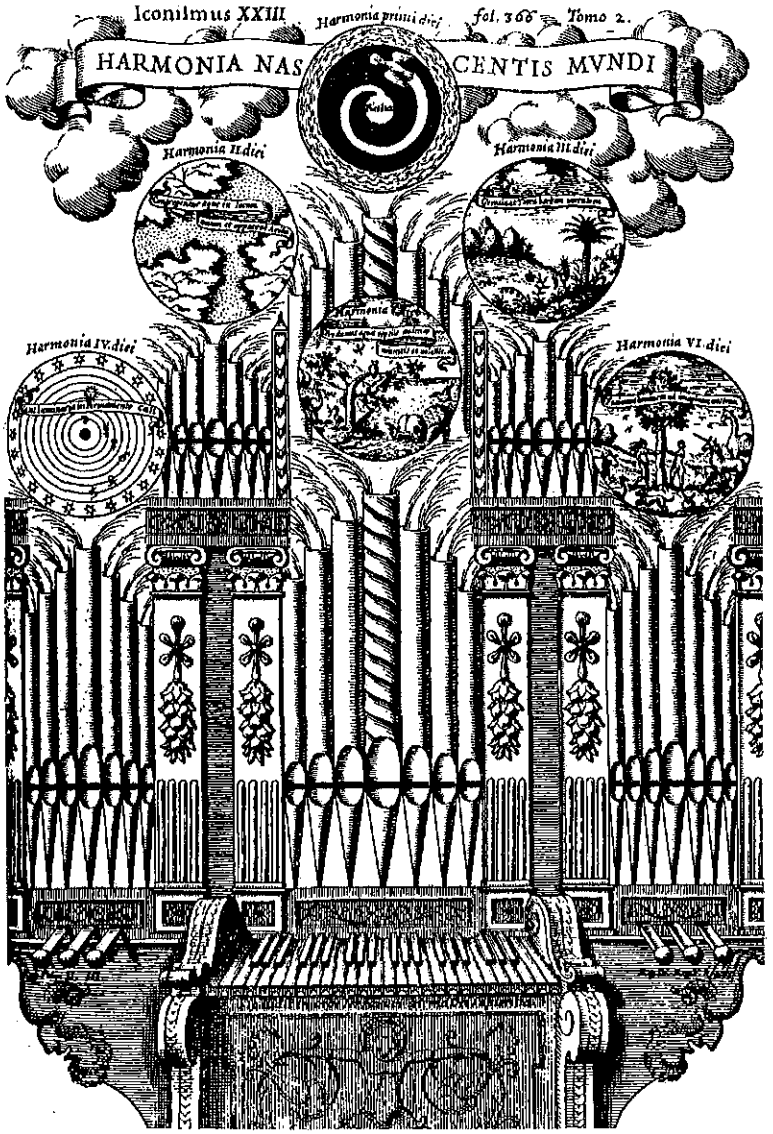
RHYTHMIC FORMATIVE FORCES OF MUSIC



MICHAEL THEROUX

With The Eidophone Voice Figures of Margaret Watts Hughes

Foreword by Gerry Vassilatos

BORDERLAND SCIENCES RESEARCH FOUNDATION

For Briana

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Contents

Foreword

MUSIC precedes all other artforms, and is the primal expression of humanity. The development of consciousness in early humanity is observed in the microcosm of child development. From the moment of our physical birth into this world-frame we utter sounds. Sound and song launch the expressive foundation from which all of our arts, sciences, and technologies spring. Sound and song launch our civilization ...and represent our primary access into eidetic space worlds of astounding presence, permeation, and power.

As babies grow in world-awareness they manifest engagement with a polyplasmic freeplay which explores all possible sounds...simultaneously. The glossalalia of little babies remains a phenomenon of extreme mystery. Ancient mystics heralded this phase of early child development as a theophaniam ...the appearance of Divine Language in a child's consciousness.

Indeed, every phoneme and morpheme is heard simultaneously when a baby makes vocal expressions. Babies do not make simple vocalizations; they make tone-pitched utterances ...songs. Careful attention to baby-song reveals a startling fact: babies pitch their expressions without previous knowledge. Babies are naive to our socially meaningful pitched expressions of inquiry, emphatic demand, free improvisatory vocal play, and cries for help. Esoteric Science recognizes in these simple observations that babies cooperate in a space-transecting process of enormous penetrative power. Indeed we see evidence that consciousness itself is a shared medium by which we have our being. Early development of consciousness is a process in which the individual partakes of articulations from a greater pre-existent source. Our personal development is marked by permeating (often unrecognized) participations in space-transecting eidetic transactions.

Evidence in child development indicates that infants do not simply explore and take pleasure in the syllables which they make ...but that they actively receive corresponding ideaforms with each ululation. As infants reach a critical stage in vocal development they begin to take extreme pleasure in simply ...singing their ideaforms. The infant arrives fully equipped to receive universal eidetic signals .... holoforms ... ideas ... visions. Lifelong consciousness development engages the individual in eideto-receptive processes in which the recipient becomes better articulated to participate in the universal song. Personal tuition in eideto-articulations produces visionaries of extreme precision. These are the individuals in whom civilization is magnified. We are each given the rare potential to become custodians of eidetic treasures ...and to share them liberally with those among whom we are fortunately placed.

Certain individuals exhibit particular acumen in continuous melodic receptivity. These individuals were heralded among early societies as divine messengers on earth. Those who conveyed idea in song were eminent members of their parent societies who later were honored as primal priestly caste. The musician was both loved and feared as the one who communicated directly with the heavens. The musician learned, taught, and conducted first tribal ritual as song. Eidetic receptivity precedes all True Arts and Sciences. Without a vision we perish. Eidetic receptivity is

our lifeblood and being. Space is fundamentally eideto-active ...and we have our being in eidetic holoforms. Before you speak ...and think ...you have been initiated (unrecognized and subtle) by eidetic transactivity. Space is the body of consciousness ...the Persona in which ideaforms are structured ...and in which they are exchanged. Sentient beings are fortunate recipients in this marvelous flux.

The musician learned how to make devices which eidetic song required. Instruments of every imaginable kind were devised for "completing the song". Indeed, song is not truly "complete" without the accompanying complements of rhythm and tone. Early tribal song was group-participational. Early song was spontaneously composed around the forms which musician-priests had first received.

Through the first channel of Music the eidetic worlds projected all other arts and sciences. First of these was technology in making instruments ...organs of eidetic space. Instrument making represents our second access in eidetic space. Instruments solidify our ability to engage eidetic currents directly. Specific instruments so powerfully engage eidetic currents that whole societies are moved along musically defined directions *en masse*. In this sense musicians and their instruments are eidetic navigators ...whose leadership enunciates, fixates, directs, and opens the conscious course of cultures along eminent eidetic paths.

Musicians are those from whom logic and visions spring ...spontaneously in song. Cultures are identified by the musical preferences ...from the musical metaphors in which they are saturated and which they employ. There is every indication that sacred ground points enunciate the music of a land. Indeed ...scales and songs of specific sacred sites were named by their geographical regions. These names remain to this day. How often have we travelled through a landscape and received a spontaneous breath of song? How often do these earth-songs not differ with the lands which we visit?

Musicians were first ranked most high among emerging priestly castes. Their use of instruments gradually shifted from participant-leaders ...to virtuosi. Specific musicians received and developed great ability in making melodious expression through curiously wrought instruments. We each manifest deep fascination when beholding strange musical instruments. New musical eras are born when new instruments are created.

Social consciousness transmutes when new musical instruments are made. Creations of new songs follow the development of new instruments. Plato warned early governors to observe and monitor musicians closely ...for when new instruments and new kinds of songs appear ...otherwise stable societies change abruptly. Musicians have been known to change civilizations abruptly. These changes are not always beneficial ones. Revolutions and radical fluctuations from the pure eidetic course are often disastrous among those in which specific new music appears. Noise is not the only kind of disruptive song ...sleep-inducing songs also effect life-negative extremes in their host societies.

Exposure to specific kinds of songs alters consciousness. Eidetic currents predispose certain recipients with magnified eidetic receptivity. Such individuals grow in both awareness and ...kindness. True geniuses are made in eidetic currents. These most certainly exhibit strong positive socialization. Musicians form the first focus of any new consciousness evoking regime. Examine history and see that musicians form the fundamental stem from which social events blossom forth.

Music saturates individuals and magnifies their personal eidetic correspondence among envisioned worlds.

Personal eidetic fund translates the individual into other worlds and realities ...which are not fantasies ...but eidetic realities. Eidetic translation is true space travel...true astrognomia. Music engages our whole being in receptivities and translations which explore eidetic space at large. Societies which engaged in such travel also developed scientific awareness of earth and space.

With the consciousness-modifying awareness among musicians came those who recognized also that many natural places and materials were emanating vision and consciousness ...continually. Eidetic awareness grew among those whose consciousness and conscious sensitivity recognized the ground sources from which consciousness actually flows ...sacred spots. From musical sensitivity came spiritual awarenesses. Tribal gatherings celebrated, honored, and worshipped at these ground sites. The musician led tribal celebrations no longer simply around old social gathering places ...but near the specific newly discerned sites. Proximal contact with the mind-expanding flux which emanates from such places granted greater technological prowess to certain recipients. These individuals now superseded primary caste musicians ...in the creation of simple devices which actively focussed, magnified, and directed consciousness. Totems, groves, megaliths, and finally architecture was developed among these first mystics. Devotions to the sacred sites became the cultural focus of each significant civilization. Increased devotion to these sites granted deeper eidetically received revelation. With these new mind-magnifying revelations came a third access for humanity.

The primary position of musicians gradually shifted ...until those who wielded ætheric consciousness-modifying instruments seized power ...and became rulers. In these eideto-active devices we see total reliance on musical principles. For eideto-active devices to provide their greatest life-magnifying benefit we must rely on musical principles. Eideto-active technology provides us with our third and access in eidetic space. Humanly accessible eidetic energies are heralding a new world which will surely come. This new world will first appear among those whose sensitivities and natures permit eidetic freeplay. Eidetic space grants us revelations of its being in vision and song. Our response stimulates magnified receptivity: first access. Increased eidetic participation produces magnified receptivity ...and eideto-magnifying musical instruments are made: our second access in eidetic space. Deep contact in eidetic streams grants to us the ability to directly absorb, concentrate, magnify, modify, and direct eidetic currents: our third access. In this lies the future of societies, nations, cultures, and civilization. Music is the eideto-accessible threadway through which all advanced civilized developments emerge.

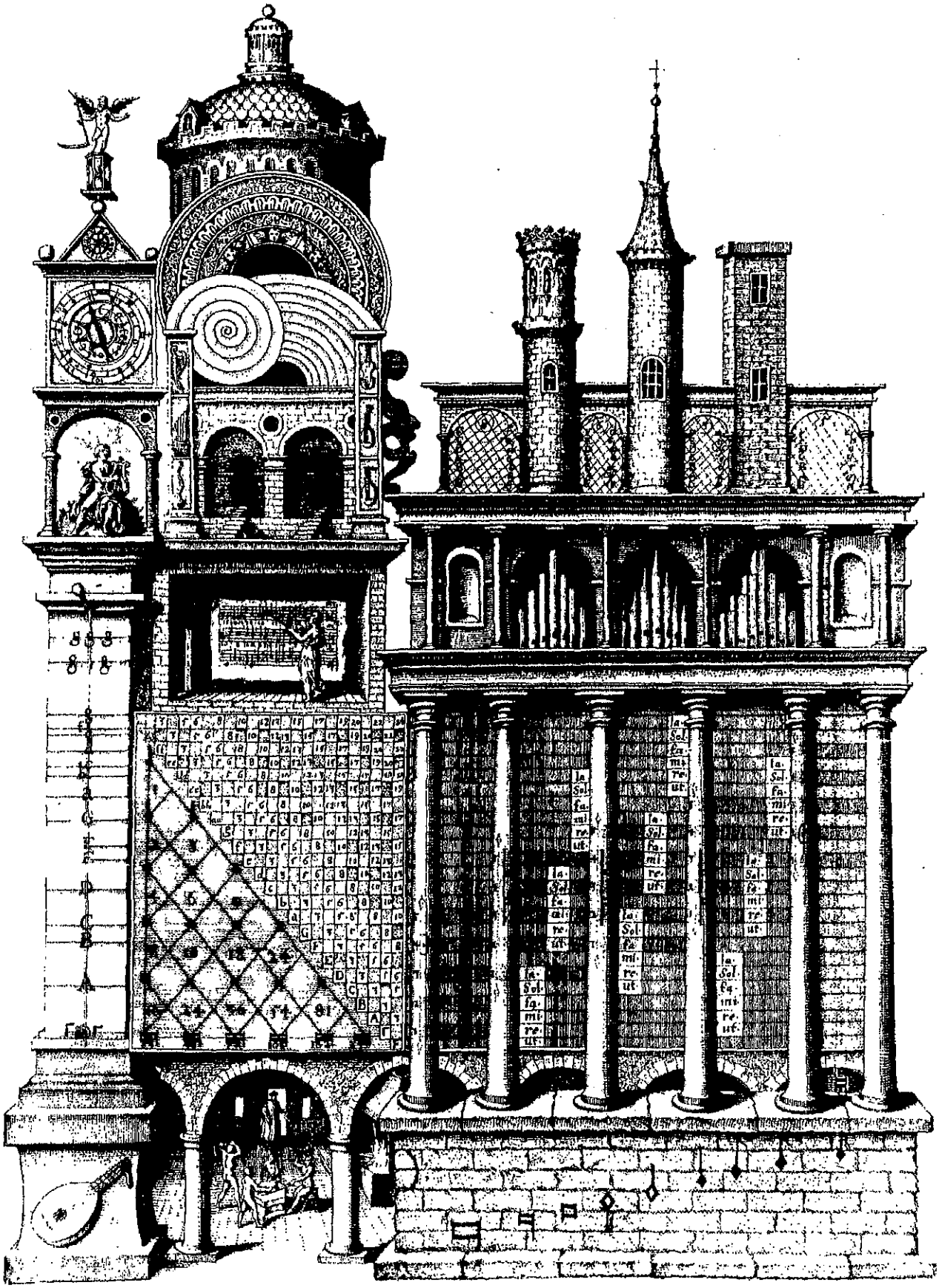
Friend and collaborator Michael Theroux has devoted considerable time, struggle, experiment, and development among the potentials which MUSIC engages. His thorough discussions focus our awareness with pinpoint accuracy upon the critically necessary lessons which necessarily precede eideto-active technology. Clear and forthright in writing style, his empirical fund of knowledge makes him the best expositor of such matters. Mr. Theroux's brilliant tonal compositions and virtuosic abilities transduce specific eidetic experiences directly. In this melodious furnace of revelation all these powerful enunciations were forged.

His investigation of telluric sounds and his numerous phenomenal recordings of earthquake signatures place him among the very finest contemporary empirical researchers. Such exposure and

familiarity with eideto-ætheric potentials have been translated in readable language in this rare and excellent treatise. I have personally counted my friendship with Michael Theroux a fortunate privilege. We have together shared, researched, and collaborated on numerous rewarding ventures. I encourage you the reader to delve into these treasures, saturating and meditating deeply on each presented discussion. In these you will find your thematic focus ...for MUSIC remains our first expression and primary access in eidetic space.

Inertialistic Science is characterized by selective and continual terminations of thematic continuity by which potential visionaries lose touch with traditional development and personal access. Here you will rediscover the thematic connections which have previously eluded your own personal development. With such thematic continuity restored and clarified, your own thought process will enable you to absorb the startling conclusions that are drawn from Mr. Theroux's statements. With these clarifications and conclusions there will no doubt appear new technologies among us. This wonderful treatise floods over with strong projective visions ...which the startled sensitive will receive.

Gerry Vassilatos
Staten Island, New York
March 1994



Introduction

WITHIN the small space of this introduction, I would like to touch upon the nature of how this book came into being, and the general purpose of its undertaking. This work has been in progress for over 5 years, and much of the present volume has evolved over a long period of experiment and investigation. The first three chapters in the book were all published previously in the *Journal of Borderland Research*. These articles, over time, have been modified extensively, and include much new information. Of the last three chapters, *The Evocations of Erich Zann* was written for another publication, *Duende* was created especially for this book, and *Of Language and Song* is an introduction to another series of articles in progress.

The main purpose in putting all of this information under the cover of one title was that none of the this data has ever been collected and presented together before, and it may shed some new light on the topic of esoteric music. In most cases, books on the subject of the mystical nature of music have nothing new to say, or they are merely discussing it from an acoustic or vibrational standpoint. It is from within the borderlands of science, which endeavors to understand the qualitative nature of things, that this subject is covered. This tome will tell you nothing about the new-agey term, "the music of the spheres".

When the ancient seers spoke of the correct 'vibration' of, or properly 'vibrating' sounds as in the recitation of magical names, etc., they were not merely referring to the physical characteristics of the act. It was the *qualities* of the interacting tones that they were most concerned with. From a compositional standpoint, the arrangement of vowels, consonants, and other sounds was most important, as the disposition of each in its relationship to the whole would produce individual qualities with distinct geometric interrelations, and this along with the emotional passion of the adept would produce the desired results. Thus, each form of a word or phrase had its corresponding quality and geometry giving each a separate function, which was noted by the ancients in their use of such devices.

This fact is no different for music, and it is the dominant theme of this work – to reveal this conception, and to provide new possibilities for experimentation in the art. Much of this has been incorporated into my own personal compositions on the albums *Mundus Subterraneus* (Vibra-Ray Music, from Borderlands), and *Deros* (as yet unreleased). In the appendix one will find a block diagram of one of my compositions from *Deros*. It is a rough sketch of some of the devices used which make up a greater portion of the works.

It is my hope that this book will open an interest into some of the more obscure ways which music plays a part in our nature. It is time to leave behind the innumerable, mechanistic definitions of the "music of the spheres". This music will go on without our imposed laws and assignments. For real research to move forward, it is important to begin understanding the qualitative aspects of our musical cosmology, as it is a vast and seemingly untouched area of borderland science.

I would like to thank all who made this book possible; Gerry Vassilatos, for his incredible insight into the subject, and his friendly encouragement; all of the composers and musicians who gave me inspiration while writing this, and not least, Deva, for everything else that matters.

Michael Theroux
April 1994

El grande Orpheo primero inuentor
porque es de todos / de todo hazedor.
por quien la vihuela / parece cosa diuina
si el fue primero / no fue sin segundo
ORPHEO

The Formative Forces of Music

Rhythm, Melody, and Harmony

IF we over-intellectualize about music, we really remove ourselves from what music truly is. To conceptualize music by physical interpretation via mathematical analysis of tones, removes music from its element. While there is a place for the study of tone physiology (acoustics), it has nothing to say about the musical element, and thus should be left as the individual science that it is. The musical element dwells purely in the spiritual.

In assessing the other arts such as painting, sculpture, and architecture, one can find models in the physical world from which the artist must at first pass through mental image to create pictures of the will. The creative musician, on the other hand, has no models to imitate, thus composes musical ideas from his/her soul into direct expressions of the will. As art can be considered an attempt to reveal nature's secret intentions, the painter or sculptor, through the combination of mental pictures merely expresses the idea of nature, but the composer of rhythms, melodies, and harmonies expresses the will of nature in song and dance.

Before we look at the evolutionary progression of music, we must understand rhythm, melody, and harmony, and how the human being initially experiences them.

COSMIC RHYTHM

Let us return to art for a brief explanation concerning rhythm in the musical element. The sculptor, painter, or architect, has physical forms with which to create his/her art transforming it into matter, whereas the composing musician, utilizing time as canvas, has the ability to generate the composition anew, again and again with varying quality.

Time, or rhythm, is the measure of motion, or to quote Aristotle, "Time is the measure of motion and rest," as all rest is in time. Rhythm, then, must be exalted high above melody and harmony in this case, as rhythm can exist without them, but melody and harmony cannot exist apart from rhythm.

Many seem to be driven to the conclusion that nature is a reflection of music as an ordered (or chaotic?) number of cosmic vibrations, based on static interval relationships, but through simple observation of nature's motive characteristics, we could rightly presume that she is an expression of rhythmic formative force; being a series of varied, cyclic emanations from the spiritual world. This rhythmic formative force is the primordial foundation underlying all creative processes in nature, of which examples may be obtained via the measurement of time (using our time scale, many of

the forms in nature are simply motion come to rest). One such example can be found in the human body, as our internal experience of rhythm is based on the connection between pulse and breath – in the average person this ratio is 4:1, hence our affinity for 4/4 time.

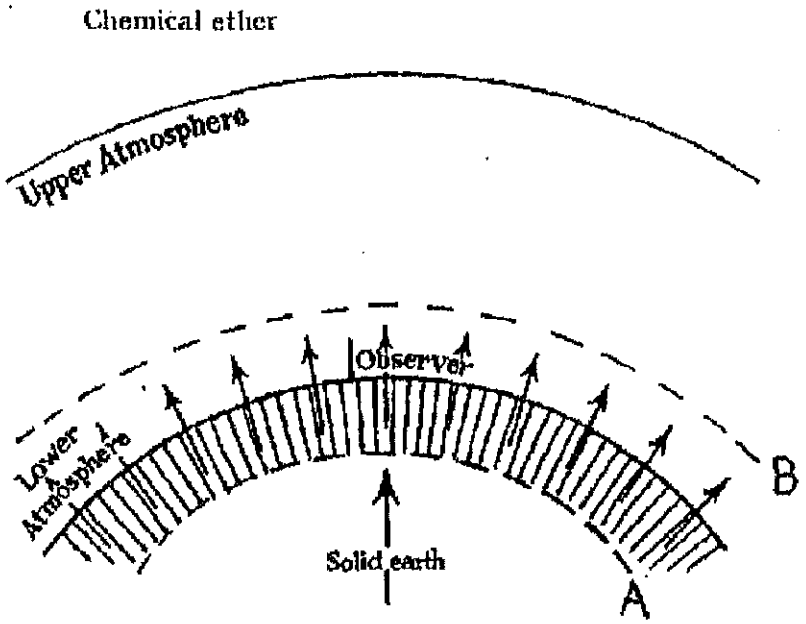
In a greater, cosmic connection we find a definite relationship between the breathing rhythm of the earth organism and the breathing rhythm of the human being. The earth organism's breathing process is observed in the alternating barometric pressure of day and night; exhaling at sunrise, and inhaling at sunset. The average person inhales and exhales approximately 18 times a minute, or 1080 times an hour (1080 itself is a most prominent number in ancient geometrical cosmology, and is also the radius in miles of the moon), or 25,920 times a day (24 hours equaling one earth breath). The number of human breaths in one day corresponds to the number of years (revolutions of the earth around the sun) it takes the sun to pass through each of the twelve signs in the circle of the zodiac (called the precession of the vernal equinox). This duration of time (25,920 years) is also called the Platonic year.

