a major third we muſt aſcend in a contrary direction: as for example, in the minor mode of A the ſyſtem will be A, G, F, E, D, C; but contrary to this in the major mode of C, the ſyſtem muſt aſcend, C, D, E, F, G, A. Theſe are the names of the ſcales which may be applied to regulate the mutations in this natural mode. The rule is the ſame with reſpect to any number of ſharp or flat dieſes. As to the diſtinction between the primary and ſecondary ſcales in the major mode, the firſt, fourth and fifth ſcales aſcending, by having the ſame ſpecies of thirds, are the primary; and the ſecond, third, and ſixth aſcending, whoſe thirds are different from the other, are ſecondary: but in the minor mode, the firſt, fourth and fifth ſcales aſcending are the primary; and the ſecond, third and ſixth deſcending are the ſecondary ſcales.

It will now be proper to turn to Euclid on this very important ſubject, whoſe deciſive authority will confirm all the foregoing obſervations.

In page 20, he ſays, "Mutation is deſcribed four ways. By "Gender, Syſtem, Tone, and Melopæia." He explains each, of theſe, but rather too conciſely for ſo intereſting a ſubject,

The

The mutation " by Gender (he ſays) is when there is a " tranſition from diatonic to chromatic, or enharmonic, or " from the chromatic or enharmonic to any of the reſt.

The number and variety of dieſes diſcovered in the ſeven ſpecies of the diapaſon in each diagram, and applied to the genders, are different to illuſtrate this mutation.

The ſecond " by Syſtem (he tells us) is when the mu- " tation is made from conjunction to disjunction, or the con- " trary.

This mutation by the alteration of one dieſis is a fifth lower by conjunction, or a fifth higher by disjunction. See the firſt and fourth ſpecies of diapaſon, Plate III. fig. R and S in the firſt diagram, and the contrary in the ſecond, plate VII.

The 3d " by Tone (he ſays) is when we make a change " from the dorian to the phrygian, or from the phrygian to " the lydian, or hypermixolydian, or hypodorian; or, in gene- " ral, from any one of the thirteen tones into any of the reſt; " and mutations are made beginning from hemitone even unto " *diapaſon.*"

If theſe changes of the tone proceed from the interval of dieſis to diapaſon, we have already ſeen how the ſyſtem of diapaſon, being formed as a ſcale at any given pitch, is changed, and the whole conſtitution of its parts altered by the introduction of a ſharp or flat dieſis. By this conſtruction, which is a very natural

natural one, we come to have a knowledge of the ancient tone or mode, whoſe natural poſition can receive no mutation but by a ſharp or flat dieſis.

With reſpect to a change from dorian to phrygian, &c. or, in general, from any one of the thirteen tones into any other, the ſpiſs intervals, or genders, ſufficiently ſupply whatever is wanted in compoſitions the moſt extenſive and elaborate; ſuch as operas, oratorios, and the like; in which a kind of wandering modulation is required to expreſs the recitatives, agreeably to the great variety of ſentiment.

Theſe fugitive mutations are tranſient, ſerving to diverſify and ſupport the ſeveral incidents which muſt ariſe in long performances, in which the thirteen tones (mentioned by Euclid) may be uſed with the greateſt ſucceſs.

Euclid, in addition to his former definitions, ſays [p. 21.]
" Some mutations are made by conſonant intervals, others by
" diſſonant; and ſome of theſe are leſs concinnous or inconcin-
" nous, ſome more. Thoſe that have a greater communion
" among themſelves are more concinnous, and thoſe that have
" *leſs are more inconcinnous; for in every mutation there muſt*
" be ſomething common, either ſound, or interval, or ſyſtem:
" and this communion is taken according to the ſimilitude of
" *ſounds*; for when *ſimilar ſounds fall mutually in the muta-*
" tions, according as they partake of the ſpiſs the mutation is
" concinnous; but when diſſimilar, inconcinnous."