The rhythmic perceptions of the body are not only confined to the function of breathing but through the propagation of blood from the heart to the limbs (a likening to our circulatory system can be observed in the earth as well; i.e. the alternating temperature differences in night/winter and day/summer). Now if we take the average pulse rate which is 72 beats a minute and compare it to the average number of breaths in one minute (18), we will find precisly the same relationship in the astronomical sphere between the precession of the vernal equinox, and the nutation of the moon. So, one day of a Platonic year would be equal to 72 earth years. The nutation of the moon (the period during which the axis of the earth, under the influence of the moon, describes a small cone around the axis of the earth) is a period of about 18 years. Thus, we have the ratio of 72:18, or 4:1. All of this should lead us to the conclusion that the human organism is completely immersed in rhythmic formative force.

Now if we return to rhythm in the musical element; in association with the human organism, the question of healing arises. Why is it then that in most of the healing circles involved with music, one rarely hears of the rhythmic process save only in connection to the shaman? Apparently, it is due in part to character armouring brought on by medieval western societal dysfunction with its ever imposing religious belief systems whereby music was slowly transformed into a civilized affair (no wild dancing to the beat of that savage music, or you will end up in the place where the man with the horns and pointed stick reigns). There are still some areas of the world where Christian missionaries forbid the locals to use the drum.

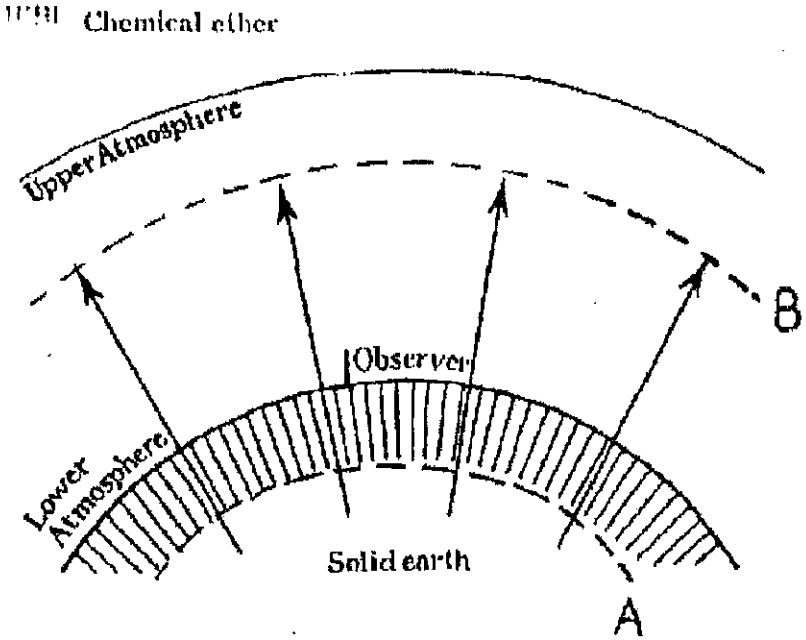
The fundamental reason for the absence of the rhythmic process among musician/healers seems to be that they lack the understanding of complex rhythms and do not know how to categorize them. While it is easy to discriminate tones by their frequency, overtones, etc., rhythms tend to be elusive and difficult to classify in relation to musical healing techniques, especially if one considers polyrhythms and polymeters. Studies in the treatment of pain, resolution of depression, and induction of relaxation have been performed using shamanic drumming (with favorable results), but no classifications of the exact rhythms has been done and every drummer will have their own unique style. It should be noted that certain experiments with plants have suggested that the rhythmic element might be more harmful than healing. In the late 1960s, Mrs. Dorothy Rettalack performed several hundred experiments designed to ascertain the influence of music upon plants. Her findings

Exhalation begins during and after sunrise.



II

Exhalation process is completed during midday and in the afternoon.



Breathing of the Earth Organism from *Etheric Formative Forces in Cosmos, Earth, and Man* by Guenther Wachsmuth

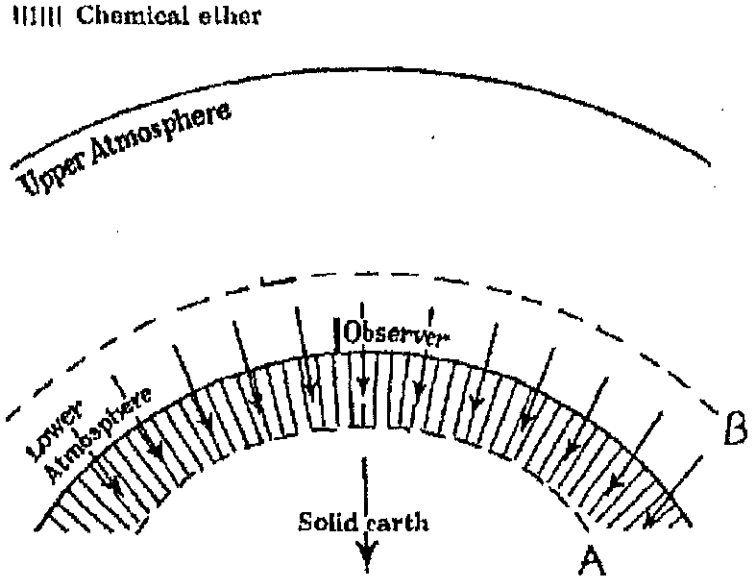
concluded that plants preferred music *without* percussion in nearly all cases. For one experiment, she selected two versions the Spanish tune "La Paloma," one played on steel drums, and the other on violins. The plants leaned 10 degrees away from the speaker playing the drum version, but found the string version to their liking, leaning close to 15 degrees *toward* the speaker. Several other of her experiments found conclusions of a similar nature.

Although the rhythmic element is somewhat elusive in healing practises, one may find that within the medical practise of homeopathy, there exists one such use of rhythm – in the potentising of the homeopathic remedy. Samuel Hanemann, founder of Homeopathy, showed that a remedy may not be merely diluted, but must be *potentised* in order to work effectively. This involves the rhythmic succussion, or shaking of the remedy between each dilution. This succussion process engages the use of specific rhythms for each individual substance. Thus, if the remedy used is of Aurum (gold), the rhythmic element applied would be one of five beats. Not much has ever been published with respect to the correct use of rhythms in the succusion process, but it should be sufficient for now to follow standard correspondences with each substance to be potentised.

Before leaving the rhythmic element of music, let's briefly examine its association with the astrological geometries of the ancients. The early megalithic builders were highly aware of the sacred geometry needed to attract the forces of nature to their celestial monuments. But, as this sacred geometry could only duplicate the static form of life they realized the importance of giving life to these structures by creating motion within. Now if we are to illustrate and expand upon our knowledge of form, we must encounter a suitable geometry to go with the shape-building process. The Euclidean geometries will not alone suffice – their limitations exist by the fact that they only represent centric form and one that is fixed in time – that is without position or motion in space. Only Projective geometry can fill in the vital gaps. In its rhythmical interplay of peripheral and centric principles it not only defines position in space, but also allows for motive properties which exist in the growth of all form. It is essentially a sculpting process.

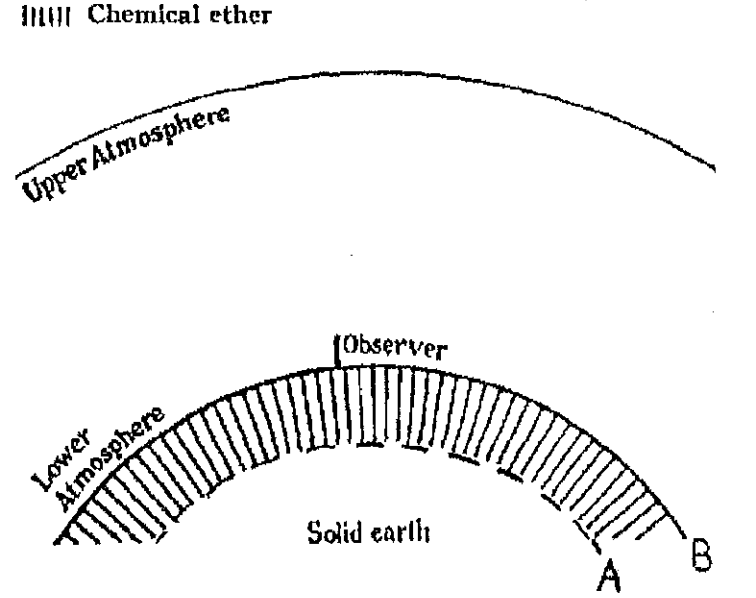
Let us relate this to the energic properties of the Golden Mean. The ancients knew that artificial constructs (such as pyramids, etc.) using Golden Mean geometries (of which all form in life is related to) would draw to them life giving energies. This is quite truthful, but we must not misinterpret this

Inhalation begins towards sunset.



IV

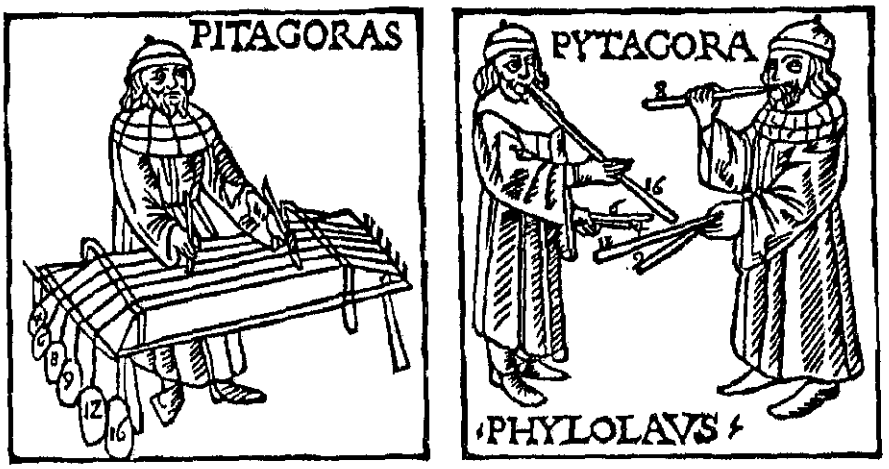
Inhalation process is completed during night, 3-4 o'clock.



Breathing of the Earth Organism from *Etheric Formative Forces in Cosmos, Earth, and Man* by Guenther Wachsmuth

to be a product of inertial or static geometry. Everything in nature is in motion, and this is true provided we allow for an individual form's particular time-scale (for instance, if we observed one hundred years of tree growth on five minutes of time-lapse photography, we could only liken it to an intense electrical discharge). The formative forces which give life its characteristic golden proportions *do this through the motive properties of projective geometry.* All growth is motion, and only here do we see the Golden Mean revealed. As an example, consider the phyllotaxis of a plant. Through the specific arrangement of its leaves in its spiralling upward motion, we able to observe this sacred geometry. The Golden Mean only arises through growth in life, therefore it is a product of projective geometry. We can, moreover, say that it is projective geometry which should be considered sacred.

The ancients gave the motion of life to their structures through the ritual of chant and dance and this was subject to the rigid correspondence of the time of day or night. The evocative substance of this etherial music did not emulate the vibratory emanations of the desired energies, but rather took on the rhythmic and emotional *qualities* of the energy (for instance, in the workings of Jupiter, common time and major keys would be typically characteristic of the mood of that sphere).



The ancients had a profound working knowledge of nature's rhythmic cycles (cycle, from the Greek meaning circle, implies a coming around to the place of beginning) and through careful interpretation they could construct the rituals with which to breathe life into their sacred sites. The fact that these ancient peoples were inseparably connected to certain earth currents certainly would have had a profound effect on the music indigenous to a particular area, and this will be dealt with in detail later.

MELODY AND HARMONY

Melody and harmony are by no means one and the same entity, but need to be expressed here in context to one another. Melody, in conjunction with rhythm, is the only component necessary for the construction of song (as for the use of the term melody; it already possesses some form of rhythm or it could not exist, so we will continue to apply it unaccompanied).

In observing melody, we find that a new type of motion occurs on the vertical axis with the ascending and descending notes of the composition. This is really only an implied motion as it is dependent upon the longitudinal motion of rhythm, but it is still a part of our sense perception of melody. As we know, the human ear percieves tone as a sensory function, but the ear is also related to a sense of spatial orientation (relative to three dimensions) that we are no longer aware of. Remnants of this sense arise when the ear becomes injured, and our balance and regard to direction

become upset. When harmony enters the picture, other types of motion will appear to the senses, but the differences between melody and harmony need to be examined first.

If we take a look at folk music, which is considered province of the commoner and primitive to the 'educated', we will usually find in the very early forms that there is a lack of accompaniment (other than the employment of a drone in some areas such as India and the Celtic countries) to the standard melodies. To the modern listener accustomed to harmony, straight melody is generally not satisfying due to the fact that harmonised music is actually falsified; given to its adjusted temperment. To really feel this type of music one must recover the sense of pure intonation and defy all implied harmonies.

Equally distinctive in solo melody, is the use of grace notes (giving the transcriber incredible difficulty in interpretation) which add varying degrees of light and shade to the structural arrangement of the composition. Early attempts to add harmonization to the often complicated and highly ornamented bagpipe and fiddle tunes of the Celtic peoples failed miserably, and most efforts were abandoned due to the many dissonances encountered. We are left with the realization that unaccompanied melody is capable of standing on its own.

Another important feature of most folk music is the emphasis on the interval rather than the note sung or played. The exception to this lies in the art of counterpoint, giving rise to the aforementioned other types of motion. Through contrapuntal music we see the emergence of spiraling movement propagated by the oscillating currents of intervallic inversion, and retrograde themes. Here again, it is an implied motion, which is confined to the same horizontal plane as the rhythmic element, and experienced only through spatial (and counter-spatial) orientation. For the desired effect, one actually needs to listen to some examples of the music, otherwise the descriptions are probably meaningless.

The qualitative and energic properties of each of the three musical elements may now be described as such:

1. Rhythm – Related to the function of time. Melody and harmony appear to be dependant upon rhythm (later we shall see how they may become dissociated).

2. Harmony – Related to the function of space. Through the combination of interval relationships – form in space is created. This is a molding process which most often shapes from the periphery inward but can take on characteristics of counter-Euclidean geometries which involves an interplay betwixt the peripheral and centric planar themes. It most often accompanies the horizontal patterns of time.

3. Melody – Related to the functions of extra dimensions. Melody always involves change which in its randomness (especially in improvisation) makes it intangible in form and can only be grasped in association with the horizontal rhythmic element (unless the rhythms are of a vertical nature such as the palindromic or non-retrogradable patterns).

This, of course, does not express that these qualities are fixed or dogmatic, but that they are purely a matter of observation – much open to speculation. We shall soon observe that music is not derived from unalterable scientific and mathematical constants, but has been created from artistic invention.

The Nature and Meaning of Intervals

The Artistic Experience in Music

The facts of human evolution are expressed in musical development more clearly than anywhere else. Rudolf Steiner

INQUIRY into the nature of interval relationships usually leads us on a direct path through the western diatonic or twelve-tone chromatic foundations of familiarity. Although this discussion will turn to our perceptions of the more common interval relationships through time, we have a need to understand that these particular intervals are a product of artistic invention and not naturally occurring formations of scales and harmonic tissue. Music cannot, and does not rest solely upon unalterable natural laws.

In addressing the melodies of song we find that their alterations of pitch take place by intervals and not by the continuous transition of notes in a scale. "The musical scale is as it were the divided rod, by which we measure progression in pitch, as rhythm measures progression in time." (Helmholtz) Now if we observe the progression of the interval through musical history, we will almost always find the intervals of the octave, fifth, and the fourth in all musical scales. It has been said that the origin of all scales can be explained by the assumption that all melodies arise from thinking of a harmony to them, and that scales arose from breaking down the fundamental chords of a particular key. But scales existed long before the experience of harmony and ancient composers had no feeling for harmonic accompaniment, as non-harmonic scales are far more numerous than harmonic scales. (see table on pg. 26)

THE TONIC SOL-FAISTS

There really exists only one harmonic scale; one that contains notes with pitch numbers composed of products and multiples of the powers of 2,3,5,7,17,etc., etc., etc., but the term 'harmonic' has been extended to include all tempered imitations of scales and these are not truly harmonic. As for the many and varied systems of tuning, it can be stated that there is more disturbance in listening to very falsely tuned thirds amidst correctly tuned intervals, than to hear intervals which are all equally out of tune and are not contrasted with others in just intonation. This, and the fact that the high development of contrapuntal music could not have been achieved without the advent of tempered intonation are its only advantages. But, in just or natural intonation, we can really only say that it is natural for uncorrupted ears; ears that have not become accustomed to

tempered intonation. There is quite a complicated calculation of intervals necessary for the completion of the natural scale. The just scale also increases the manual difficulty of performance on instruments with fixed tones, such as the pianoforte, but not so for the singer or the musician who plays on unfretted instruments such as the violin.

The natural system is really only complicated to the theoretician whereas musicians may find it an instinctive process provided they allow themselves to be guided by their ear. A fine example is the Society of the Tonic Sol-faists. This is a group of people in England dedicated to singing in natural intonation. The Tonic Sol-faists represent the tones of the major scale by using the solfeggio, or the Tonic Sol Fa system of notation in which the syllables *doh*, *ray*, *me*, fah, *soh*, *lah*, *te*, with certain modifications, are used in place of notes, staff, clefs and ordinary characters of musical notation. When the tonic changes in modulation, the new tonic is called *Doh* and is pointed out in the notation. The advantage of this system is that it allows the singer to relate each tone to the tonic whereas ordinary notation gives nothing directly but absolute pitch in tempered intonation.

"I think that many of our best musical performances owe their beauty to an unconscious introduction of the natural system, and that we should oftener enjoy their charms if that system were taught pedagogically, and made the foundation of all instruction of music, in place of the tempered intonation which endeavours to prevent the human voice and bowed instruments from developing their full harmoniousness, for the sake of not interfering with the convenience of performers on the pianoforte and the organ." (Helmholtz)

INTONATION AND THE HISTORY OF MUSICAL PITCH

The intentions thus far have shewn that there are still many avenues of experimentation left to the inventive musician. As for the composers of the Renaissance and Baroque periods, it may be stated that they were the discoverers and architects of the contrapuntal songform and even through their many and varied applications of counterpoint, they still upheld melody above harmonic structure. But, it would appear that with the introduction of equal temperament and the predominance of the pianoforte in composition and instruction, there was but this brief period of exploration into the dimensional possibilities of music only to be woefully overthrown by the newly enthroned harmaniacal geniuses of modern technical and social conformity. It may be likened to the discovery of alternating current where once the electrical sciences figured out how to use the energy, they stopped investigating the natural properties of electricity itself. Only a handful of composers starting in the late nineteenth through the twentieth century have brought back an emphasis on melody in conjunction with new forms of musical composition, and this is a step toward investigation once more.

Upon returning to interval relationships, we need to examine the early theorists methods of determining the interval's virtues. It is fairly obvious that singing was the first music, later to be accompanied by drums and instrumentation, but it would seem that strings (a very late form of musical instrument) are where most experimentation has taken place. In determining intervals from string lengths one comes across many variables which are not generally considered. On any stringed instrument the string has to rise further and further from the fingerboard as the string proceeds from the nut to the bridge. The pressure created by the finger in stopping the string either on the fingerboard or the fret increases the tension of the string making the note sharper than it would be

if it could be stopped at its natural height. This could only be achieved in all practicality by the use of a slide such as used in slide guitar, but even then the results cannot be considered accurate. So, the law that the number of vibrations is inversely proportional to the length of the string can be at best an approximation. Moreover, the margin of error is wholly dependent on the compositional structure of the string – diameter, temperature, and material ingredients of the string being most important. Therefore, the old intervals are not so accurately tuned.

Musical pitch (tuning pitch) has undergone continual change throughout history. Tuning pitch or the tuning note is here classified as the 'A' of the violin from which the pitch number of all other notes in the scale must be calculated from the temperament and method of tuning in use. Now, the pitch of musical instruments has always varied greatly and "...since the ancients were not accustomed to play in concert with all kinds of instruments at the same time, wind instruments were very differently made and intoned by instrument makers, some high and some low." (Prætorii) It is well known that for higher instruments such as the mandolin, trumpet, violin, etc., the higher one tunes, "the more freshly it sounds and resounds." (Prætorii) For the deeper instruments, the lower they are tuned, "...the more majestic and magnificent is their stately march." (Prætorii) The general rise in standard tuning pitch began at the Congress of Vienna in 1814, when the Emperor of Russia bestowed upon his Austrian regimental band new and sharper instruments. This band became noted for the brilliancy of its music, and gradually tuning pitch at Vienna rose from A' 421.6 cycles per second (Mozart's pitch), to A' 456.1 cps or nearly three quarters of a tone. As far as recorded history is concerned, standard pitch has undergone changes from Delezenne's A' 373.1 cps (1640?) to Steinway's orchestral pitch of A' 460.8 cps (1880) and seems to have stabilized at around A' 440 cps today.

Most Ancient Form of Greek Scales with 7 Tones and Octave.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
25. Lydian	0	182	386	498	702	884	1088	1200
26. Phrygian	0	182	316	498	702	884	1018	1200
27. Doric	0	90	294	498	702	792	996	1200
28. Hypolydian	0	204	386	590	702	884	1088	1200
29. Hypophrygian (Ionic)	0	204	386	498	702	884	1018	1200
30. Hypodoric (Eolic)	0	204	294	498	702	792	996	1200
31. Mixolydian	0	112	294	498	610	814	996	1200

Later Greek Scales with Pythagorean Intonation.

32. Lydian	0	204	408	498	702	906	1110	1200
33. Hypophrygian (Ionic)	0	204	408	498	702	906	996	1200
34. Phrygian	0	204	294	498	702	906	996	1200
35. Eolic	0	204	294	498	702	792	996	1200
36. Doric (same as No. 27)	0	90	294	498	702	792	996	1200
37. Mixolydian	0	90	294	498	588	792	996	1200
38. Syntonolydian	0	204	408	612	702	906	1110	1200

Al Farabi's Greek Scales as reported by Prof. Land.