The " conſonant mutation" has already been deſcribed by the alteration of a dieſis, and the mutation is a fifth higher or lower with the ſame ſpecies of third. Therefore theſe mutations are more concinnous, by having a more natural communion with each other, than a diſſonant mutation, which has nothing common; as for inſtance, if the change is made from the fifth above the governing ſcale to the fifth below with the ſame ſpecies of thirds, or the contrary, we have a diſſonant mutation, in which the neceſſary alterations are two dieſes; and if one ſcale is compared with the other, the difference will be a tone major in every part, and conſequently not only leſs concinnous than the other deſcribed above, but in every part a diſſonant mutation.

With reſpect to the next part of his definition, wherein he tells us that " in every mutation there muſt be ſomething " common; either ſound, interval, or ſyſtem;" " Sound," may be the pitch of a ſcale with a minor third, and afterwards move into another with a major third, with the ſame name; as from A minor to A major, or from major to minor, in which three dieſes make the difference between the two ſcales.

In this mutation the thirds to the fundamental baſſes are altered from minor to major, but the fundamental baſſes are the ſame; and the whole forms a mixed mode in A, by having two ſpecies of thirds. See Plate VIII. In all mutations of this ſort there is a difference of three dieſes between the two ſcales.

" Interval "

"Interval" is the next thing which may be common.

The moſt remarkable interval which diſtinguiſhes the character of the ſcales in their moſt eſſential parts is that of the minor or major third; and therefore if the mutation is regulated by either of theſe intervals, it muſt be in changing from one minor ſcale to another, or from a major to a major third.

Theſe mutations, as before obſerved, will be a fifth higher or lower, which are the perfect conſonant mutations; or they may be a tone higher or lower, which have been before diſtinguiſhed as diſſonant.

As to the mutation in which the "Syſtems" may be common, the ſeven ſpecies of diapaſon in each diagram are ſo many examples of this change; for the ſyſtems at R are the ſame as at S, [Plate III.] and yet, by the application of the fundamental baſſes, we have minor thirds at R, and major thirds at S. The ſame two ſpecies of thirds are alſo diſcovered throughout the ſecond diagram at T and U. [Plate VII.] Though the ſyſtems are the ſame in each ſpecies of diapaſon, yet the difference of the pitch of theſe ſyſtems, by the application of the fundamental baſſes, is a minor third; and the ſame number of ſharp or flat dieſes applied to one will be equally neceſſary to the other. See Plates VIII. and IX.

" This communion (Euclid ſays) is taken according to " the ſimilitude of ſounds."

Thus far Euclid has directed the great variety of modulation; and taught us to vary the ſentiment by conſonant and diſſonant mutations, together with a mixed mode, and the imperfect mutation of a minor third higher or lower; but the other imperfect mutation of a major third higher or lower is diſcovered in Euclid, [page 2.] where he ſays " Mutation is a " tranſpoſition of a ſimilar into a diſſimilar place."

This deſcription is much more applicable to the mutation of a major third higher than to any of the others; and where the alterations are ſo much greater they muſt neceſſarily be more diſſimilar; as for inſtance, if we change from C major to E minor, the tone or pitch is removed a major third higher, with the addition of one dieſis, and a different ſpecies of third to each ſcale.

If we compare this mutation with the conſonant one, by disjunction or conjunction, and the imperfect one of a minor third, we diſcover that in the firſt it is made by the alteration of one dieſis, but the thirds are of the ſame ſpecies; and in the ſecond there is no other difference than in the ſpecies of thirds. Hence it appears that the alterations of a dieſis, or of the ſame ſpecies of thirds, which in the former mutations acted ſeperately, are now united, and concur to make this a diſſimilar mutation. As to the diſſonant mutations, they have been diſtinguiſhed as ſuch by Euclid, and cannot therefore be applied in the preſent caſe.

I muſt

I muſt obſerve, that all the mutations are found in the tetrachords, Plates III. and VII. and alſo Plates VIII. and IX. But ſo reſpectable an authority as that of Euclid is not to be neglected, eſpecially as he has explained himſelf fully on the ſubject of the mutations, and as his doctrine is conformable to the moſt eſtabliſhed rules of the beſt modern compoſers.

Having diſcovered the laws of the mutations, and the limitations of each mode, which are confined to ſix ſcales only, from whence we have an almoſt endleſs variety of modulation, which is not only the moſt animating part of muſical compoſition, but prevents that tireſome monotony of cadence, which is the conſtant attendant of moving in one ſcale only; I ſhall now conſider how the number of modes is fixed and determined by the ſeven ſpecies of diapaſon in each diagram, agreeably to the Ariſtoxenian writers; by which the agreement and harmony of the ſeveral parts of this theory will be united and confirmed in a ſatisfactory manner, and remove every objection that has been made to this part of the ancient harmonica.

There are different opinions among the ancient writers with reſpect to the number of modes. Ariſtoxenus, Euclid, and Ariſtides Quintilianus, mention thirteen. Alypius gives the names and characters of fifteen.

Theſe two opinions are combated by Ptolemy, who has written expreſsly in favour of ſeven only; of whoſe work the learned Dr. Wallis has given a tranſlation in Latin with notes.

As

As I do not intend to become a party in the diſpute, I ſhall only aſſign ſome probable reaſon for this difference of opinion, which will be ſupported by the whole theory, and will lead us to the knowledge of their uſe and application; but with reſpect to their names, as they can be of no uſe to the modern muſician, I ſhall leave them for thoſe who may think them of more conſequence.

It has been obſerved before that Euclid, in deſcribing the ſeven ſpecies of diapaſon [p. 15.] gives at the ſame time the names of ſeven modes, by which, he ſays, they were called by the ancients, and which I have placed accordingly, in Plate II. fig. 1. But (in page 19.) he tells us that Ariſtoxenus mentions thirteen tones or modes, and he gives their names, diſtinguiſhing ſome as acute, and others grave.

To reconcile theſe different opinions will not be difficult, if it be granted (and I think there can be no doubt) that the inverſion of the diagram, already explained page 43, was ſo univerſally underſtood as to make a particular deſcription of it unneceſſary; and the more ſo, if we conſider that the intervals, tetrachords, hemitones, and tone of disjunction, were the ſame in each, except the difference of the thirds, and their motion in a contrary direction; and therefore an explanation of the firſt could be equally applied to the ſecond diagram by thoſe who were acquainted with the doctrine; for the flat dieſes were as neceſſary to perfect this theory as the ſharp, and the want of either would have deſtroyed the whole.

This

This obſervation is ſo true, that no practical muſician can refuſe his aſſent to it; eſpecially if it be conſidered that the formation of the ſpiſs intervals and genders in each diagram, which correſpond ſo exactly with the method preſcribed by the Ariſtoxenian writers, could not be diſcovered on any other principles.

The conſtruction of the ſeveral ſpecies of diapaſon, already explained, has proved the neceſſity of ſix ſharp and ſix flat dieſes. Therefore, if to theſe twelve dieſes we add the natural ſcale, which is the medium between the two ſpecies of ſharp and flat dieſes, we have exactly the number of thirteen tones or modes mentioned by Euclid.

By this double doctrine of the diagrams (if I may call it ſo) the ancients are vindicated from the charge of inconſiſtency, or of giving contradictory accounts of the modes. Some modern writers of reputation have obſerved that the more ancient of the Greek writers looked upon grave ſounds as high, and acute ones as low; and that this diſtinction was afterwards changed to the contrary, and has ſince prevailed univerſally.

If Ptolemy was not acquainted with this double doctrine, it is as eaſy to account for his limiting them to the ſeven ſpecies of the firſt diagram, as it is for Alypius to make them fifteen by the addition of two more dieſes. It was very eaſy to fall into this miſtake from not obſerving the limitations preſcribed by the diapaſons in the two diagrams.

If we examine the mutations of the thirteen modes [Plates VIII. and IX.] it will be found that the extreme modes at the ſixth ſharp and ſixth flat cannot be equally perfect with the others, unleſs theſe additional dieſes are continued, to give a latitude of mutation, by riſing a fifth, from a ſcale of ſix ſharps to one of ſeven; or to fall a fifth, from a ſcale of ſix flats to another of ſeven.

Yet theſe auxiliary ſcales muſt not be conſidered as principals, but only as increaſing and perfecting the powers of mutation in theſe extreme modes, in common with the others.