39. Genus conjunctum medium	0	204	408	590	702	906	1088	1200
40. Genus duplicatum medium, or ditonum (same as No. 38)	0	204	408	612	702	906	1110	1200
41. Genus conjunctum primum	0	204	435	639	702	933	1137	1200
42. Genus forte duplicatum primum	0	204	435	666	702	933	1164	1200
43. Genus conjunctum tertium, or forte aequatum	0	204	386	551	702	884	1049	1200
44. Genus forte disjunctum primum	0	204	435	617	702	933	1115	1200
45. Genus non continuum acre	0	204	471	622	702	969	1120	1200
46. Genus non continuum mediocre	0	204	520	639	702	1018	1137	1200
47. Genus non continuum laxum	0	204	590	664	702	1088	1162	1200
48. Genus chromaticum forte	0	204	471	690	702	969	1088	1200
49. Genus chromat·um mollissimum	0	204	520	613	702	1018	1111	1200
50. Genus mollissi.. m ordinantium	0	204	590	647	702	1088	1145	1200

Arabic and Persian Scales as reported by Prof. Land.

51. Zalzal, see No. 66	0	204	355	498	702	853	996	1200

Highland Bagpipe made by Macdonald of Edinburgh.

52. Observed	0	197	341	495	703	853	1009	1200

Modern Arabic Scale as reported by Eli Smith.

53. Meshāqah, theoretical	0	200	350	500	700	850	1000	1200

CHARACTER OF MUSICAL KEYS

It is now apparent that there are many modifications of interval relationships, intonations and standards of pitch pertaining to the art musical. These anomalies do have a remarkable influence on whether or not each particular key in music possesses its own individual character. One must understand, however, that

only specific instruments will allow for the distinction between keys. If we were to choose an instrument of fixed tones with uniform tuning, and magnitude (such as the digital synthesizer and other digital electronic instruments – usually of the keyboard type) one could not distinguish between the absolute character of keys. On the other hand, there is a decidedly contrasting character in the disparate keys on stringed instruments which the following experiment may reveal. If we take two different instruments, tuning one in such a fashion that its D flat is the same as the C major of the other, we will notice that on both instruments the C major retains its brighter and bolder character while the D flat remains soft and veiled. This is of course due greatly to the differences in the quality of tone of strings which being stopped at different places on the fingerboard will no doubt alter the intonation in comparison to the open string's perfect intervals of tuning. Differences of character on wind instruments can be even more striking, as one rises and falls through the octaves.

In review of the above material, we can see that all intervals suggested are mere interpretations of approximations due to intonational differences, pitch differences, etc., and no two can really be alike. When we speak of the interval of the fourth, fifth and so on, we are really speaking of the ideas that these applied titles represent. Our perception of intervals rests solely upon how we divide the octave, be it into twelve equal parts or one hundred unequal parts as the octave is our only musical boundary. The definition of intervals can only be limited according to esthetic and artistic creation. However, whether fortunate or unfortunate, our musical history demonstrates a natural leaning toward a diatonic and twelve-tone chromatic system which we as its creators can not ignore. This system, with its wide-spread and long-term usage, has (through varition and usage of these common intervals) become a sort of radionic 'rate chart'. This has been utilised in severalof the author's compositions with the following definitions to effect certain experiences and moods.

THE SPIRITUAL SIGNIFICANCE OF INTERVALS

The real experience of the interval is most appreciated by our thoughts, feelings and by our spiritual being. Music can reflect such sundry and diverse characters of motion as "Graceful rapidity, quiet advance, grave procession, and wild leaping, ...and as music expresses these motions, it gives an expression also to those mental conditions which naturally evoke similar motions, whether of the body and the voice, or of the thinking and feeling principle itself." (Helmholtz) As thoughts and feelings dance about, so do the melodic motions of tones, by imitation and expression. We may deal with the multifold complexion of motion in music at a later time but, for now, let us deal with our awareness of consonant intervals.

FROM THE OCTAVE TO THE SECOND

The true feeling for the octave has really not yet been developed in humankind. As one may perceive the differences that exist between intervals up to the seventh in relation to the tonic, one cannot actually discriminate between the octave and the tonic on a spiritual level. We simply do not use the octave in the same manner as the other intervals. Although, we can certainly distinguish the difference between the tonic and its octave by difference of frequency, we have not yet acquired its feeling, and this will be developed in time. "...in the future the feeling for the octave will be something completely different, and will one day be able to deepen the musical experience tremendously, ...and will become a new form of proving the existence of God." (Steiner)

Returning to an earlier period in human evolution, all musical experience (according to Steiner) saw its first development in the Atlantean age (corresponding roughly with the Paleolithic Era) with the experience of the seventh. If we could go back to this age, we would find that the music, having little resemblance to today's music, was arranged according to continuing sevenths and all other intervals were absent. This experience, which has become an unpleasant effect as of the post-Atlantean era, was based on the interval of the seventh through the full spectrum of octaves and gave one the feeling of transportation from our earthbound existence (even earlier, in the Lemurian period, or geologically referred to as the Tertiary Era, the experience was larger than the octave -- in ninths – but this experience was confined to the inaudible; and is analogous to hearing our thoughts as we read silently). This feeling of the seventh eventually became somewhat offensive and was replaced by the feeling of the sixth, followed by the fifth as the human being wished to incarnate more deeply into the physical body.

Music that progresses in fifths is actually still connected to the transported feeling of the seventh by experiencing motion outside of physical organisation. This becomes more evident when we take the scales through the range of seven octaves and realise that it is possible for the fifth to manifest itself twelve times within these seven scales. This, of course, has always been considered a Pythagorean invention for it has been stated (historically) that he constructed the whole diatonic scale from this series of fifths thusly;

$$F \pm C \pm G \pm D \pm A \pm E \pm B,$$

and calculated all intervals from the above scale. The fact is, the Greek scale was actually derived from the tetrachord, or divisions of the fourth. If we proceed upwards from C by fourths, we obtain:

C F Bb Eb Ab Db Gb Cb Fb Bbb Ebb Abb Dbb,

and if we continue downwards we get:

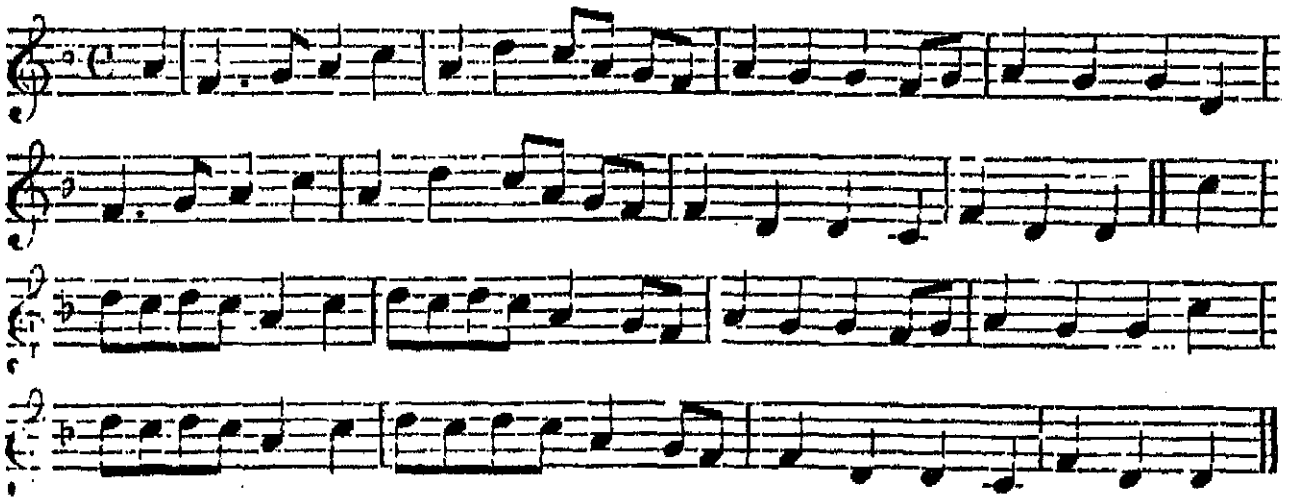
C G D A E.

The notes after Gb in the first series, are actually:

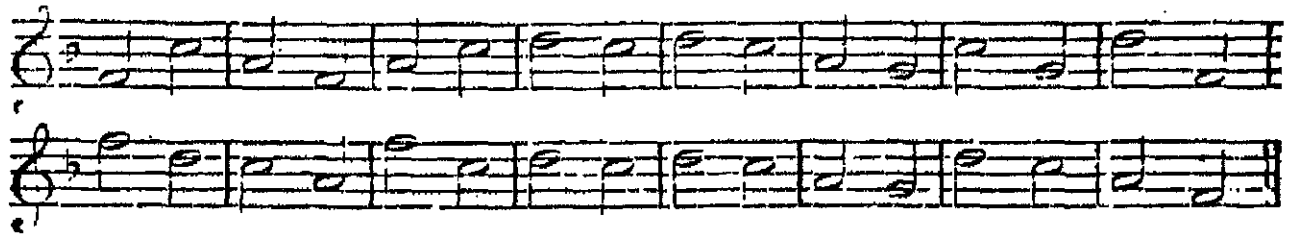
B E A D G C,

and are the same as those related to by Abdul Kadir, a celebrated Persian theorist of the fourteenth century. This system can be seen throughout the whole Arabic and Persian musical system which seems to have developed before the Arabian conquest, and "...shews an essential advance on the Pythagorean system of fifths."(Helmholtz) (Note: the Arabic lute is tuned in fourths.) All of this is really only important for its historical significance in reference to our interval experience.

In the earlier music of the fifths, the human being felt lifted out of the physical. We still find remnants of this in the pentatonic scales of the Chinese and the Gaels. Many of the ancient Chinese, as well as Scotch and Irish tunes have neither a fourth nor a seventh in them. As far as the these Celtic



Without the second or sixth: The Scotch air, Cockle Shells.



Without the fourth or seventh: A Chinese temple hymn.

melodies are concerned it may be of some interest that early bagpipes (upon which, much of this music was composed) were constructed without these two intervals. In most of their melodies, the omissions in both major (the 4th and the 7th) and minor (the 2nd and 6th) scales are so premeditated as to avoid the intervals of a semitone, and are replaced by intervals of a tone and a half . This, of course, gives the music a certain quality which may indeed give one the feeling of being transported to the 'Land of Færie'.

With our experience of the fourth, we may reach out to the forgotten self in the spiritual sensations of the fifth, and also return inwardly to our inner being in the experience of the third. Our common 1-4-5 progression exhibits this border phenomenon of the fourth, and is an integral part of many folk musics. In the experience of the fourth, we may move about between the spiritual and physical worlds. The sixth also expresses this border sensation only on a higher level – uniting the fifth and seventh.

Now we may come to the most significant experience in the interval of the third. Something new appears with the arrival of the experience of the third. Now we can encounter the feelings aroused by major and minor keys. With the third we can color the musical entity with mood, and this displays for us the inner life of feeling. This is the predominant experience of the present age, or the age of introversion. As the more inward element tends toward the minor side, the more outward element

tends toward the major side. If we consider the seventh's role in our present age, we see that minor and major sevenths tend to rule composition in what is considered popular music.

The perception of the interval of the second establishes the intensification of our inner life, and this is only a recent experience in Western music (it is found in some Eastern folk musics, as it has a particularly interesting usage in Balkan music). It is usually only encountered under the guise of the ninth chord which brings us to an interesting conjecture. In ancient traditions our sevenfold nature is referred to quite often. Spiritual experience of that age had developed in part from the observation that the number of planets in the solar system corresponded to the seven scales and that the twelve signs of the zodiac equalled the twelve fifths of the seven scales. But, a disturbing revelation came with the changeover from the ancient geocentric system of seven planets to the modern heliocentric system of nine, rendering the system of correspondences imperfect. One may see the blooming of our technological and materialistic age from a galloping (or should we say hobbling?) science of discovery taking shape in some of the more recent musical trends as well. Discovery without regard to spiritual interpretation may not always be such a good thing.

We can view the whole of the experience of the intervals from Rudolf Steiner's graphic depiction as seen below. Since 3 and 4 overlap, as well as 6 and 7, Steiner has cleverly arrived at the human being's sevenfold nature through a ninefold organisation.

Athanasius Kircher (1602-1680), a German Jesuit, published his ninefold relationship tables (which is an incredible table of correspondences) in a work entitled *Musurgia universalis* (The Universal Work-of-the-Muses) in 1650. Academicians, having missed the significance of the work,

9 (spirit man)
8 (life spirit)
7 (spirit self)

6 (consciousness soul)
5 (intellectual soul)
4 (sentient soul)

3 (astral or sentient body)
2 (etheric body)
1 (physical body)

called it "a preposterous piece of outmoded pedantry, often building on false assumptions and rising to equally false conclusions". In Kircher's ninefold organization the categories are divided among minerals (metals), trees, plants, stones, etc. For instance, under the third category, *mundus mineralis*, the earth corresponds to "salts, stars, and minerals". At the far left of the chart is a musical scale revealing each note which corresponds to each category. The whole of the diagram is quite noteworthy as it is a representation of our dimensional universe from a symphonic point of view. This is similar with respect to other works of the period such as Fludd's *Ultriusque cosmi...historia*, and Kepler's *Harmonice mundi*, but with Kircher, there are some radical and very important differences. In *Musurgia universalis*, Kircher defines uses for his correspondences as they are

applicable to musical development. With this, one may realize the transmutative powers of the notes in connection to their correspondences. This most important alchemical significance of musical works will be dealt with in the next chapter.

Harmonia Mundi Sympathica, ro Enneachordis totius naturæ Symphoniam exhibens.

Enneachordon I	Enneach. II	Enneach. III	Enneach. IV	Enneach. V	Enneach. VI	Enneach. VII	Enneach. VIII	Enneach. IX	Enneach. X
Mundus Archetyp. DEVS	*Mundus Sidereus* Cœl.Emp.	*Mundus Mineralis*	*Lapides*	*Planta*	*Arbores*	*Aquatilia*	*Volucria*	*Quadrupedia*	*Colores varij*
Seraphim	Firmamentum	Salia, ſtellę Minerales.	Aſtrites	Herbæ & Flor. ſtell.	Frutices Bacciferę	Piſces ſtellares	Gallina Pharaonis	Pardus	Diuerſi Colores
Cherubim	♄ Nete	Plumbum	Topazius	Helleborus	Cypreſſus	Tynnus	Bubo	Aſinus, Vrſus	Fuſcus
Troni	♃ Paranete	Æs	Amethiſtus	Betonica	Citrus	Acipenſer	Aquila	Elephas	Roſeus
Dominationes	♂ Parameſ.	Ferrum	Adamas	Abſynthiũ	Quercus	Pſyphias	Falco Accipiter	Lupus	Flammeus
Virtutes	☼ Meſe	Aurum	Pyropus	Heliotropium	Lotus, Laurus	Delphinus	Gallus	Leo	Aureus
Poteſtates	♀ Lichanos	Stannum	Beryllus	Satyrium	Myrtus	Truta	Cygnus Columba	Ceruus	Viridis
Principatus	☿ Parhypa.	Argentum Viuum	Achates Iaſpis	Pæonia	Maluſpunica	Caſtor	Pſittacus	Canis	Cæruleus
Archangeli	☽ Hypate	Argentum	Selenites Cryſtallus	Lunaria	Colutea	Oſtrea	Anates Anſeres	Ælurus	Candidus
Angeli	Ter. cũ Ele. Proslamb.	Sulphur	Magnes	Gramina	Frutices	Anguilla	Struthio camelus	Inſecta	Niger

Table from *Musurgia universalis* by Athanasius Kircher

Alchemy, Counterpoint, and Projective Geometry

The Weaving of the Stone

IN order to fully comprehend this most important correspondence between alchemy and the contrapuntal songform of the Renaissance and Baroque periods and projective geometry, one must be familiar with not only the alchemical process but also understand that the highly developed form of musical counterpoint arose out of the alchemical philosophy of that era. It will be concluded somewhat later that this alchemical philosophy did indeed include a thorough knowledge of the principles employed in projective geometry and that these principles helped in the moulding of a complete cosmological ideology.

Renaissance creativity was driven by the concept that the arts and sciences were inseparable and that spiritual and even non-spiritual truths were discovered only when these two forms of expression mirrored the doings of their supreme guide. Nature, in Her role as supreme guide or spiritual advisor, directed all operations of astronomy, astrology, geometry, architecture, sculpture, music, medicine, etc., hence all of these works were integrated into a cosmic one. As we shall see in the foregoing conclusions, these ideas are once again coming to fruition.

AN ALCHEMICAL REVIEW

"Transformation and perfection of the soul" or simply "Transmutation" are two very similar ideas which may best define what alchemy is in its broadest sense. Here, we are not concerned with the physical transformation of base metals into gold, (although allegorically correct, and quite possible within this context) but with the spiritual chemistry implicit in the Emerald Tablet's reconciliation of opposites, or more appropriately, the divine union of microcosm and macrocosm.

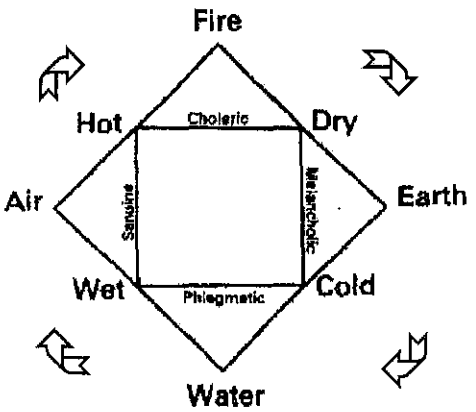


Figure I

The four elements: Earth, Air, Fire, and Water are at once essential to the alchemical process emerging as they do from the Prima Materia or primordial matter, only to return from whence they came. These elements are in a constant state of transformation as can

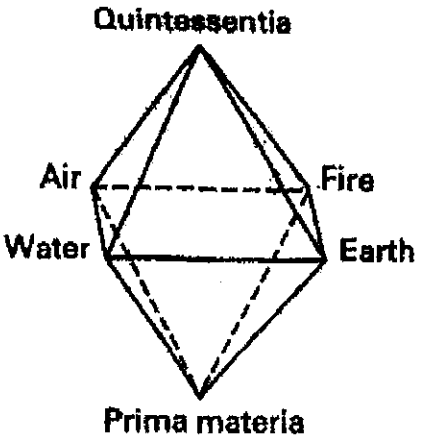


Figure 2

be seen in figure 1.

Continuing on – from the sum of the four elements is created a fifth element known as the quintessence or spirit, which can be viewed as a mirror image of the Prima Materia (see figure 2). Of still greater significance here, are the myriad triplicities or Tria Prima of the alchemical process, of which salt, sulfur, and mercury form the basis.

Of the most profound consequence is the triplicity involving the three stages of alchemical transformation. The first is that of the *nigredo*, or blackening stage which is an expression of putrefaction or darkness; a breaking down so to speak of a particular essence. The second is that of the *albedo*, or whitening stage denoting revivification and enlightenment, and the third and last stage is that of *rubedo*, or reddening which is likened to the perfection of pure gold.

Although this is merely a scant condensation of what may be considered a most penetrating spiritual and scientific discipline, it possesses the prerequisite information needed to understand the following ideas concerning counterpoint and projective geometry. Alchemy is an all encompassing study; one which reveals an unending string of correspondences relating everything micro and macrocosmically. Through actual application of these ideas one may discover the unfolding of an initiatory path of truth and wisdom. For further study one should consult the list of alchemical treatises in the bibliography.

CONTRAPUNTAL MUSIC

The High Renaissance and early Baroque period (roughly 1500 to 1700) in Western musical history heralded the advent and development of a style of music which would last nearly two-hundred years. Counterpoint, as this style of music became known, is a translation of the Latin *contra punctus* and literally means 'against the point' (or 'against the note' as notes were called points in those days). This music was termed polyphonic as opposed to homophonic and it can be most easily described as a melody accompanied by one or more related, but independent melodies.

The quality of a music may indeed be determined by its actual longevity; the fact that the music of this period is still alive and appreciated today is an excellent testimonial to this idea. Although most modern composers do not engage in this type of writing style, the music of the Renaissance and Baroque masters is continually revived in new recordings and on the concert platform; a veritable proof of its perennial enjoyment (The Academy of St. Martin in the Fields under the direction of Sir Neville Marriner was formed solely to perform and record the works of the Renaissance and Baroque masters and is considered one of the finest groups in the history of classical music).

Why is it then that very few continue in the tradition of this contrapuntal composition? As we shall see, this historical period's musical constructs reflected the philosophical and cosmological

disposition of its most creative composers.

ALCHEMICAL COMPOSERS

Nearly everyone is familiar with the well known composers of this era. To list a few one might include Handel, Bach, Telemann, Vivaldi, Purcell, etc., and the list goes on. But for our purposes here, a good starting point will be with the works of Monteverdi. Claudio Monteverdi (1567-1643) was not only a an innovative composer but a practising alchemist as well, (being referred to as a 'Great Master of Alchemy') and his music is a reflection of the many and diverse philosophical concepts of the time. Already at the age of 19, Monteverdi had composed his first book of madrigals (of which there were to be nine in all) and in 1590 moved from Cremona, Italy (his place of birth and the city of great violin makers) to Mantua.

At this time, the earliest developments of musical style were directly inspired by group studies. One of the most influential organizations of this time was the Florentine Academy. This altogether stuffy fraternal group was involved with the hermetic studies of the Cabala, astrology, and other such metaphysical teachings interwoven with artistic and scientific invention. But the sincerity of their dedication is questionable as they seemed 'hell bent' on presenting the idea that there were no conflicts with these teachings and Christianity. Although the Florentine Academy had its inspiring effect on the musical posterity of the time, it was Monteverdi's involvement with an academic group in the nearby town of Ferrara that helped shape his own musical direction. Known as "Ferrara's Club of the Fearless", (so called for obvious reasons) this group joined the strengths of scholars and musicians alike in studious deliberation and musical performance, and Monteverdi inscribed his fourth book of madrigals to them.

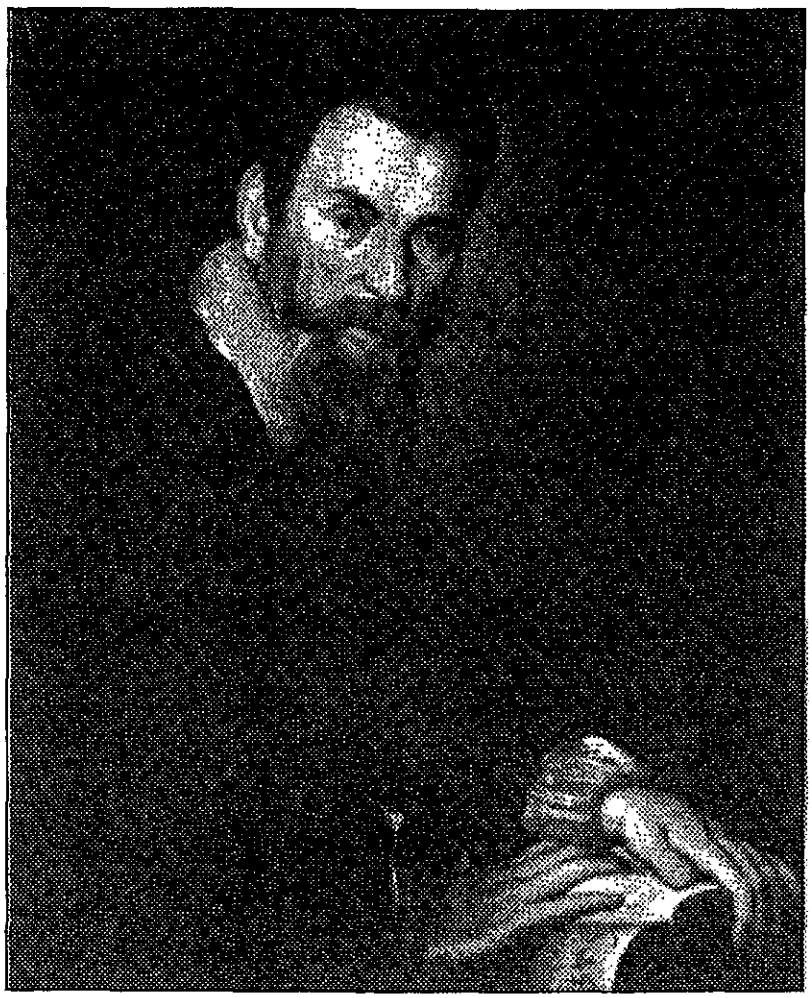
By this time certain radical features of Monteverdi's style, notably the boldness of arranged dissonances, had begun to irritate a certain Bolognese theorist, Canon Artusi. As the years went by, he publicly attacked Monteverdi, who had to defend his new techniques.

Monteverdi was probably the first and foremost composer of the late Renaissance and early Baroque period to feel caught up in the powerful flux that was pulling music away from the old contrapuntal style, to the new standards of solo melody. Monteverdi referred to the old style as prima prattica, and the new as seconda prattica, avoiding the personal attributes of "old" and "new". Monteverdi experimented more and more with seconda while continuing to use prima as well. But his seconda works were becoming more complex in technique with the development of the basso continuo; a device involving the free harmonic elaboration of a continuous bass line by a harpsichordist, lutanist, or organist. In 1614, (upon receiving a copy of the sixth book of madrigals from Monteverdi) the Abbot Angelo Grillo said, "I can assure you of the eminent worth of your harmonious gift; it seems to me to belong not so much to the earth on which I accept it, as to the heaven in which I listen to it. My monks here first studied it in the most careful manner - for the work requires thorough preparation - and then they sang a part of it to me. My heart was as much carried away by the lovely harmony as my mind was refreshed by the newness of the devices." Those new devices included the highlighting of solo voices and duets above a basso continuo line of growing significance.

One of the more notable works associated with Monteverdi's alchemical influences is the secular oratorio *Il Combattimento di Tancredi e Clorinda*, a setting of a long section from Tasso's *Geruselemme*

Liberata – the vivid description of the fight between the knight Tancred and the warrior maiden Clorinda. In it we find a true example of the alchemical wedding between the archetypal symbols of Divine Masculine and Feminine - the union of Logos and Sophia. This represents the balance of micro and macrocosmic polarities so common to the 'reconciliation of opposites' concepts of alchemical tradition and can be encountered via the intimacy of the White Queen and Red King, the Celtic story of Cuchulain and Aife, and in Maier's impressions of Hippomenes and Atalanta, to cite but a few. It is in this 'Western Tantra' that the real secrets of the highest workings of alchemy may be uncovered.

Also, with *Combattamento*, the beginnings of the three-fold nature of much of the period's music began to develop. Monteverdi maintained that earlier music expressed only two types of emotion: the prayerful and the temperate. Nowhere to be found was the expression of anger or agitation. Thus, he went on to include the warlike sounds of rage and strife in the rest of his works, metamorphosing his style into the compositional triplicity of concitato, molle, and temperato (agitated, soft, and temperate). Quite obviously this style is in direct sympathy with the three stages of the alchemical process; the nigredo, albedo, and rubedo. One may also note that three-fold style of composition known as the prelude, fugue, and allegro, as popularized by Bach and many contemporaries, is a somewhat jumbled version of the same idea. Of course, the Christian doctrine of the Trinity (which is certainly not bereft of its own connections to the alchemical triplicities) probably figured more prominently in later works, hence the lack of the seemingly less important order.



Claudio Monteverdi 1567-1643

Nature has many ways of disclosing musical direction to composers and it is here that we turn to the most highly developed form of alchemical expression in this era's music. It was Count Michael Maier (1568-1622) who said, "Let Nature be your guide, and with your art follow Her closely. Without Her you'll err." This revealing wisdom comes from his monumental work entitled *Atalanta Fugiens* which is an edition of 50 fugues, emblems, and epigrams first introduced in 1617. In it, Maier sets to music the

Count Michael Maier 1568-1622

classical myth of Atalanta and Hippomenes; the huntress Atalanta representing the fleet-footed Mercury; Hippomenes, the fiery male force of Sulfur, and the Golden Apples (with which Hippomenes used to bait Atalanta) depicting the balancing force of salt. Thus, the three alchemical raw materials were each personified and then interpreted by a musical voice. These pieces of music are actually an early form of fugue, having canons in two parts over a cantus firmus. The cantus firmus is a plainsong theme, which represents the Golden Apple, and is used throughout the work, while the other two voices, representing Atalanta and Hippomenes, are woven above, below and around theme.

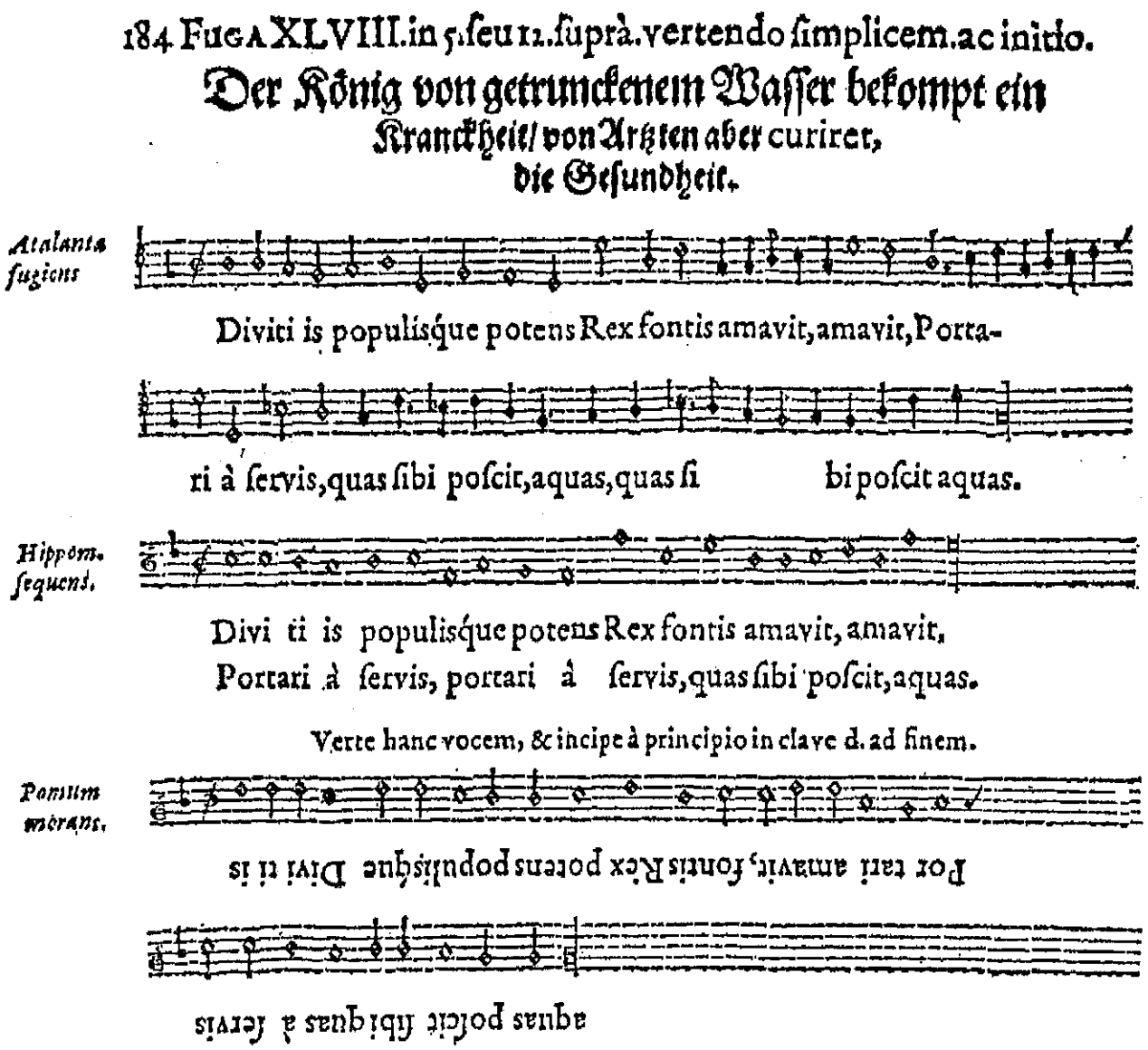
ALCHEMY AND MUSIC

Although Maier did not possess the compositional agility of Monteverdi or his contemporaries, his creations stand out as incredible alchemical masterpieces of song. It is with Maier that we see the emergence of the contrapuntal songform as an actual tool of the art whose usefulness becomes apparent in the alchemical workings of the day. As each fugue represented a particular alchemical concept, so each individual melody within the composition acted out (physically) the process and when combined with the other melodies became an intricate interplay of musical forces. That music of this kind should be wholly integrated into the workings of alchemy is not unfounded. Alchemy's mystical relationships relied heavily on the mathematics derived in part from Cabalistic sources. In the gematria of the Cabalists, words can be represented by numbers. For instance, gold, having the value of 192 (1 x 2 x 3 x 4)8 is directly related to the four-lettered Tetragrammaton (IHVH). Also included in the mystical groups of four were the four elements, the four seasons (of which Vivaldi was no stranger), the four directions, the four worlds, etc. It may also be noted that as far as numerical relationships are concerned, that within Rudolf Steiner's four ethers, the chemical ether is also known as the number or tone ether.

Music, from the most ancient times has always played an important part in the rituals of religion and magic. The earliest record of the musical associations of alchemy appears to come from Arabic

origin as far back as the 10th century. Abou-Nasr-Mohammed-Ibm-Tarkan, known as al-Farabi is said to have flourished in Asia Minor and Syria about this period and is represented as an author of works on alchemy and music. He was also an accomplished lutanist. According to A.E. Waite, "At the request of the Sultan (of Syria) he produced a piece of his own composing, sung it, and accompanied it with great force and spirit to the delight of all his hearers. The air was so sprightly that even the gravest philosopher could not resist dancing, but by another tune he as easily melted them to tears, and then by a soft unobtrusive melody he lulled whole company to sleep." Here again we see the triune structure emerging in its early stages. In Celtic myth these three forms of music are always to be found in the harper's repetoire as the smile-strain, the wail-strain, and the sleep-strain respectively.

A most prominent association betwixt alchemical laboratory operations and music comes from



Facsimile page from *Atalanta Fugiens*

Norton's Ordinall of 1477:

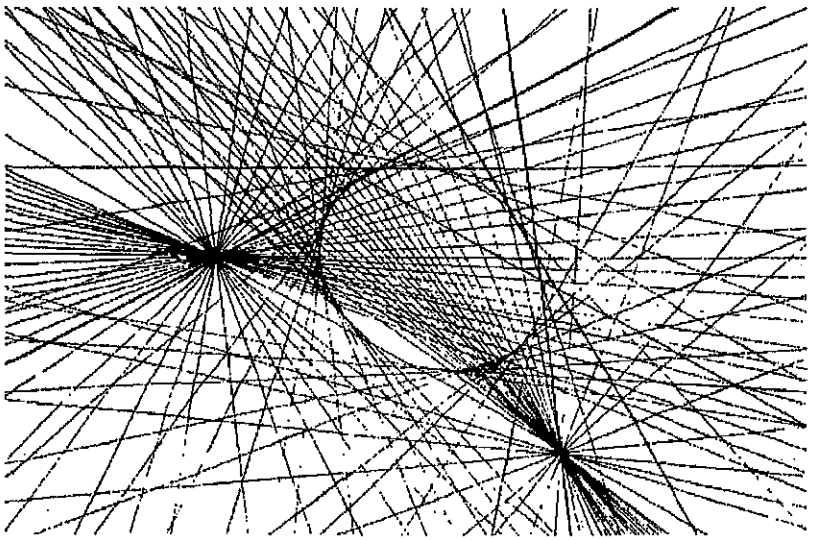
Joyne your elements Musically,
For two causes, one is for Melody:
Which there accords will make to your mind,
the trewe effect when that ye shall finde.
And also for like as Diapason,
With Diapente and with Diatesseron,
With ypate ypaton, and Lecanos muse,
With other accords which in Musick be,
With their proporcions causen harmony,
Much like proportions be in Alkimy...

This bit of prose was actually acquired from John Read's *Prelude To Chemistry.* Mr Read's interpretation was that Norton was emphasizing Pythagorean values based on string lengths, but actually Norton was, on a larger scale, revealing that there is a direct relationship between the alchemical process and the contrapuntal songform. The first thing Norton places significance on is melody and rightfully so, as melody is the true being which may leave its indelible impression on the subconscious, thus giving it its extra-dimensional quality. True to the period, melody was placed above harmony, setting it apart from the later periods' emphasis on harmonic development. In the other part of Norton's prose he speaks of the "other accords" which link the proportions of harmony to the proportions of alchemy and this is in reference to the contrapuntal interplay of melodies being like that of the contrapuntal interplay of forces in alchemy.

THE PROJECTIVE GEOMETRY OF THE ALCHEMISTS

He who attains to the great secret will come to know how the fire spirit hath its root in the spiritual fire earth, and receive from it a secret influx. Nay, more he will know while all influx of fire descends (against the nature of fire) coming downwards from heaven and while the same fire having found a body ascends again towards heaven and grows upwards.

This quote comes from the alchemist Thomas Vaughan (1626-1666). Although he stayed away from actual laboratory research (he most knowledgeably felt an aversion from what he called the 'torture of metals'), his alchemical prose reveals a profound wisdom not seen in others' works of the time. In this small quote he speaks of a descending and ascending cosmic periphery which envelops the earth – which is expressed as a result of the immediate outcome of a mystical communion with nature. It is no accident that these Renaissance alchemists speak in such paradoxical parables for they understood wholly the concepts of a projective geometry from the direct observation of nature. Other Renaissance figures such as Da Vinci and Dürer with their naturalistic art and sciences penetrated the secrets of nature and developed the science of perspective vision. It was their practical and æsthetic application of perspective vision which gave birth to projective geometry. This new geometry in art and science not only included the finite elements of Euclid's space but included infinite distance in space with vanishing lines of perspective. Now the fixed forms such as the square



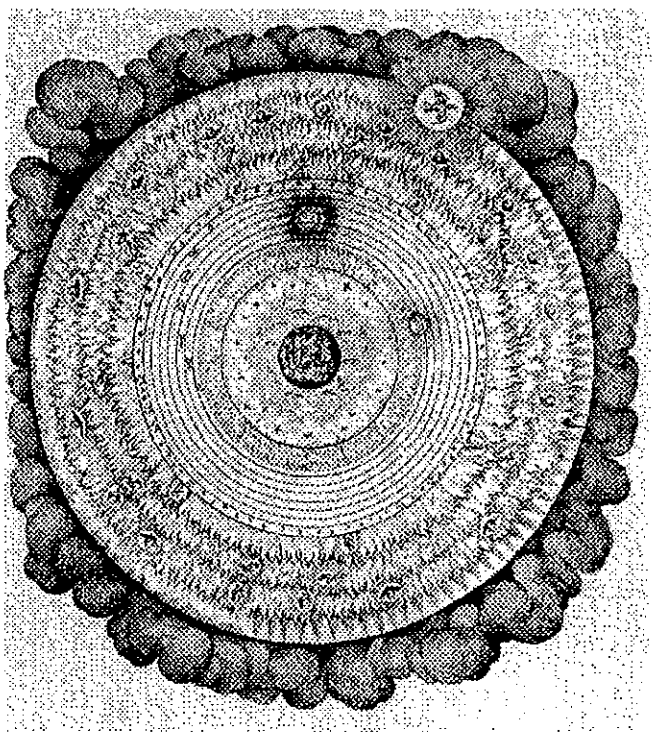
Section of the conic produced by peripheral lines and planes

or circle were cast aside in favor of mobile types of form taking on geometrical transformation in the diverse aspects of perspective. The section of the conic can be considered the resident glyph of projective geometry in that all organic forms arise from its transformative properties. One may cite Wilhelm Reich's theory of cosmic superimposition where he arrives at the same conclusion from actual observation and experimentation. Projective geometry produces a *quality* of spatial thinking which is synonymous with the metamorphoses of living form.

It is fact that Renaissance wisdom produced this ideology – and this was very much due to geocentric orientation. There is a certain rhythmic interplay between point-centered forces and the peripheral forces in much of Renaissance creation. For instance, this underlying polarity of expansion and contraction can easily be viewed in the works of Robert Fludd (1574-1637). In the many engravings accompanying his works we see the forces of nature expanding toward the heavens in concentric spheres, but at the same time contracting in a most anthropocentric fashion. The two basic entities of space, namely the point and plane, are defined projectively in these spheres. As they expand toward the periphery, they create the plane, and likewise their contraction reveals the point.

Another point worthy of mention is that Fludd also studied Paracelsian medicine. Paracelsus's medicine was the alchemical forerunner of today's homeopathy and the similarities exist not only in the treatment of like with like, but in the utilisation of rhythmic and projective forces. In homeopathy, the rhythmic process of dilution or potentisation of a substance calls forth the ætheric-peripheral healing forces which tend toward germinating point-centers of life.

It therefore becomes obvious that a perfect association between the contrapuntal songform and alchemical works must exist. As each



The Cosmos according to Fludd.
The Earth is in the center.

melody is formed from individual points (notes), a plane (melodic) is created and the interplay between these peripheral planes (melodies) will create ætheric forms in space necessary for certain operations. These musical talismans indeed can be likened to the peripheral forces at work in a homeopathic remedy and likewise to Radionic rates that 'tune in' the geometries particular to an individual ætheric form. These musical radionic rates have quite a different quality than the simple inertial forms associated with radionic machinery in that they are animated through the mobility of song. Although it may appear somewhat complex, much work is being performed and simplified in this field today.

Robert Fludd (1574-1637)

The common thread which has woven these ideas together would appear to rest in the art of a new and more profound geometry. This geometry has always been overlooked and mostly cast out by mechanistic science in favor of analytic (one might call it chaotic) mathematics. These scientists also turn up their noses at alchemy – as they find it nothing more than an oddity of idiots playing with retorts and metals in an attempt to become wealthy. Their misconceptions only contribute to their demise. We may conclude that there is something wholly vital and organic in the three disciplines discussed – Alchemy, Contrapuntal music, and of course, Projective geometry. Maybe a new Renaissance will take charge with this knowledge in hand and mold it toward the future. Fortunately, fertile ideas are not alone. That which is seemingly original has always been defined in some fashion before – but when it arises anew, it will be certain to bring with it the fresh insights of rebirth.

The Evocations of Erich Zann

Musical Experience in Forbidden Dimensions

HOWARD Phillips Lovecraft is most widely recognized as the author of such preternatural works like *The Call of Cuthulu* and *The Colour Out of Space* but a most fascinating work which I have never seen even a brief mention of is *The Music of Erich Zann.*

Lovecraft would speak of calling forth the Old Ones to once again open the gates through which those of the void will re-enter, to confront Yog-sothoth, and to enter the realm of abysmal chaos in uncharted counterspace.

These are the unequivocal actions of Erich Zann whose evocative powers did not come from the recitation of verbose incantations alleged to the great Book of Dead Names, *The Necronomicon*, but from the contrapuntal magic of his musical improvisations.

To briefly recount the story, we are at first introduced to the loathsome setting of the infamous Rue d'Auseil in the seemingly unintelligible and typically anonymous first-person ramblings of Lovecraftian style. We are shortly thereafter led to this character's discovery and subsequent befriending of a Mr. Erich Zann, who is described as "a composer of highly original genius". In the end we find Mr. Zann furiously thrashing about his violin, eyes bulging, cold and zombie-like, while his guest takes a peek out the window through the blown open shutters and to his horror finds not the familiar city of lights below but "an impenetrable darkness of chaos and Pandemonium [*sic*] having no semblance of anything on earth".

Of course, this brief 're-telling' certainly does not do the story justice. What we are really interested in is the exact nature of the so-called 'weird harmonies' with which Erich Zann was able to transcend this earth-bound dimension. We needn't be reminded that this is indeed a work of fiction. All too often we have noted Lovecraft's ingenuity at crafting a tale around the diverse occultisms with which he was versed. That we hope to learn something new in this unclaimed region of music is our dominant objective. And, need it be said, ...this definitely isn't the music of the spheres!

Upon examination of the descriptions of Mr. Zann's music we can begin to realize it for its evocative powers:

"strains of his own devising...they were a kind of fugue with recurrent passages of the most captivating quality," and..., "at certain intervals they assumed a symphonic quality which I could

hardly conceive as produced by one player."