Without attending to this obſervation, and ſeeing how much the number of modes depends on thoſe of the dieſes, we ſhould determine in favour of the fifteen, mentioned by Alypius, rather than the thirteen of the Ariſtoxenians, until we recollect the firſt limitations of the modes, which confined them to the ſpecies of the diapaſon, in which neither of theſe additional dieſes is found; becauſe the notes to which they are applied are the natural and fixed points, from whence the diapaſons in each diagram begin their progreſſion. Thus B natural in the firſt diagram, and F natural in the ſecond, could receive no alteration in their firſt application; but from the neceſſity of forming two auxiliary ſcales to perfect the mutations of ſix ſharps and ſix flats, the ſeventh ſharp and flat dieſis became abſolutely neceſſary; though neither the one nor the other can be a principal note, or pitch of a mode.

Theſe extreme ſounds are a part of the ſeſquialter chromatic gender, and form an interval of twenty-one parts of the tetrachord, equal to a deficient fourth peculiar to this gender.

Hence we may conclude that if the ſpiſs intervals within the limits of diapaſon (as deſcribed at Plate IV.) are to determine the number of modes, whoſe mutations are fully complete, there cannot be more or leſs than thirteen: for it appears, that if the minor and major ſcales were each to be formed into modes in ſeperate and diſtinct claſſes, and be brought to the account, we ſhould have an even number; becauſe the two natural ſcales being added to the two belonging to each dieſis, would make them continually even numbers. But as no ſuch is contended for among the ancients, we may conclude that the ſix ſharp and ſix flat dieſes, added to the natural mode, complete the whole number, which Euclid and others have mentioned, and which muſt therefore be limited to thirteen.

I have before taken notice of the Grecian diagrams, which, being a compoſition of tones major and limmas, have occaſioned one of the principal objections by the moderns to their doctrine.

This compoſition of ſounds has always been underſtood by the moderns to be the ſcale, or natural degrees of voice, in which the eighths, fifths, and fourths only could be diſcovered; but as the imperfect concords of thirds and ſixes major and minor were not to be found in the diagrams, and as they make ſo great a part of muſical compoſition, they have con-

cluded it was impoſſible for the ancients to have any knowledge of harmony, by uniting two or more melodies together.

They did not conſider the great advantage of a general arrangement of the ſeven ſpecies of the diapaſon, the nature and formation of the tetrachords, the genders, and other parts of the harmonica, which would ſo eaſily have removed their objections, by ſupplying them with the imperfect concords, and every other muſical interval: nor did they conſider the nature and extent of their objection; for if an untuneable, or inconcinnous ſeries of ſounds was improper for harmony, it muſt for the ſame reaſon be improper for melody, even if attempted by the moſt eminent profeſſors.

This laſt, namely, melody, the advocates for modern improvements in harmony allow the Grecians to have had in very great perfection; but yet deny the poſſibility of their having any knowledge of combination or harmony, from the very nature and conſtitution of their ſcale, or diagram.

As this objection has already been removed by the diſcovery of the imperfect concords, together with the tone major and minor, ſemitone major and minor, and many other intervals, which could not be found in a ſcale of tones major and limmas, but which, according to the rules laid down by Euclid, have been diſcovered in forming the genders; one may conclude that the ſcale of tones major and limmas was originally intended for a very different purpoſe than that to which it has been applied

applied by the moderns. But that I may not draw a concluſion without good and ſufficient authority, I ſhall in ſupport of it ſhew the original of this ſcale, its application and importance in a muſical theory.

The ſeven ſpecies of diapaſon, as deſcribed at Plate III. fig. R, are regulated agreeably to this ſcale. In order to underſtand theſe properly, we muſt diſcover ſome particular ſound, not only the moſt characteriſtic in the diapaſon, but common to each ſpecies.

This ſound was diſtinguiſhed by the ancients in every diapaſon by the name of Meſe, and its poſition was the next ſound to the tone of disjunction, which is marked by a croſs ┼ in each ſpecies of diapaſon. Plate III.

This meſe determines the utmoſt limits of the tetrachord to which it is applied; and if we proceed to the ſound above it, the principal ſound, or key, is altered a fifth more acute, which requires an alteration of one dieſis to complete the whole.