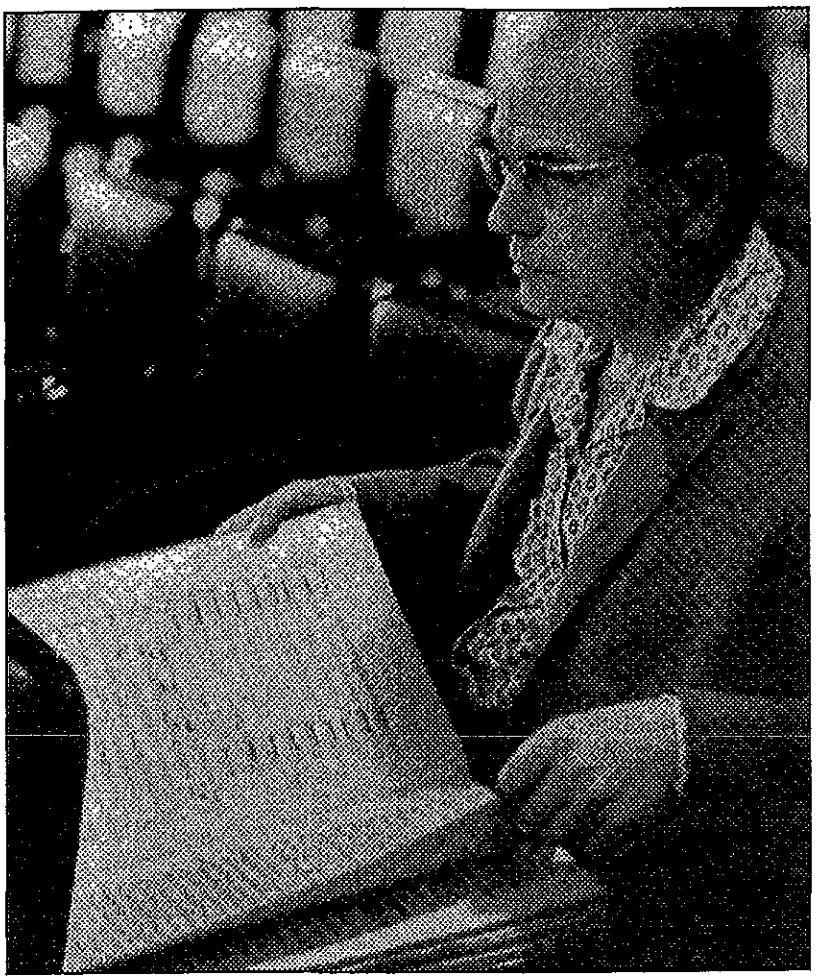
The very first thing of note is that these "strains which were a kind of fugue" implies the most highly developed form of counterpoint. Interesting that Lovecraft should harken back to the days of the contrapuntal stylings of the Baroque era when he should at once be more familiar with the more modernistic compositional prowess of his day, but we shall soon come to understand his most profound choice.

The contrapuntal style, in its essence, is the dimensional crossroad of musical form. In certain mystical traditions, the crossroads beholds an undeniable puissance whose intersection is the gateway to otherworldly dimensions betwixt the planes. This crossroad "conjuring" is most pronounced in the Voudoun systems of ritual and is helpfully summoned by the polyrhythmic drumming of their Petro Rites. Likewise, the polyphony of planar melodies in the contrapuntal songform with its interwoven conjunctions and inversions creates the same gateways but with seemingly greater flexibility and control within the confines of melody and harmony. As in projective geometry, the many points, or notes and phrases (lines) in a melody make up the plane, hence two or more melodies (planes) conjoined in song will indeed form counterspatial points, or more clearly, entrances into the spaces of the spiritual.

The rhythmic interplay between peripheral and centric planar forces in counterspatial or projective geometries most aptly defines these gateways becoming multidimensionless yantras for the subconscious playground. When applied to this music, certain spatial dimensions become quite obvious as the melodies dance in and around one another, but it is the things that we do not so consciously hear that are of great import such as inverted and retrograde themes. But, to know of these things is to assay their usage. One may see hints of the learned Gilman in Lovecraft's *The Dreams in the Witch House* who crosses the dimensional boundaries through the non-Euclidean architectural designs of the house itself. Here, it is also necessary to mention Austin Spare's coordination of space and time by the use of two perspectives simultaneously in many of his

drawings.

To speculate further into these mysteries, we might assume that Lovecraft was actually hinting at a more obscure euphonic vernacular as yet to be developed. One may cite as an example the musical language of the twentieth century composer Olivier Messiaen. For it is in the works of Messiaen that we find the departure of resolved dissonance; that consonance or harmony becomes decorative and therefore a dissonance cannot exist as we perceive it. With Messiaen, the Euclidean angularities of form normally created by the unification of rhythm, melody, and harmony have become abstracted. More clearly, the total independence of these three musical elements (rhythm, melody, and harmony) allows for a virtual timelessness to occur within the music. Where rhythm functions as the extension of durations in time rather than strict divisions, harmony working in conjunction with melody defines the elements of space, and the dissociation of these elements allows for the suspension of time in that the harmonic content is allowed to ascend vertically rather than plod along horizontally. Alas, we have been led back to the crossroad of space and time ultimately by their apparent dissection whereby only through the use of projective geometries are we able to fully comprehend this counter-dimensional phenomenon.



Olivier Messiaen (1909-1992)

Our diversion from the familiar Cartesian definitions of space to an all encompassing geometry of movement and position where no metric axioms exist is certainly not unfounded and concomitant with our musical inquests can be the only method of spatial interpretation. From Poncelet, J. Steiner, to C. P. Steinmetz of Lovecraft's day, all preferred the synthetic method of geometric interpretation over the analytic, as with the synthetic, we are able to see what we are doing and obtain a physical conception of it. This means that there is certainly no place here for the newly so-called sciences of chaos (and new-agey chaos magic) within the realm of this dimensional discovery, for in these followers' worship of the ultra-dogmatic foundations of orthodox physics, they bombastically adhere to the use of purely Euclidean techniques.

Upon returning to the original intention of explicating Erich Zann's musical inspiration, one of

the most important aspects of his compositional agility is the fact that his themes initially originated from the spontaneity of improvisation. It is with some regret that this invocative phenomenon of extemporization would seem to be mostly confined to the musician's internal experience, but it is when the musician is able to fully translate this into an evocative format that the listener is also deeply affected. How this is accomplished may always remain a mystery to the uninitiated non-musician, but as we read of Mr. Zann's somewhat twisted and grotesque appearance while playing the violin, we may recognise a continuity among all musicians who have achieved this state. We may at once allude to the agonising convulsions of Jimmy Smith at the Hammond organ, or the facial contortions of Mahavishnu John McLaughlin as his fingers fly over the fingerboard of his guitar—both possessing a most extraordinary improvisational dexterity.

At last we come to the end of the tale with Mr. Zann reverting to a common Hungarian dance in order to banish that which he has so skillfully evoked. It is the telluric or earth energies from which any and all folk music has evolved that will provide the means of grounding so necessary upon return to our familiar plane. Whether or not he was successful in warding off his monstrous creations or even returning to this earthly dimension, we will never know. But, we can be certain of one thing... *The Music of Erich Zann* is not just a work of fiction. Its interpretation beholds a truly powerful reality of artistic and scientific expression which may continue to exist in our present sphere of time and silence.

Duende

The Ætheric Thread of Music

THROUGHOUT the course of this book, much has been referred to concerning the compositional nature of music, but there is one thing, touched upon briefly in the last chapter, that almost defies description. I prefer to call it *duende*, after the Flamenco tradition. *Duende* can only be described as a sort of mystical sensation similar to shock waves the soul experiences in hearing the music. From exceptional music and dancing, this *duende* flows; it is at once, passion, fire, spirit, heart, soul, and even grace. In music, it is the true ætheric force.

Again, the compositional nature of music certainly has its place, and it is necessary to understand for development and technique, but in order for the *duende* to flow, one must be rid of the over-indulgence in musical knowledge, as it becomes an inertial blockade to the flow. In many of the harmonically limited forms of music, this *duende* has a tendency to flow more freely. It is fairly easy to see this in many of the folk musics such as blues, flamenco, all of the Celtic varieties, and many more. There are usually no more than 3 or 4 chords in any given arrangement, but the music, in the hands of the right performers, conveys incredible depth. This brings up an interesting point. It is not the artist who creates *duende*. Certain artists are able to open up the channels, and allow *duende* to flow. It is the same with radionics, as the radionic practitioner merely "tunes" in proper rates in order to allow the flow to come through.

IMPROVISATION AND DUENDE

It is not an essential factor that the music be simple in order for the flow to emerge, and one of the keys to its release may be found in the art of improvisation. Once again, blues and flamenco display this flow through their emphasis on improvisation, and much of the process may be very demanding technically. Modern jazz also places a high importance on extemporization, but instances of musicians opening up to the flow seem quite rare these days. Other more obscure musics, such as the improvisational tonal collages of Gerry Vassilatos, very powerfully open up the channels to the flow as well.

One may find that the classically trained are stunted in this art due to the emphasis on learning music from a fixed score, rather than playing by ear in an improvisatory fashion. As a general rule, this method of playing and developing 'by ear' is taught and handed down in most folk cultures, and allows the most freedom of expression with which to evoke *duende*. Within their ritual, and at the gatherings of the festivals, one may observe this process of evoking *duende* heightened, and quite

purposefully so, as it is an intrinsic part of their culture. In the folk cultures, it is an important and natural social function of gatherings for all to participate together in the activities at hand, unlike the dissociated 'parties' of modern society.

Now, the spontaneity of the improvisation between a handful of performers/musicians contains a certain magic which cannot be transcribed into written form. Many of these moments can be recorded, but reproduction by live performers is all but impossible due to the subtle and sometimes intricate nuances of the original. Fully captured only in the moment of its creation, the experience of the original musical development of improvisation holds no equal.

THE TELLURICS OF MUSIC

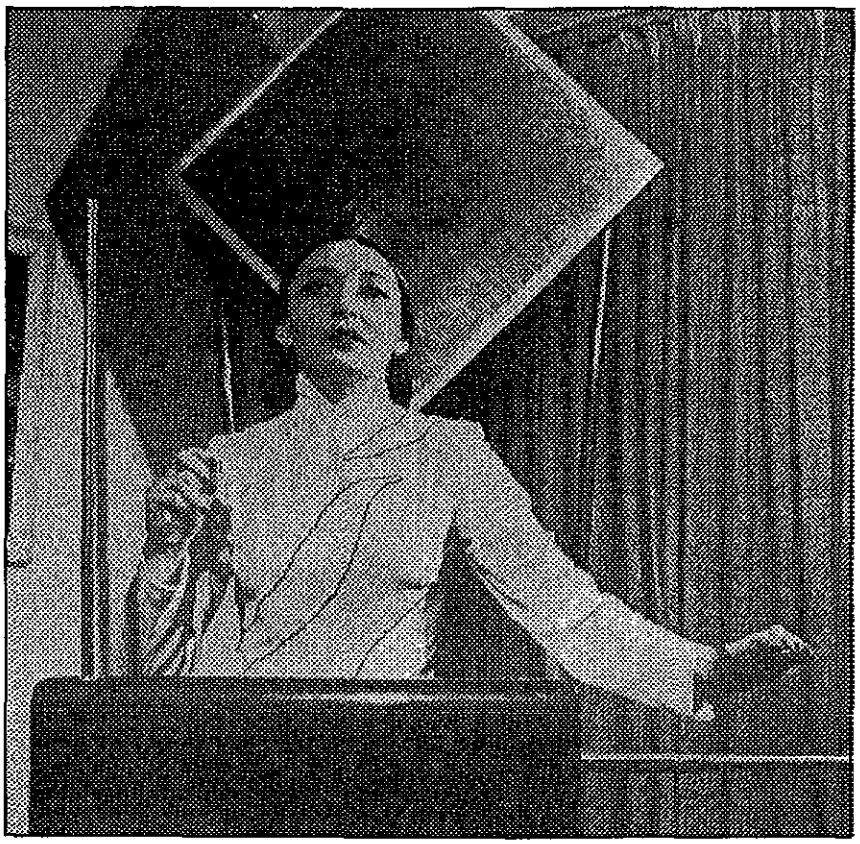
I have believed now for a long while that emotions are geographically distributed in terrain and space. When music enjoins the human heart into some mood (some "mode") all tone-exposed beings enter the mood currents and share the sentiment. This means that these emotive currents pre-existed the musician.

Gerry Vassilatos

What is it that gives folk musics their individual character? All are easily distinguishable from one another, and the qualities of each convey a completely different feeling in the listener. This is not due to the particular culture itself, but more so due to the geographic orientation of the culture. It is the land itself which shapes and molds the qualities and essences of particular styles of folk musics. It is the culture's intimate connection with the land that has allowed the creation of such individuality in the art itself. It is a transformative process as well, and we can see it take shape from the blues of the Mississippi Delta, the jigs and reels of the British Isles, to the flamenco of Andalusia – the music is formed in direct connection to the telluric currents indigenous to the location of the culture. When a musician speaks of the nature of his music, he says "it is a part of my roots" and it is very difficult if not impossible to obtain those 'roots' without actually having them in the first place. Many musicians try to duplicate various forms of folk musics, and most can only be interpretations of the corresponding notes. The feel comes from the 'roots'. Thus, it is another very important part of the flow of *duende.*

Again, free-form extemporization may, after time, allow one to 'come into' their roots. This type of experimentation will allow one to discover the nature of whence they came. Many performers on early electronic instruments made just such discoveries, and it is important to note the musician's direct connection to ground via the instrument. Instruments such as the *theremin* (see below), the *ondes Martenot*, the *Hammond organ*, and others of similar nature may pick up telluric currents and pass them on to the performer. It is quite probable, with the theremin for instance, that there is a certain longevity connected to playing it over time.

In 1918, a Russian inventor named Leon Theremin invented the first electronic musical instrument. Originally called the Ætherphone, this musical instrument was played by moving the hands in the vicinity of two antennas, (not touching the instrument) hence its original name. The instrument produces its tones by the beat frequency oscillations of two radio frequency oscillators. The antenna, attached to one of the oscillators works like a variable capacitor in conjunction with the hand's presence. Changes in capacitance, effected by the proximity of the hand, actually raise or lower the pitch of the instrument. In September of 1993, I attended a lecture and demonstration



Theremin virtuoso Clara Rockmore performing at the Theremin, c. 1945

of the theremin by Robert Moog, one of the pioneers of the synthesizer. In his lecture he provided video documentation of several of the early performers on the instrument, and made curious mention that all of these people were still living —octogenarians and older. Leon Theremin himself (who very recently passed away) lived to be the ripe age of 97! In a conversation with Mr. Moog, I found that of all the people connected with the instrument, only one other has since passed away. Nadia Reisenberg, the sister of one of the theremin's greatest virtuosos (Clara Rockmore) wasn't a theremin player at all, but the piano accompanist. Of course it may be pure speculation to assume that the reason behind the theremin performers' longevity was a direct result of their contact with the instrument. Many other factors would have to be taken into account.

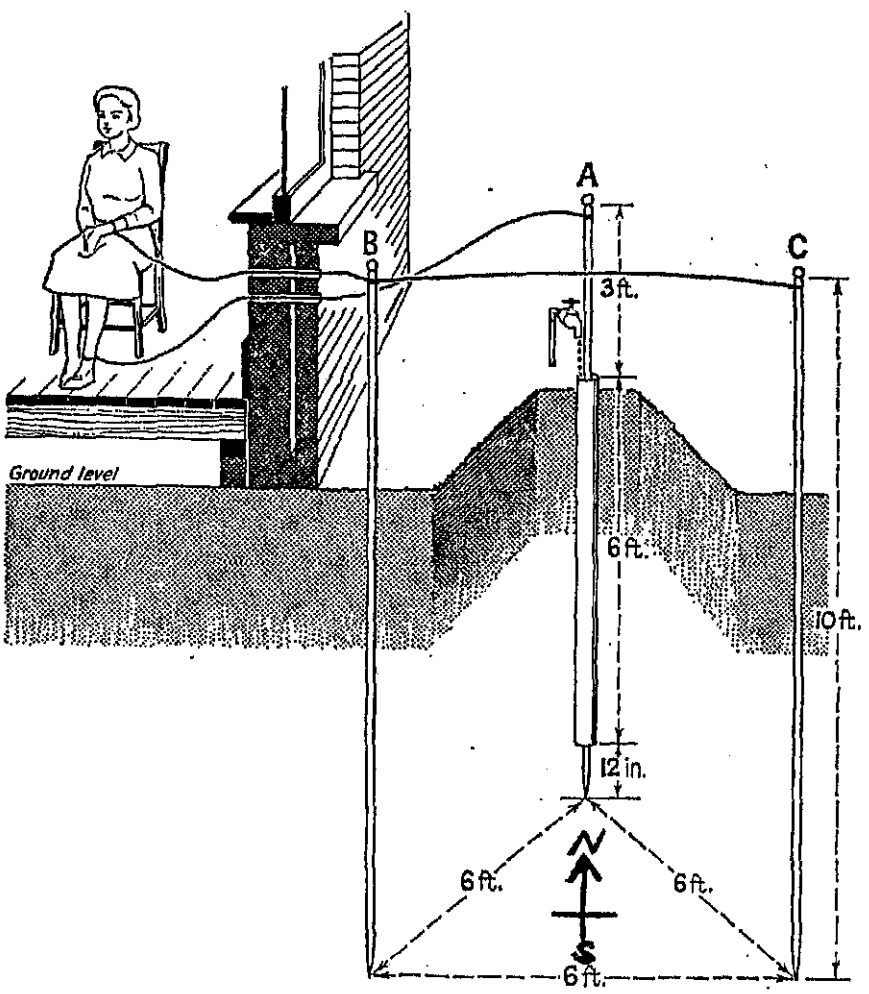
Taking a look at some of the electro-therapeutic and even nonelectro-therapeutic devices of the period, one will find a common thread from which all have been woven. With the Lakhovsky Multiple Wave Oscillator, the radionic devices of Drown and Abrams, George Starr White's Cosmo-ElectroEnergy Condenser, and many others, one will find that not only is the ground one of the essential components for the operation of such devices, but the grounding circuitry is nearly identical in all. I believe that this most important feature found in all of these apparatuses (including the early electronic musical instruments) is the key to understanding the true nature of how they work. With the basic circuitry of these machines, one can radionically *entune* the earth energy to the qualities one desires. In all cases it is the interaction of the organism with this properly entuned earth energy (VRIL) that seems to produce results - whether electrically powered or not.

ORGANS, ARCHITECTURE, ALCHEMY, AND ÆTHER

One of the more powerful instruments to induce such telluric currents, and capable of directly modifying the ætheric surroundings is the pipe organ. The first person to use the organ to effect certain changes in surroundings was Giovanni Gabrielli (1557-1612). Utilizing the Basilica of St. Mark in Venice, Gabrielli positioned two pipe organs, one on either side of the apse. He then separated

the choirs to the four corners of the church, creating an unparalleled spatial experience. It is the organ's and choir's relationship to the architectural structure that opens up and translates the telluric currents in the modification of the ætheric. The Gothic Cathedral is in itself an instrument of immense telluric energies due to the geometry and material of its construction, and its geographic orientation. The vast pilgrimages to these places for the acquisition of its healing powers is an affirmation of the Cathedral's transformative capabilities, and through its use (in connection with musical performance) becomes an alchemical vessel for the transmutation of souls.

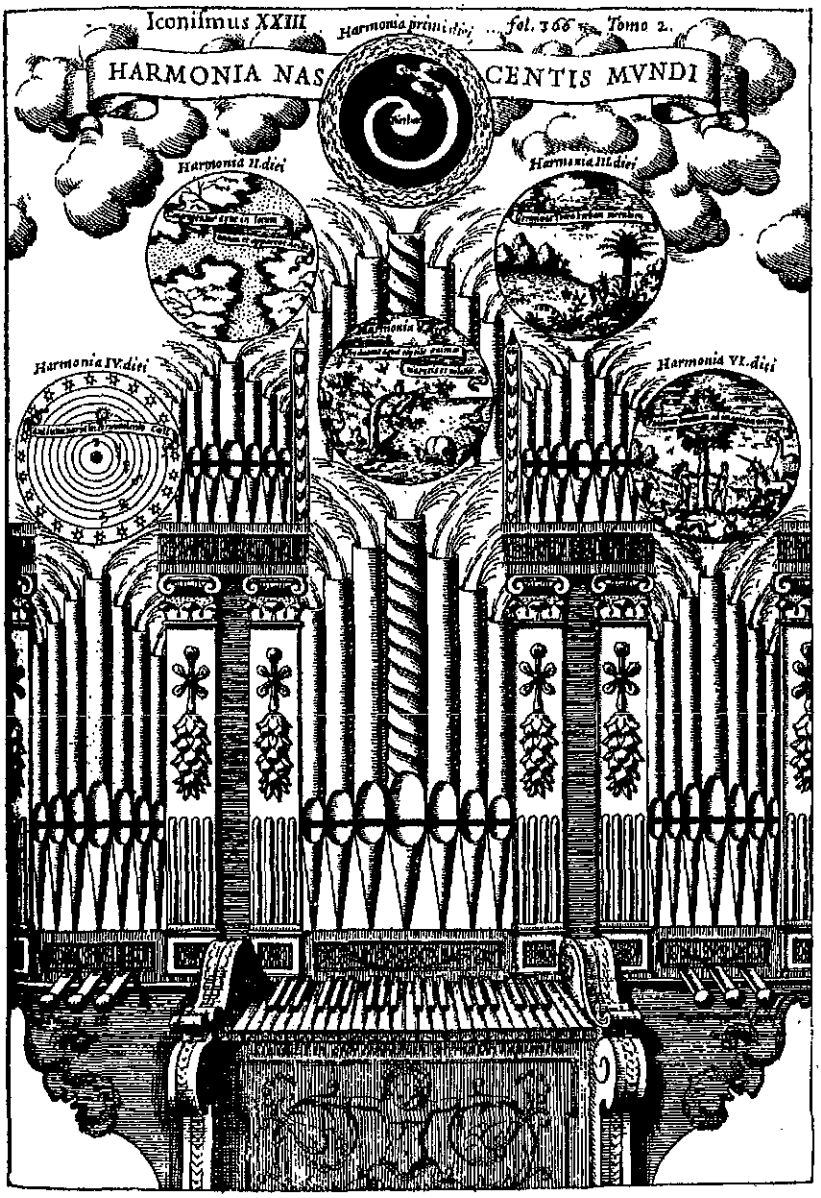
In informal studies conducted over the last few years, it has been determined that there is a direct relationship between organ concerts in Cathedrals, and dramatic changes in the weather. Grace Cathedral in San Francisco was one site chosen for these studies due to the fact that it possessed all the requirements in the proper geometry of its architecture, and that it could be easily monitored for upcoming events. Out of nearly 20 organ concerts, 17 were accompanied by anomalous weather either shortly after, or within 24 hours of performance. These anomalies were recorded as unforcast amounts of rain, wind, and general ætheric disruption. Note, that no regard to repetoire, musician, or type of organ was considered. This type of study is easily performed, and can be undertaken by anyone. More technical studies of this nature in many other locations should be done as this could have profound implications.



George Starr White's Cosmo Electro Energy Condenser

We may also learn something of this from Kircher's *Musurgia unversalis*, which contains the engraving of the organ compared to divine creation (the Great Work - *mundus organo comparatur*). Through this, and many of his tables of correspondences, one may build an alchemical model for transmutation in the most literal sense. We must behold such alchemical knowledge as not merely analogy, but in the sense of being familiar with processes of the time period, as an original facet of the physical undertaking. *Congregentur ague in locum – Luminaria in Firmamento.*

Hildegard von Bingen (1098-1179) in her work, *De operatione Dei* (Book of Divine Works),



Mundus organo comparatur (comparison of the organ to creation) from *Musurgia universalis,* 1650 by Athanasius

predates all with revelations and visions of a living cosmology. She fully understood these connections, and composed a quantity of evocative music. Her interpretation of the alchemical significance of the white and black rays (see her *Second Vision: On the Construction of the World*), is truly a foundation for all succeeding alchemical works of the Renaissance, and her writings and music should be studied by anyone interested in this work.

These alchemical connections to the local earth currents are not without foundation. One imagines the physical alchemical operation to be one of transmutation of elements by some violent thermal or electrical manipulation. This could not be further from the truth. The secret of transmutation to behold from many of the early practitioners of the art such as Mehung, Norton, Barbault, and others was not the outright "torture" of substances, but one of carefully nurturing - as one would in the cultivation of the plant. Mineral substances were not to be transformed from one to another - they were to be *grown from one in and of another.* Thus, these alchemical culturists knew the importance of the local telluric currents in the operation of the growth of certain essences. Location was of utmost import — the nature of the substance to be grown had to correspond to localized energies — and this evoked that pure *duende* stream. The arrival of this understanding had to come from an intimate knowledge first of the energies at work, and second of the nature of the materials to be used in the operation. So, it is without doubt that the chronology of study must begin with the likes of those whose studies emphasized energic qualities, and then on to those who would perform the work based on the use of such qualitative energies.

We may conclude that *duende* in these cases is completely dependent upon the differences in the qualities of the local earth currents, and that as an absolute necessity in the transformative process,

needs cultivation from the artist. Much of everything else, in its presentation here, may be an aide to the understanding of *duende*. In the next chapter, we will become more intimate with the actual geometric structurings of composition, which will allow a greater understanding yet of music's esoteric nature.

Athanasius Kircher (1602-1680)

Of Language and Song

The Eido-Dendritic Experience of Composition

WE have spoken of certain geometric relationships in musical composition and their various effects such as physical and non-physical transmutations, but the communicative structure of composition needs definition in order to understand its application. We at once must allude to the realm of eidetic imagery to comprehend the nature of any musical composition. Eidetic imagery is a part of our thoughts, our being – it holds the ultimate truth in the cosmology of our perception. The eidetic experience is a vision of the spiritual. Such visions of the spiritual are the basis and foundation for much in composition. Composers have long held the keys to translating these visions into musical creations. Likewise, the poet, through the structure of his words, presents a direct view into the persistence of eidetic worlds. In order to fully grasp how composition rises to this occasion, we must first go back to the beginnings of communication – speaking, singing , and writing.

DENDRITES – THE STRUCTURAL ARCHETYPE OF COMMUNICATION

The term *dendrite* refers to the branching figure resembling trees found on or in mineral substances, and for our purposes, it may be defined as anything possessing a branching pattern similar to trees, rivers, lightning, etc. Nearly all organic forms of natural energic systems display this characteristic. The geometric configuration of such systems can be ascertained from not only the sections of branching, but from its "phyllotaxis" as well. The phyllotaxis of any given branching system is determined by the spiral arrangement of branching parts on its axis or stem, and in all cases it displays the living geometries of the Golden Mean.

The very essence of the composition of spoken language, due to its basis in thought, possesses an eido-dendritic form. The details of the process of language from its conception to the actual written word may be summed up in the following explanation.

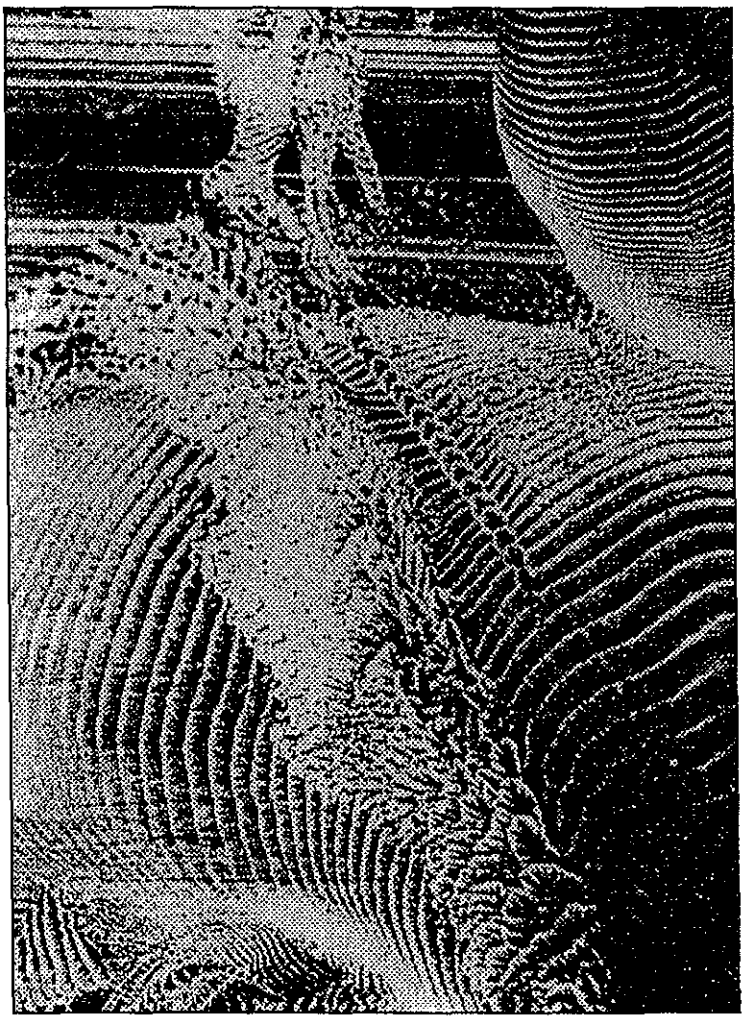
The first issuance of a language's composition will arise from the biological structure of our neurological system which has been determined to be dendritic in form. Next, the ordering process of the composition in conjunction with thought may be expressed vocally. This does not take on the familiar acoustic/two dimensional transverse wave-shape that we have become accustomed to through the interpretations of conventional physics, but it reveals all the characteristics of dendritic form, as it is a *quality of composition.* Finally, the written language is composed out of distinct and separate individual parts of the dendritic sounded form. The highly complex branching pattern of

the eido-dendritic thought/sentence configuration has now been reduced to a system of simple symbols which derive their form from the segments of the dendritic cast. The meaning of each symbol and/or groups of these symbols carries the representation of the associated eidetic image in its dendritic matrix. To detail such symbols, including all forms of ancient inscriptions, written language, magical/religious glyphs, etc., and their eidetic similarity to one another is far beyond the scope of this book, but research is currently in progress.

Now we know that spoken language carries with it a quality of living energy. It is not a static, monotonicity of randomly grouped sounds, but a living composition of carefully selected intonations with high and low points of emotion. To objectify this, we will now look to the remarkable experiments of Margaret Watts-Hughes.

THE EIDOPHONE VOICE FIGURES

In 1885, a woman by the name of Margaret Watts-Hughes developed an instrument which, in combination with the human voice, was able to create the branching figures of flowers, ferns, trees and other organic forms into physical manifestation. She called this invention the *Eidophone*. The Eidophone was constructed of a hollow tube which opened up into a larger, bell-like chamber. The top of the bell chamber was covered with a thin membrane of indiarubber. Singing into the tube produced a variety of tone signatures on the surface of the membrane. In her earlier experiments, Watts-Hughes used differing qualities of lycopodium powder to sprinkle on the surface of the membrane which, when sung into, produced simple vibrational geometric patterns. She noted that it was not only the pitch and magnitude, but the *tonal quality* of the voice which induced varying characteristics in the shape of the figures. Not long after her initial experiments, she began using liquid substances to coat the membrane, and to her astonishment, the organic forms started to appear. These forms were not composed out of simple variation



Example of a very organic looking dendritic eidoform produced by singing into the Eidophone.

in vibrational structure, but were characteristic of the qualities inherent in the compositional arrangement of the tones themselves.

One need only examine the photographs of these figures to capture the essence of their organic eido-dendritic form. Her experiments justify the claims that information of this compositional nature is transmitted in eido-dendritic form. The complete work, *Eidophone Voice Figures*, may be consulted in the second part of this book.

The medium of transmission (as in the Eidophone's liquid forms) must naturally be dendrite-receptive in order for the correct formation to arrange itself. Thus, from the philosophical viewpoint of Rudolf Steiner's four ethers, these eido-dendritic forms find their natural habitat in the chemical or tone ether. The four ethers – Warmth, Light, Chemical, and Life – are endowed with formative processes, and the chemical/tone ether possesses the requisite living, liquid substance of which all vocal and musical composition finds its medium. This chemical/tone ether is the living, breathing substance of the earth itself.

In the written works of Gerry Vassilatos, specifically the *Vril Compendium*, he defines the very essence of all forms arising not from the ætheric, but from *Vril* manifestation. Vril is the fundamental eidetic thread of the universe; the underlying and archetypal energic quality of the living. "Vril is dendritic and generates dendritic structures throughout the natural world" (Vassilatos). In Volume 4, *Vril Archeforms,* Gerry reveals that Vril permeates everything dendritically, and "organizes and variegates itself through the ground ...extending through us and continues entwining itself throughout the universe" (Vassilatos).

So, it is without question that the telluric/ætheric medium of vocal and musical composition finds as its conveyance, a dependency to dendritic form.

DENDRITIC ANGULARITY IN MUSICAL COMPOSITION

Many composers have sought to convey the essence of their visions of the spiritual in their musical ideas. In the purer visions of eidetic realities, the translation into composition almost always displays the characteristics of angularity common to dendritic forms. We must remember again, that there exists none of what are refered to as dissonances in these angular intervals. The term dissonance, used to describe so-called unpleasing combinations in harmony, is strictly an uninitiated concept.

Many twentieth century composers such as Olivier Messiaen, György Ligeti, Krzystoff Penderecki, and others have most profoundly rendered their visions into this compositional form. Examples may be found in Messiaen's *Trois petites Liturgies de la Présence divine, Quatuor pour la Fin du Temps,* and *Visions de L'Amen;* Ligeti's *Atmosphères* and *Melodien,* and Penderecki's *Dimensions of Time and Silence,* to name but a few. This ability seems to have its roots centered around the latter part of the 19th century with impressionists like Debussy, who subscribed to the radical idea (at the time) that the composer's ear and taste were more important than governing composition by the rules of harmony and counterpoint.

Dendritic angularity also finds itself in highly inspired improvisation. The music and extemporization of John McLaughlin has often been described as "angular", and there is very little linearity in his compositions or improvisations. Other inspired jazz musicians such as John Coltrane have had their improvisations very simply, but most intuitively described as "scrambled eggs". While

it is certain that this angularity is not prerequisite to "good music", it is merely an indication that much is conveyed by its presence. Even in the folk tunes of the British Isles, one finds a complexity of angularity to the music, and this confirms its association with the dendritic/telluric emanations of the land itself.

EPILOGUE

Conveying the idea that geometric structure and musical composition has transformative effects on not only our consciousness, but in our physical environment, has been the major task of this work as a whole. We must not forget that these transformations can only take place in combination with the presence of ætheric/telluric *duende* – in whatever fashion it is evoked – for this is the true key to understanding music's formative powers. Further lines of investigation must include these esoteric qualities if any progress is to be made in the acquisition of knowledge concerning the subject. A summary of the key elements outlined in this book, can be detailed as follows:

Cosmic Rhythms/Human Rhythms
Intervallic Relationships and Their Correspondences
Projective and Sacred Geometry
Counterpoint
Improvisational Composition/Duende
Ætheric/Telluric Influence/Alchemy
Eido-Dendritic Structure in Composition

With these elements one may be able to focus upon the sense of a more divine nature in the musical art. It is time that we remove ourselves from viewing music as a lifeless series of mixed vibrations, and study the true being of its life – as a formative force with which we may use in the transformation of ourselves and our surroundings.

Vox Terra

Bibliography

Aurea Catena Homeri – The Golden Chain of Homerus, Sigismund Bacstrom tr., Sapre Aude Metaphysical Republishers, 1983.

George Adams. *Physical and Ethereal Spaces*. Rudolf Steiner Press,1965.

Frater Albertus. *Alchemist's Handbook*, Samuel Weiser, 1974.

Hildegard von Bingen. *Book of Divine Works*. Edited by Matthew Fox. Bear & Co., 1987.

Titus Burckhardt. *Alchemy – Science of the Cosmos, Science of the Soul*, Element Books, 1986.

Lin Carter. *Lovecraft: A Look Behind the Cuthulu Mythos*. Starmont House, 1992.

William Chappell. *Popular Music of the Olden Time*. Volumes I and II, London: 18??

Louis Charpentier. *The Mysteries of Chartres Cathedral*. Avon Books, 1975.

H. A. Clarke. *Pronouncing Dictionary of Musical Terms*, Theodore Presser Co., 1896. Reprinted by Borderland Sciences, 1991.

H. A. Clarke. *Counterpoint – Strict and Free*. Reprinted by Borderland Sciences, 1991.

Ananda K. Coomaraswamy. *The Dance of Siva, Essays on Indian Art and Culture*. Dover, 1985.

Ananda K. Coomaraswamy. *The Transformation of Nature in Art*. Dover, 1956.

Edward Dewey and Edwin Dakin. *Cycles, The Science of Prediction*. Henry Holt and Co. 1947.

Melita Denning and Osborne Phillips. *The Dance as an Instrument of Magic*, Gnostica: No. 51 May/June 1979 pp 14-17.

Ruth B. Drown. *The Science and Philsophy of the Drown Radio Therapy*. Borderland Sciences, 1980.

Fulcanelli. *Le Mystère des Cathédrales*. Brotherhood of Life, 1990.

Cherry Gilchrist. *The Elements of Alchemy*. Element Books, 1991.

Jocelyn Godwin. *Robert Fludd – Hermetic Philosopher and Suveyor of Two Worlds*. Phanes Press, 1991.

Peter Michael Hamel. *Through Music to the Self*. Shambala, 1979.

Hermann Helmholtz. *On the Sensations of Tone*. Dover, 1954.

S. K. Heninger, Jr. *The Cosmographical Glass -- Renaissance Diagrams of the Universe*. The Huntington Library, 1977.

E. J. Holmyard. *Alchemy*. Dover, 1990.

Stuart Holroyd. *Magic, Words, and Numbers*. Aldus Books, 1975.

John Tasker Howard and James Lyons. *Modern Music*. Mentor Books, 1958.

Alan Isaacs & Elizabeth Martin. *The Illustrated Encyclopedia of Music*. Gallery Books, 1990.

Robert Sherlaw Johnson. *Messiaen*. University of California Press, 1975.

Anny von Lange. *Man, Music, and Cosmos - A Goethean Study of Music*, Rudolf Steiner Press, 1992.

Hans Erhard Lauer. *The Evolution of Music Through Changes in Tone-Systems* from *Cosmic Music* – Edited by Jocelyn Godwin. Inner Traditions, 1989.

Robert Lawlor. *Sacred Geometry.* Crossroad Publishing Co., 1982.

Horace Leaf. *The Healing Power of Music -- Sound in Relation to Health.* Reprinted by Borderland Sciences, 1993.

H. P. Lovecraft. *The Music of Erich Zann.* Arkham House, 1963.

Michael Maier. *Atalanta Fugiens,* – Translated and edited by Jocelyn Godwin. Phanes Press, 1989.

Ernst Marti. *The Four Ethers*, Schaumberg Publications, 1984.

Caitlin and John Matthews. *The Western Way – Vol. 2, The Hermetic Tradition*, Arkana, 1986.

John Matthews and Bob Stewart. *Warriors of Arthur.* Blandford Press, 1987.

Caitlin Matthews. *The Elements of The Celtic Tradition.* Element Books, 1989.

Adam McLean. *The Alchemical Mandala.* Phanes Press, 1989.

John Michell. *The New View Over Atlantis.* Harper & Row, 1983.

Thomas Morley. *A Plaine and Easie Introduction to Practicall Musicke.* 1597.

Paracelsus. *The Coelum Philosophorum.* Translated by A. E. Waite, 1894.

Michaelis Prætorii C. *Syntagmatis Musici. Tomus Secundus, de Organographia*, 1619.

Peter Randall. *Rhythm in Action.* Belwin Mills, 1981.

John Read. *Prelude to Chemistry – An Outline of Alchemy.* G. Bell & Sons, Ltd, 1936.

Wilhelm Reich. *Ether, God and Devil/Cosmic Superimposition.* Noonday Press, 1973.

Rudolf Steiner. *The Inner Nature of Music and the Experience of Tone.* Anthroposophic Press, 1983.

Denis Stevens. *The Story of Great Music from the Renaissance.* Time, Inc, 1967.

Michael Theroux. *Geometry: In Support of the Etheric.* Journal of Borderland Research: March-April, 1987.

Michael Theroux. *Back to Bach.* Journal of Borderland Research: May-June, 1988.

Michael Theroux. *3.1415927...etc.,etc.,etc.* Journal of Borderland Research: May-June, 1987.

Donald Francis Tovey. *A Companion to 'Art of Fugue'.* Oxford, 1982.

Gerry Vassilatos. *Vril Archeforms -- The Vril Compendium, Volume 4.* Borderland Sciences, 1992.

Dr. Guenther Wachsmuth. *The Etheric Formative Forces in Cosmos, Earth and Man.* Anthroposophic Press, 1932.

Dr. Guenther Wachsmuth. *Reincarnation -- As a Phenomenon of Metamorphoses.* Anthroposophic Press, 1937.

A. E. Waite. *The Hemetic and Alchemical Writings of Paracelsus*, James Elliot & Co., 1894.

Margaret Watts-Hughes. *The Eidophone Voice Figures.* Reprint – Borderland Sciences, 1989.

Olive Whicher. *Projective Geometry – Creative Polarities in Space and Time.* Rudolf Steiner Press, 1971.

Olive Whicher. *The Idea of Counterspace.* Anthroposophic Press.

Francis Yates. Giordano Bruno and the Hermetic Tradition, Univ. of Chicago Press, 1964.

Appendix A

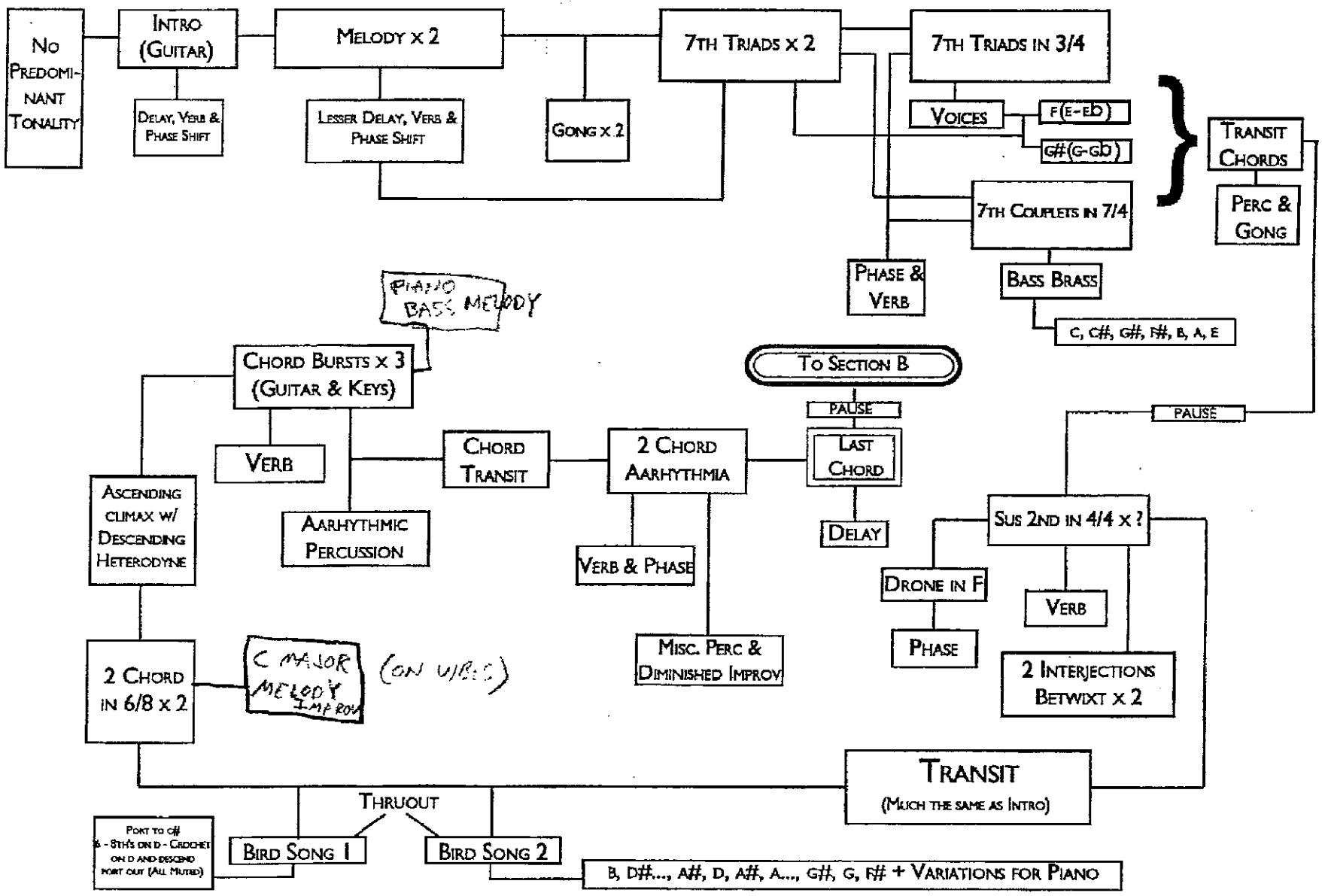
Working Block Diagram of Vertical Euphonies in Time

THE following two pages represent the working block diagram of the composition *Vertical Euphonies in Time* (from the album *Deros*). This was originally composed for more elaborate orchestration and voices, but due to lack of funds it was never recorded as such, and I felt it necessary to at least record the guitar and percussion parts for the sake of interest. This working block denotes the relative structure of the piece rhythmically with some definitions of tonal phrasing. As this was intended for the studio, there are accompanying notes on what effects were to be used, but in the recording on *Deros*, the classical guitar was used with only a feedback loop through a spring reverb.