As the meſe was the only ſound in every diapaſon, that required two baſſes to diſtinguiſh and mark the disjunction, its poſition was regulated by the order in which the ſeven ſpecies of the diapaſon were placed. By this the place of the principal ſound, or key-note, was eaſily diſcovered, as well as the number of dieſes neceſſary to form a new ſcale.

Thus the meſe was always found to be a fifth to the principal note of the ſcale; but when the temperament, or ſecond baſs, was applied, it was an eighth to it, and the principal ſound or key-note of the ſucceeding tetrachord.

This diſtinguiſhed character of the meſe, ſupported by the application of the fundamental baſſes and harmonic principles, prevented the diſagreeable effects of three tones in ſucceſſion; and the ſounds that formed the ſcale are extracted from the harmonics of each tetrachord.

Thus the knowledge of the ancients with reſpect to harmony appears to have been very great, in not admitting the imperfections of the ſyſtem of the diapaſon: a ſyſtem incapable of harmonic principles without introducing a new ſcale, or deſtroying the whole theory by having three tones in ſucceſſion.

If we examine the ſeven ſpecies of diapaſon at R, Plate III. we diſcover that the meſe deſcends in an alphabetical order from the firſt to the ſeventh ſpecies of diapaſon thus, $\widehat{A, G\sharp}$, $\widehat{F\natural, E, D\natural}$, $C\sharp$, B.

This ſyſtem, at firſt ſight, has the appearance of being diatonic, but will be found to be tones major and limmas in the Second Part of this work, where the magnitude of all intervals will be determined by the ratio. Thus from A to $G\sharp$, and from E to $D\natural$, will each be found a limma, and the other intervals will be tones major; all of which are formed by the meſe, or note of diſjunction.

If

If we attend to the regular order in which the ſeven ſpecies of diapaſon ſucceed each other, and to the poſition of the meſe, together with the number of dieſes neceſſary to form the ſeveral tetrachords, on which the mutations ſo much depend, we muſt own this to be a theory deſerving our greateſt admiration; not only from the wonderful agreement diſcovered among the ſeveral parts, but as it contains more muſical knowledge with reſpect to harmony, than any theory formed by the moderns.

I ſhall end this part, which has already been longer than I intended, with one obſervation, which may put an end to the diſpute between the advocates for ancient, and thoſe for modern, harmony; and which I have never yet met with in any author. This is, that the great, the perfect, and immutable ſyſtem of the Grecians, ſo little underſtood, and almoſt univerſally condemned by the moderns, is a very eſſential part of our own theory: for if the principal ſounds, or pitch, of the ſeveral modern ſcales are placed in an alphabetical order, in the ſame manner as the meſe, the relation of each principal ſound to the next will be either a tone major or limma.

In conſequence of this obſervation it appears that the ancients had as good a claim to the knowledge of harmony as the moderns. The truth is, the principles of ſcience have always been the ſame, and are governed by the ſame fixed and unerring laws, though they are not always equally underſtood: and I wiſh to have any concord, or other muſical interval, pointed out, which is not to be found in the harmonica of the Grecians.

As

As I am deſirous of removing every objection to the Grecian doctrine, I muſt not paſs over a very material one."

Ariſtoxenus ſays [p. 20.] " that many intervals are modu-
" lated leſs than diateſſaron, but are all diſſonant."

If this were true, all ſyſtems muſt be diſcords, which would deſtroy the harmonious conſtitution of the tetrachord; but as he cannot be underſtood to have any ſuch intention, it muſt relate to the movement of the roots or fundamental baſſes, which move by fifths, or fourths the inverſion of the fifths: this will be eaſily underſtood; for in this theory we have no inſtance of the roots moving a tone, and the third is the only motion that remains; the conſequence of which will be a change of key from major to minor, or the contrary, and will occaſion a temperament that always attends a fourth term; which, in the Second Part, in treating of diſcords, will be more particularly explained. At preſent it is ſufficient to obſerve, that no ſuch motion of falling or riſing a third can be found among the fundamental baſſes of the tetrachords, except at the diſjunction at S, Plate III. which changes the ſcale a fifth higher, and is not one of the primes, but is a ſecondary fundamental baſs, or fourth term, and moves immediately into one of the primes of the next tetrachord.