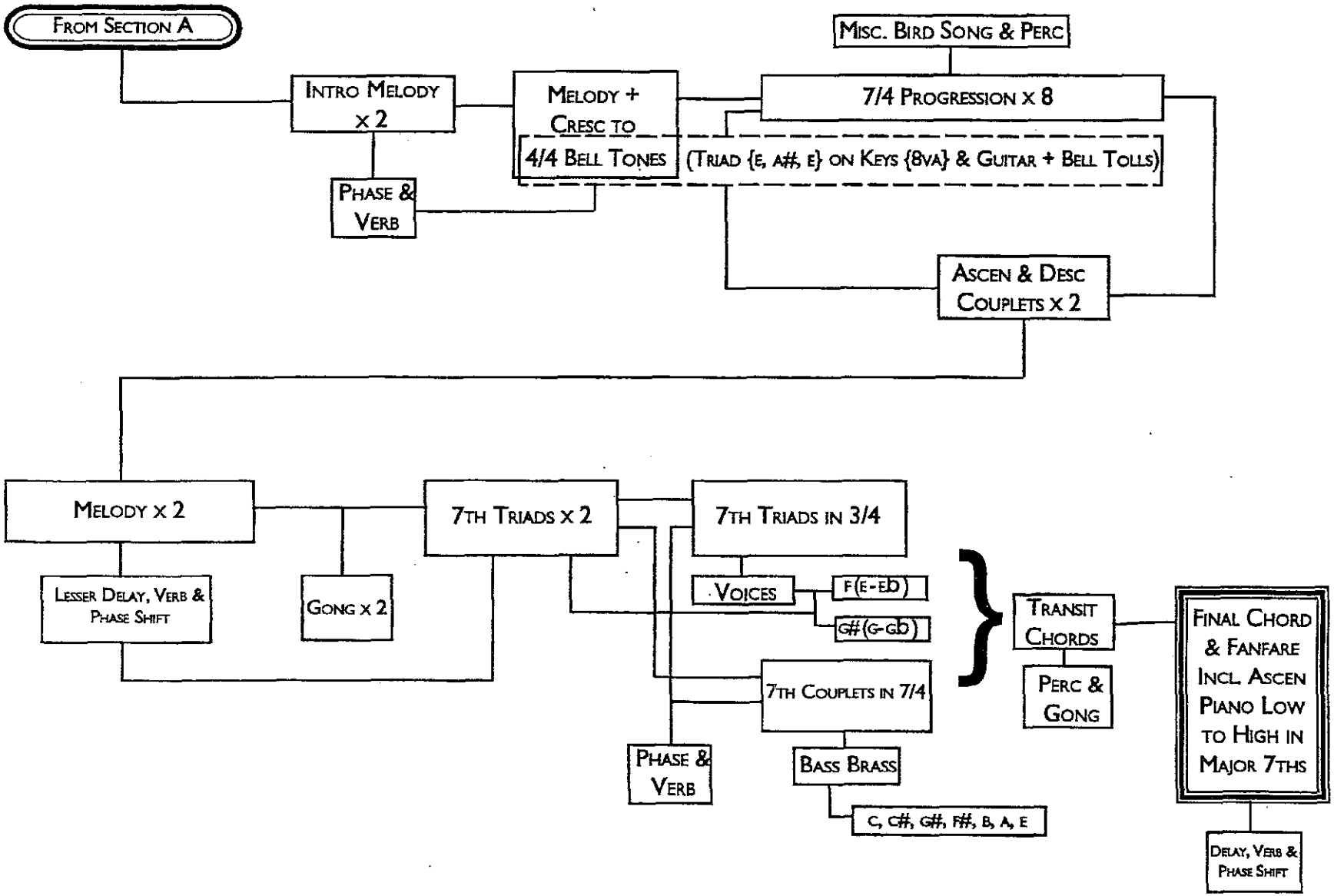
The first block denotes "no predominant tonality", which is interesting in that if one listens to the piece, it seems as though it actually possesses some key signature. After the intro, the piece builds up to seventh triads which were composed using consecutive sevenths in the fashion Steiner described as the Atlantian scale. What happens here is that the first and second intervals of the seventh are major, but the first tone in relation to the third tone of the triad is actually a #13th, or minor seventh. The continuation of consecutive sevenths will produce such a pattern throughout. The polyrhythms that begin to occur here are due to the 3/4 phrase on top of the 7/4 phrase culminating in series of rapid triplets composed of the intervals of b5 and major 5 which also produces from it the so-called dissonance of the minor second. The phrases of certain bird songs (Messiaen used birdsong extensively in his works), and improvisational passages were used in various portions throughout the piece as ornamentation.

The "B" section begins with a new device which centers around an ostinato of alternating b5/#5 intervals. This section contains a 4/4 "bell" tone over the 7/4 ostinato. The final phase of the piece returns to the original 3/4 – 7/4 theme and goes out with a final fanfare. The fanfare includes the use of ascending sevenths from low to high, but was not included on the recording, as it was out of the guitar's range. All of the polyrhythms and so-called dissonances used here can be widely observed throughout nature. Such was the intent of the composition.

Vertical Euphonies In Time (Working Block Section A)



Vertical Euphonies In Time (Working Block Section B)



Appendix B

The Eidophone Voice Figures

by

Margaret Watts Hughes

THE

EIDOPHONE VOICE FIGURES.

GEOMETRICAL AND NATURAL FORMS PRODUCED BY VIBRATIONS OF THE HUMAN VOICE

BY

MARGARET WATTS HUGHES.

ONE SHILLING.

Printed and Published by the "CHRISTIAN HERALD" COMPANY, LIMITED,
6, TUDOR STREET, LONDON, E.C.
1904.

Entered at Stationers' Hall.]

PREFACE.

THE delay in the publication of the Second Edition of "Voice Figures" has been unavoidable; but while it has been a cause of regret to many who were unable to procure a copy of the first edition, the time that has elapsed has given opportunity for further experiment, which has resulted in the additional notes and illustrations now inserted in this New Edition.

In this work no attempt is made to give an explanation of the phenomena referred to in the description of the various forms.

The subject being a very wide one, reaching out in many directions into the realm of physical research, the first duty that devolved upon me seemed to lie in the introduction of the forms themselves; the second, in making known, as far as this was possible without practical demonstration, the various methods employed in their production.

An acquaintance with the methods of operation, and the classification of the figures, will prepare the reader for a more technical treatment of the subject.

This New Science, which is given to us by one note of the human voice, aided by simple methods of operation, yields such varied and complex results that appear not only marvellous but almost miraculous. It is a science which, for explanation of its phenomena, points to the musical world as well as to the scientific world; to the vocal artist, as also to the searcher after scientific truth, and to the interpreters of those mysterious laws which underlie the visible forces of Creation.

Readers of the Holy Scriptures who make a careful study of the Voice Figures, cannot do so without being struck with the analogies and

suggestions they contain. Some of these may prove to be helpful in throwing light upon sentences and passages to be found in the Sacred Volume.

With the aid of the Eidophone disc, both singer and scientist are able to witness the effect not only of one but of many kinds of vibration upon different substances.

The extraordinary power given to these vibrations to control and arrange various particles of matter calls undoubtedly for explanations; and enquiries will occur, such as: What may be the law which impels one kind of vibration to scatter dry powder abroad, while another vibration of the same note gathers it together, and, if needs be, to cohere so closely and so compactly as to appear like a solid whole? Or, further: What may be the secret of the arrangement of lycopodium dust into hundreds of tiny but symmetrically-shaped mounds, while another class of vibration of the same note gives a complex form of exquisite beauty?

The laws which govern the dispersion, attraction, and cohesion of dry particles, and which seem so remarkably to suggest the principle of universal integration and disintegration of matter—while these same laws are to be recognised in the semi-liquid department, they seem to operate towards a totally different end. The moistened particles, under the influence of the different vibrations, disperse, cohere, and arrange themselves, but now to assume a form resembling a natural form. Here we have given to us, also, not only the *form* of the Daisy and Trefoil flowers, but, in addition to that *form*, in many instances a floral form with streaks and delicate markings on the surface of the petals, resembling some of our well-known garden and field flowers.

In the impression figures, in response to certain kinds of vibration the result will be the instantaneous formation of a tree or fern, or some intricate pattern of cross waves.

Not the least among the many subjects for enquiry is that which points to the *force* and *energy* of the vibrations themselves, when produced under favourable circumstances. An explanation of these phenomena, and of what, also, may be the chemical or electrical action which, under the influence of *voice* vibrations, can thus control matter, suggests a very wide area of investigation.

VOICE FIGURES.

INTRODUCTION.

It is little more than a century since any connection of sound with forms was discovered. In the year 1785 Chladni ascertained that the vibrations of plates in the act of giving out musical notes (when set vibrating by drawing a violin bow across their edges) caused powder strewn upon them to form regular patterns, and these have been since known as Chladni's figures. It is only within the last few years that Professor Sedley Taylor has exhibited by his Phoneidoscope the crispations of a soap film set in vibration by a vocal sound; and still more recently that, by employing elastic membranes, I have been enabled to produce Voice Figures, in which the delicate vibrations of the voice record and register themselves in several different ways, and with remarkably interesting results. For we have only to examine these figures, simple as is the principle that underlies them, to find ourselves face to face with Nature in her almost limitless variety; while every variation that we notice records some difference in the production of the figure that displays it, either in the character or the quantity of the substance used, in the form, the quality, or the tension of the elastic membrane, the vibrations of which evoked it, or in the pitch, intensity, or quality of the vocal note that created those vibrations.

The apparatus used for producing Voice Figures I call the *Eidophone*.

Its construction may be said to have originated from the following circumstances:—In the year 1885 I had been devoting attention to the study of the six properties of sound in relation to the voice, and, being impressed with the important part played by intensity in the formation of vocal sounds, especially in relation to quality and the creation of overtones, I became desirous to find some means by which I could test the different intensities of the tones of the human voice. My first task was to search for an instrument, and I made diligent enquiry as to what had

already been accomplished in this direction. So far as I was able to ascertain, no such instrument had been produced, and I felt very much disappointed. Not willing to give up my project, I endeavoured to construct an apparatus of my own, which I hoped eventually might answer my purpose. This apparatus consisted of a tube, a receiver, and a membrane which was stretched over the top of the receiver. The membranes were made of various kinds of materials—paper, parchment, fine silk, goldbeaters' skin, tin, and indiarubber. My aim at this time was to test the force of the different notes sung into the tubes by the weight of the various substances placed on the membranes.

I had been working on this path until May, 1885, when on one occasion as I sang I noticed that the seeds which I had placed on the indiarubber membrane, on becoming quiescent, instead of scattering promiscuously in all directions and falling over the edges of the receiver on to the table, as was customary when a rather loud note was sung, resolved themselves into a perfect geometrical figure. Surprised at the unexpected appearance, and wondering if it were the result of mere accident, I cleared the diaphragm of its contents and scattered fresh seeds on its surface. Upon singing the same note as before, the seeds gave the same figure.

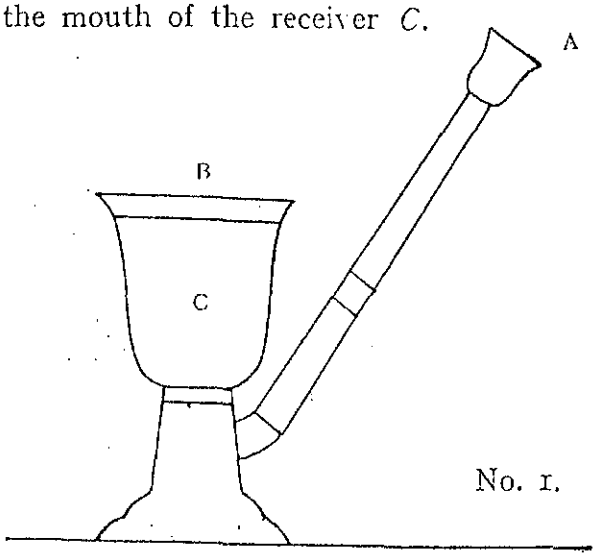
This figure, therefore, which I never searched for, became the progenitor of all that followed in the department of the dry powders, and the apparatus which was intended to demonstrate the capacities of only *one* of the properties of sound, has proved since to be the instrument that was needed to enable the singer to make visible the effects of the vibrations, and to show the endless possibilities of the human voice in this new path in the world of sound.

By varying the sizes of the discs it is possible to find one to suit the lung capacity of every voice. I have made use of a great number, ranging from one inch to thirty-seven inches in circumference.

This apparatus, simple though it be, may be said to have opened not only a new department in the domain of science, but also a new art, demanding the highest skill of the vocalist to interpret, and which appeals to human beings not by the usual way, orally, but by a new way—the visual sense.

The illustration herewith (No. 1.) shows one of the most convenient forms. A sustained vocal note is directed into the tube *A*; its

vibrations strike the elastic indiarubber disc *B*, stretched across the mouth of the receiver *C*.



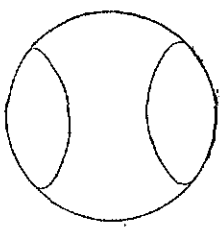
No. 1.

If the disc be thoroughly flexible, evenly stretched, and perfectly level, the sound-waves will cause it to vibrate regularly. Its vibrations will vary in rapidity with the pitch of the note producing them; and they will divide the disc and subdivide it, creating centres of motion, and boundaries or lines of rest, which in their turn govern the distribution and arrangement of the substance placed upon the surface of the disc, and thus form the Voice Figures.

The Eidophone disc can be set in motion so as to form *some* figures in sand and other substances by means of the flute, cornet, organ, or any musical instrument giving sounds sufficiently powerful to cause the disc to vibrate regularly. But complete success can be ensured only when the movements of the disc are directed by the *voice* of a skilful vocalist.

Any flexible disc, whatever its shape or size, under the influence of regular vibrations may be made to divide and subdivide so as to give a *series* of different figures.

In order to obtain such a series, the notes of the singer must correspond with those proper to the divisions of the disc itself. The singer, therefore, when experimenting, is not free to choose a keynote of any pitch, if he desires to obtain a series of figures corresponding to the diatonic scale, for he must first ascertain the capacities of the disc. The easiest way of doing this is, after strewing a little sand on the surface of the disc, to sing a few low notes, and continue to do so until a figure appears showing three centres of motion; this figure indicates one of the simplest divisions of the disc. (No. 2.) If the figure be regular, and the note easily sustained the singer can then ascend the scale, in steps of tones, semitones, or



No. 2.

quarter-tones, as high, or descend as low, as his compass will permit. In doing so, each note of different pitch should be carefully sustained, and the surface of the disc should be strewn over afresh with sand for each change of pitch.

Further, in order to obtain a series of figures in regular succession, and in correct relation to each other as to pitch, each disc should be suited to the capacities of the particular voice acting upon it, since discs of the same size differ in their rates of movement, if of different weights. Indeed, every figure formed on the disc may be said to register the movement of a definite weight, under the action of a vocal note of a necessarily corresponding definite intensity.

On ascending the scale, it will be found that it is only certain notes that will produce definite figures. To some notes the powder on the disc will respond at once by an instantaneous arrangement; to others, not so promptly, not so definitely, or not at all. In these latter cases, too, the singer experiences a constant sense of resistance, which creates a curious difficulty in sustaining the notes.

The human voice, as a power for directing the movements of the disc, is above comparison with any other musical instrument. Rightly viewed, the voice is not a single instrument at all, in the same sense as is a flute, cornet, or harp. It is more like the organ, containing a number of stops, all different in the character of the sounds they send forth; except that in the voice we can usually hear but one at a time.

Compared with most musical instruments, the range of the human voice as regards pitch is but limited, and its maximum strength is still more so. But in every other direction its comparative powers are so great as to render it unique.

The voice is the result of the combined action of four distinct sets of organs, which form a mechanism of such delicacy as to enable a skilful singer to produce sounds possessing in some degree the characteristics not only of all musical instruments, but of all sounds of whatever description.

The secret of this capacity lies in the great number of modifications of which every vocal note is capable, not only as regards pitch and intensity, but also quality. The singer can not only create notes of different pitch and strength, but can also shape, colour, and modify these, and cause them to convey a definite meaning.

Again, some vocal notes are *simple*, and others *compound*, in their character. When we hear a simple note, we distinguish a single pitch and a single quality. When, on the other hand, we listen to compound notes, we distinguish either sounds of different pitch though one in quality, or sounds of one pitch and of two different qualities. The first kind of compound note is similar in effect to two notes of different pitch sounded with the same stop of an organ; the other kind resembles in effect a single note sounded with two stops.

As it is, of course, in the power of the singer to determine the character of the notes used, it is well, when singing into the Eidophone, to bear in mind what has just been said. Notes suitable in pitch and intensity as well as in vowel should be chosen, and the vocal organs should be so adjusted that all notes sung can be sustained unwaveringly.

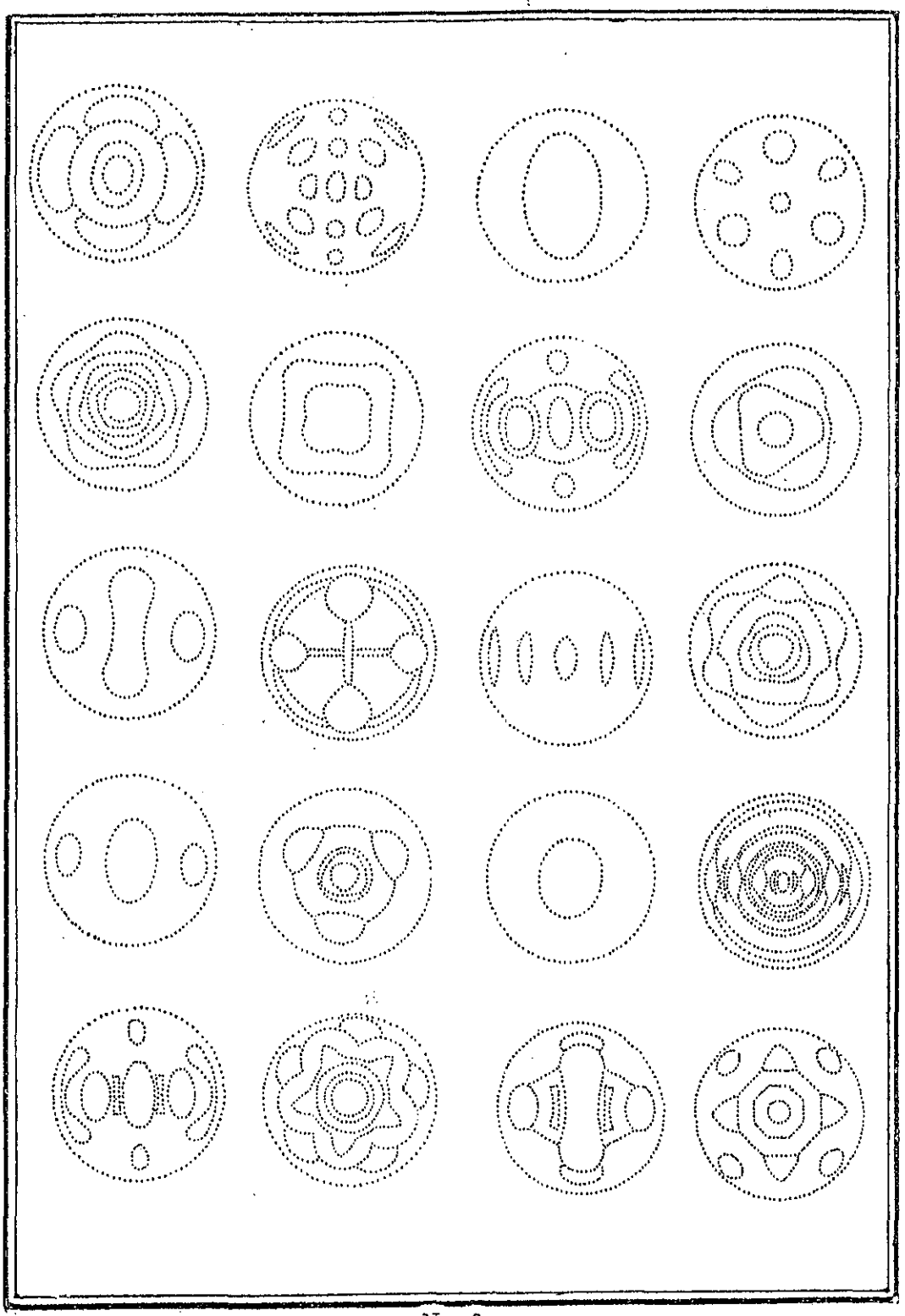
To include within the limits of these pages a detailed account of *all* forms of voice figures would be quite impracticable.

A general idea of the character of the figures may, however, be obtained by considering them in two classes :—

I. Simple disc figures—viz., those obtained simply by the distribution of material on the disc itself, through its own vibrations ; and,

II. Impression figures, taken upon other surfaces, brought into contact with the disc in vibration :—

and dividing both these classes into groups arranged, for convenience, according to the substances in which the figures are formed.