This explanation diſcovers that this part of Ariſtoxenus's doctrine muſt be applied to the roots, and not to the ſyſtems or melodies.

Euclid

Euclid [p. 8.] mentions ſomething ſimilar to what Ariſtoxenus has obſerved. He firſt enumerates the ſpecies of conſonances, and then ſays that "all intervals leſs than diateſſaron "are diſſonant," and tells us what they are; ſuch as "dieſis, "hemitone, tone, trihemitone, and ditone."

In this account of diſſonant intervals there is no mention made of the limma; but this very account furniſhes a proof of Euclid's being well acquainted with the imperfect conſonances; notwithſtanding they are excluded from a place in the diagrams, in the ſame manner as the limma is in all other places of the harmonics.

As the ſame objection to all intervals leſs than diateſſaron being admitted among the primes, or fundamental baſſes, muſt remain, as before mentioned, we may obſerve that the diagrams are not diſordered by introducing the imperfect conſonances, but are preſerved in their firſt and original ſtate of tones major and limmas, as fundamental baſſes.

It may be expected that the diſcords which make ſo eſſential a part of a muſical theory ſhould be treated of next, but as they will be better underſtood when explained by the Ratio, I ſhall reſerve them, together with their preparations and reſolutions, for the Second Part.

Theſe obſervations do not ſo properly come under the ſixth general head of the harmonica, according to Euclid; yet as the knowledge of the primary fundamental baſſes is ſo eſſential

to

to the mutations, it was neceſſary to place them in that light which their importance demands.

I now proceed to the Melopæia, or Seventh and laſt Part of the Ancient Harmonica.

VII. Of the MELOPÆIA.

The Melopæia is that part of the harmonica which determines the motion, or ſucceſſion, of ſounds proper to produce air, or melody; and, according to Euclid [p. 22.] conſiſts of Ductus, Nexus, Petteia, and Extenſio.

" Ductus" is a gradual ſucceſſion, either aſcending or deſcending.

" Nexus" directs the ſucceſſion to be by harmonic intervals, ſuch as a 3d, 4th, 5th, or 8th, and the like.

" Petteia" is a repetition of a ſound in the ſame tenſion.

" Extenſio" is a continued ſinging of a ſound in the ſame tenſion.

Ariſtides Quintilianus [p. 29.] has given many diviſions and ſubdiviſions of the Melopæia; but if it means no more than ſimply to determine all poſſible motion of ſounds, without any

any regard to the various combinations of time, the four parts mentioned here by Euclid give every thing that the ſubject demands with reſpect to a ſimple melody; which, notwithſtanding, may be applied to two or more, with equal ſucceſs, in the following order:

" Ductus," or a ſucceſſion of degrees:

Two, and ſometimes three, melodies may move in ſimilar motion; and two in the contrary, either aſcending or deſcending.

Four melodies may move in ſucceſſion by uniting ſimilar and contrary motion.

" Nexus," or the motion of harmonic intervals:

Two, and ſometimes three, melodies may move by harmonic intervals in the ſimilar motion; or three, and ſometimes four, in the contrary.

The two motions of the Ductus and Nexus may be variouſly changed, and applied to one, two, or more melodies.

" Petteia," or the repetition of a ſound in the ſame tenſion:

By this the various combinations of time may be deſcribed, but nothing relating to tune: or it may be applied as a baſs to every ſound in ſucceſſion in the melodies; for in this laſt

inſtance, as the number of pulſations, or repetitions to divide the time, is not limited, ſuch an application of the Petteia to ſounds in ſucceſſion will conſtitute air, or melody, and when united with the other parts of the Melopæia, in two or more melodies, is capable of producing great and noble effects.

" Extenſio :"

To know how to apply this part of the Melopæia, it will be neceſſary to diſcover if a ſound, continuing in the ſame tenſion, can be common to two or more fundamental baſſes.

Of this we have an example in all baſſes moving a fifth; as in the disjunction of the tetrachord at R, Plate III. where the laſt note of the tetrachord is a fifth to the firſt baſs, and an eighth to the ſecond, and continues in the ſame tenſion during the change of the baſs and two of the harmonics.

All ligatures, ſyncopation, and the preparation of diſcords, are ſo many applications of extenſion to two baſſes, and are in no reſpect contrary to the laws of harmonics. But if we conſider extenſion in its greateſt latitude, it will be found to be an application proper for three, four, or any number of baſſes or melodies in ſucceſſion: for as extenſion, when confined to a ſimple ſound, has not in itſelf any of thoſe varieties we meet with in tune and time, it follows, that the motion of other ſounds placed in oppoſition to it, according to the three firſt parts of the Melopæia before deſcribed, muſt procure us this effect. And if any diſcords ſhould be generated by the ſounds in motion, when compared with the note of extenſion, they

they are rather accidental than eſſential, becauſe they require no other reſolution than that of continuing the motion of thoſe accompaniments, till they finally terminate in a conſonant proportion.

Thus extenſion being applied to C, and the baſs moving C, D, E, or E, D, C, at the ſame time, we have in this caſe the diſcord of the ſeventh at D, the ſecond ſound, which is reſolved by the motion of the third ſound in the baſs at E, without any alteration in the extenſion; and it would be the ſame if the thirds to the baſſes and other harmonic ſounds were added. But if any diſcords are generated among the melodies in motion, as frequently happens, they muſt be regularly prepared and reſolved, according to the rules of diſcords, but without interfering with the extenſion, which may be continued any quantity of time that the compoſer pleaſes.

Many examples might be brought from the beſt writers, if what has been already ſaid on this ſubject were not ſufficient to explain this important part of the Melopæia; without which harmony would loſe a great part of its beauty, and be robbed of its principal and moſt noble effects.

I have now gone through the Seven Parts into which the Ancients divided the Harmonica. I have given each part a muſical conſtruction, by which their mutual relation and agreement have been explained, and reconciled to the laws of harmony, beginning with the firſt idea or definition of a muſical ſound, and proceeding to the knowledge of intervals, or the diſtance to be obſerved between one ſound and another in the

the formation of genders, ſyſtems, tones, or modes; from which we have been able to form and regulate the ſeveral ſcales, and diſcover the relation which every ſound in a ſcale has to its principal or fundamental ſound; likewiſe how any given ſcale, taken as a principal one, is connected with others, by which, under certain limitations with reſpect to the dieſes or poſition of the hemitones, the conſonant and diſſonant mutations are regulated; the number alſo of ſharp and flat dieſes neceſſary to perfect every ſcale, has been collected and diſpoſed in a particular order, proper for the diſcovery of the genders, as well as the ſpiſs and all other intervals, which can be wanted in the moſt elaborate compoſitions.

I was induced to, and encouraged in, this extenſive and arduous taſk by ſome diſcoveries which appeared to be of the greateſt importance towards the undertaking and explaining of a theory, which had for many ages been only a ſubject of diſpute; neither party being able to determine any thing concluſive in ſupport of their different opinions, either for, or againſt, the harmonic principles of the Grecian doctrine. Nor could I have flattered myſelf with better ſucceſs, had not the inverſion of the firſt diagram offered ſomething the moſt intereſting and agreeable to my wiſhes. To this ſucceeded the order of placing the ſeven ſpecies of diapaſon in each diagram, which encouraged me yet more to proceed; but when the tetrachords in their various poſitions could not be formed without the ſharp and flat dieſes, and the conjunction and disjunction could not be explained without the application of the harmonic principles, I remained no longer in doubt, but was fully convinced that without a perfect knowledge of harmony it muſt have been

been impoſſible to have formed a theory ſo expreſſive and curious as the Grecian in all its parts; nor can it be underſtood, unleſs explained by the ſame laws, by which it was originally formed.

However, that I may give ſome ſatisfaction to thoſe who object to all theories not demonſtrated by numbers and ſupported by the Ratio, I have determined to try how far the power of numbers will carry me in a theory of harmonics, agreeably to the *Pythagorean* doctrine, which will be the ſubject of the Second Part of this Work.

END OF THE FIRST PART.

INTRO-