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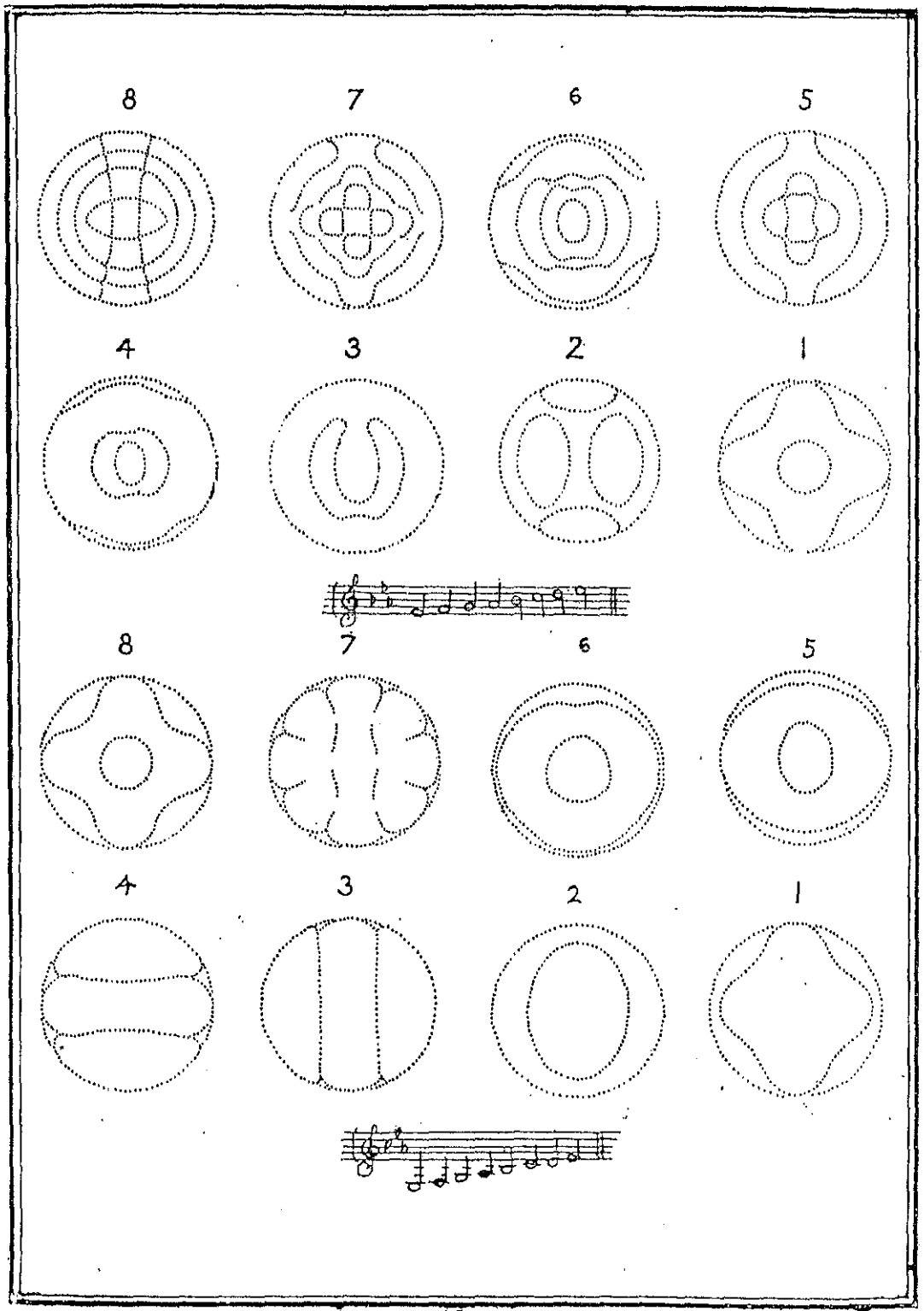
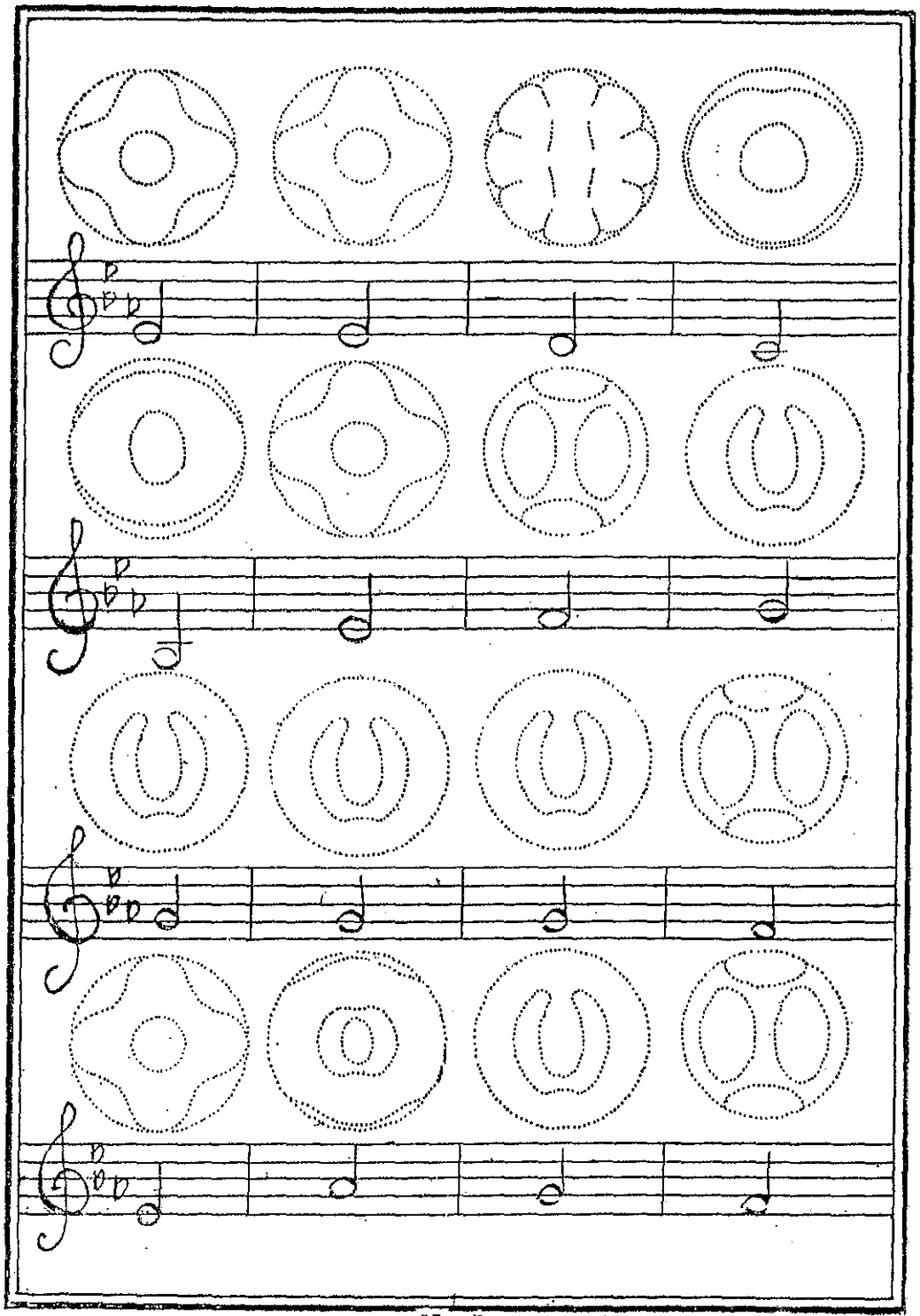


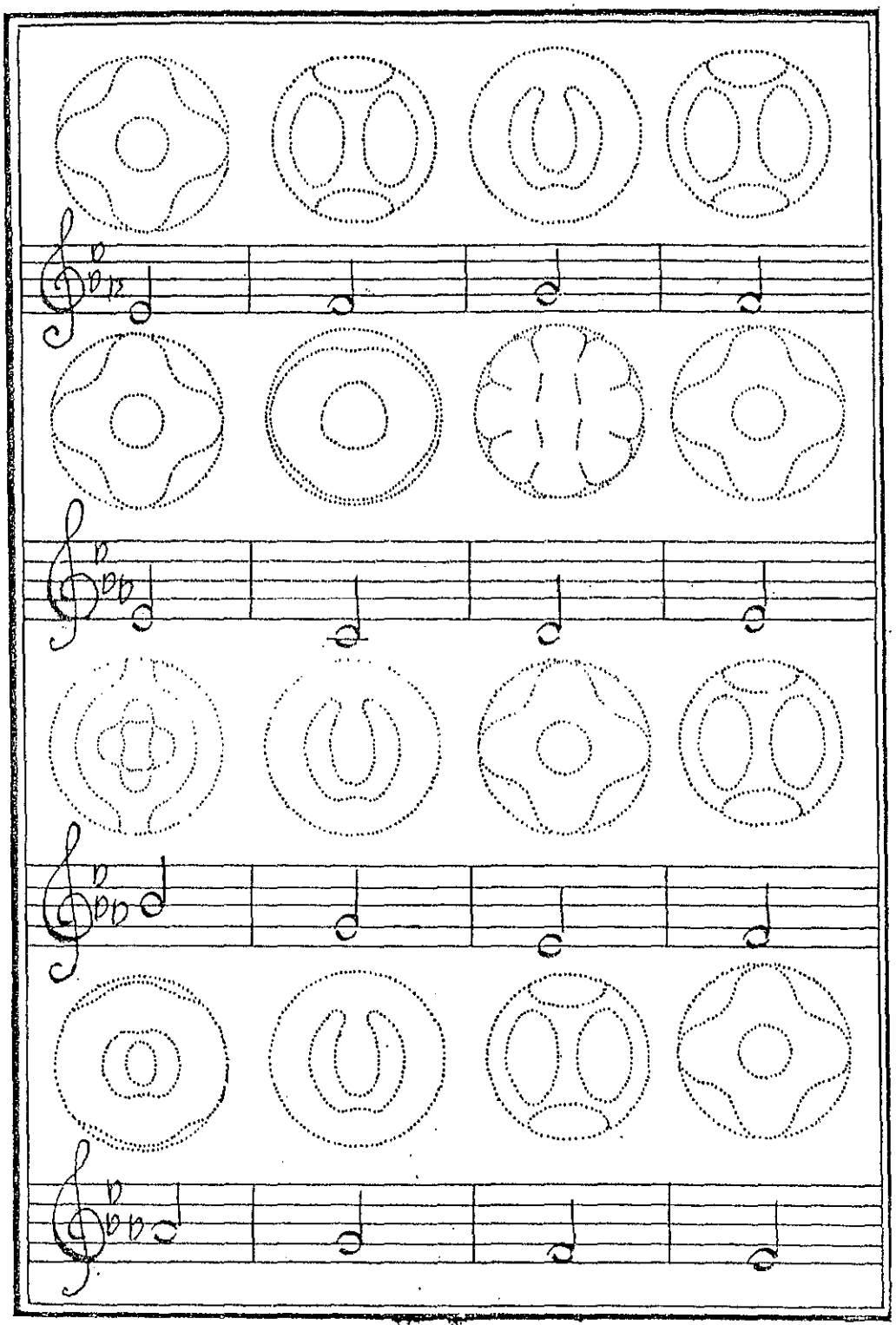
No. 4.

"The Old Hundredth."



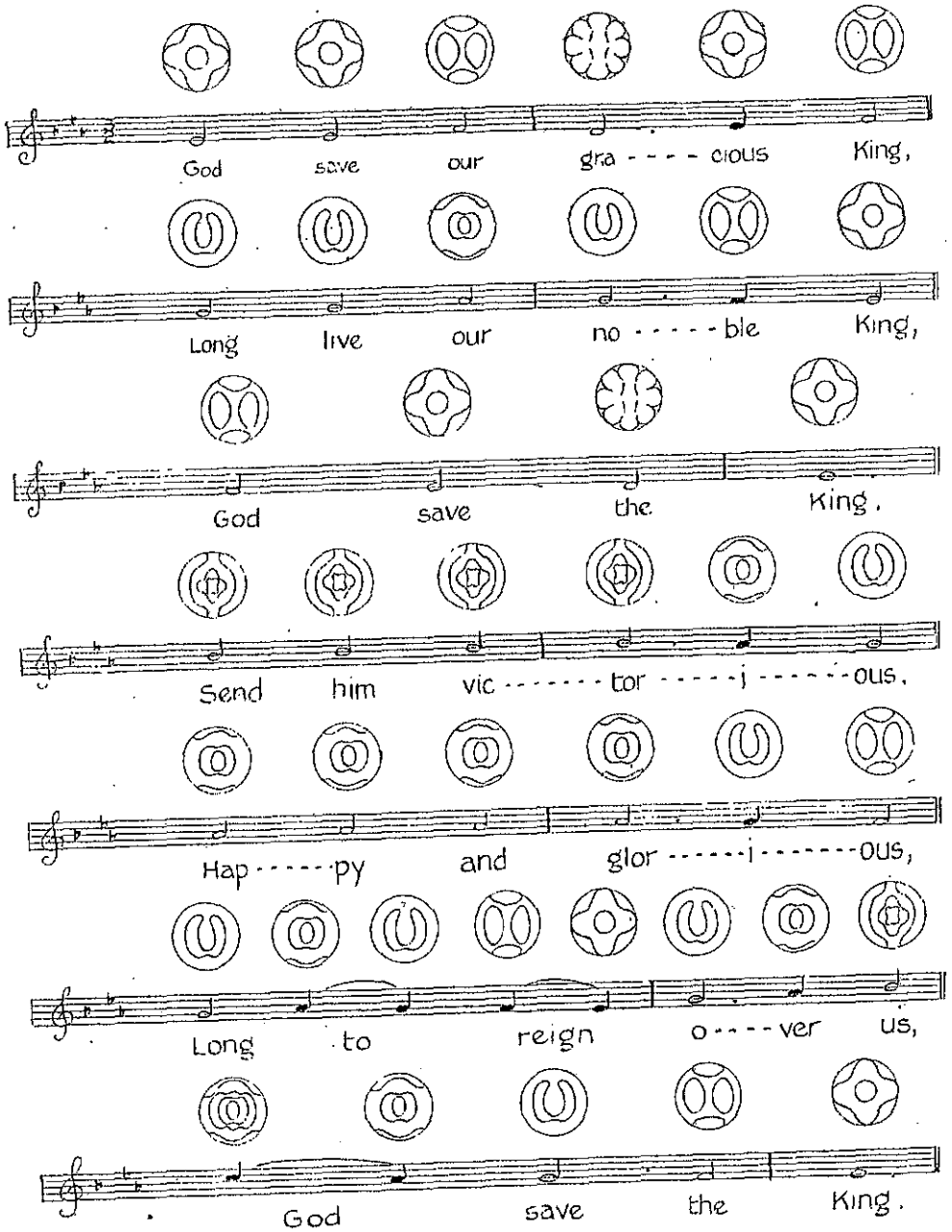
No. 5.

(The Old Hundredth—continued.)



No. 6.

GOD SAVE THE KING.



No. 7.

PART I.—SIMPLE DISC FIGURES.

Sand Figures.

When sand or other heavy powder is lightly strewn on the elastic disc, and suitable notes are sung into the tube, the sand or powder is seen to scatter away from the centre or centres of motion, and to remain upon or near the nodal lines of rest; so forming figures upon the disc, which, subject to certain limitations, alter in pattern or in position with each change of pitch, as already noted, and increase in complexity of pattern as the pitch rises.

Sand figures do not afford much scope for intensity of sound, owing to the readiness with which sand scatters. A loud note will often drive the whole off the disc, while a softer sound would leave a definite figure on the nodal lines.

The series of figures on page 6 (No. 3) I obtained with membranes which varied in thickness. The two diatonic scales on page 7 (No. 4) were sung on the same membrane, which measured fifteen inches in circumference. They are numbered in the order in which they appeared with each rise in pitch.

Lycopodium Figures.

If instead of a heavy powder, such as sand, we scatter on the disc a small quantity of *lycopodium*—the impalpably fine seeds of the puff ball—we have a different class of figures, the lightness of this substance causing it (for reasons which have been explained by Faraday) to gather at the points where vibration is greatest, and to leave the nodal lines bare.

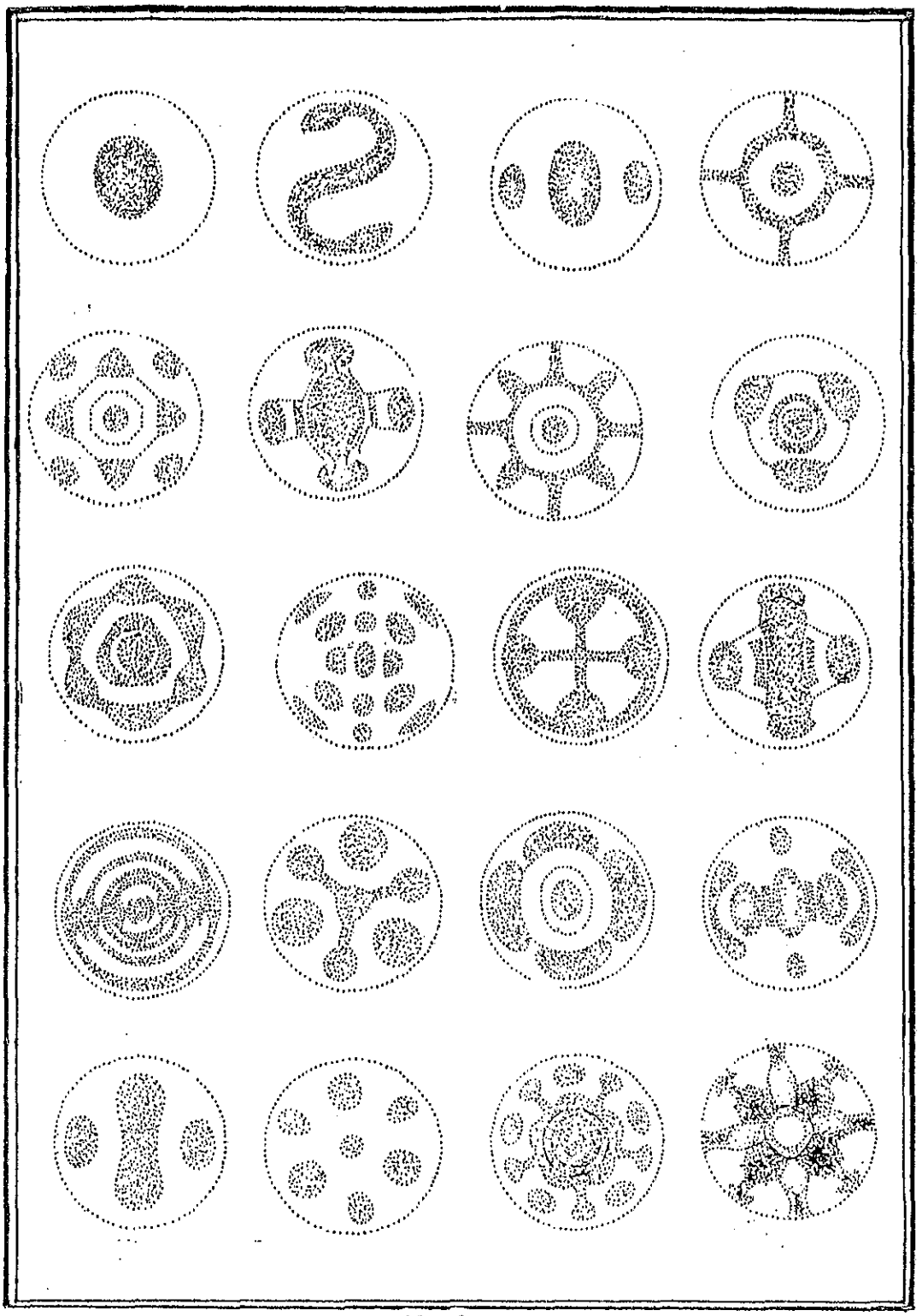
The tendency of this fine dust to cling to the centres of motion enables the singer to test the intensity of the notes sustained; for, as they increase in strength, the fine dust spreads itself farther and farther

from the centre outwards, until the whole of the vibration circle is covered. When the diminuendo is effected, the lycopodium is once more disturbed, and this time collects into a number of tiny mounds, all of which finally retreat into one central heap as at first. (See illustrations Nos. 8, 9, and 10.)

Upon one occasion, while singing notes with which I had many times previously produced figures with perfect ease, I witnessed a curious phenomenon. All at once the disc became unusually agitated, and, instead of the customary figure appearing, the lycopodium flew hither and thither about the surface of the disc, at one moment as if struggling to shape itself into the regular figure, and at another moment as if trying to form a different figure. I was perplexed to account for this unusual wavering of the disc, but another sustention of the same note abated the excitement and left on the disc the figure I had looked for. I noticed, however, that the intensity of the last note was less than that of my previous efforts. I therefore concluded that the cause of the unusual commotion was the presence of overtones, through singing too loudly. Singing then the octave above, I at once saw before me the very figure which had been struggling for predominance with its companion octave below.

By repeated experiment I have since found that every figure requires not only its exact pitch, but also its exact intensity, although each intensity will admit of a certain degree of crescendo and diminuendo. Any intensity beyond that requisite to cause the lycopodium to cover the whole of the vibrating circle is likely to excite overtones, and so to prevent the accurate formation of the figure belonging to the tone itself. Certain figures, indeed, will form only under the influence of simple tones; others will form to notes whose overtones may be present, but are too faint to affect the disc. But when the note sung and any of its overtones happen to be about equal in capacity, then the difficulties referred to may be expected.

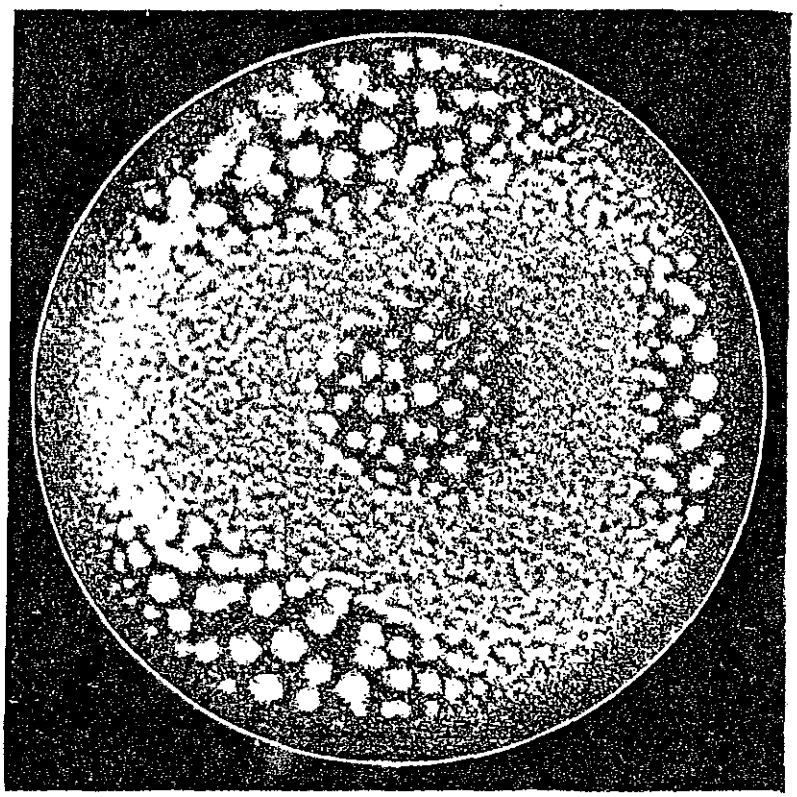
In connection with this class of figures, the student of singing might, by careful attention, become acquainted not only with the action of *overtones*, but with *notes of interference*, *beats*, and *combinational notes*, besides other interesting points relating to voice-production and acoustics.



No. 8.

In singing these two classes of figures, in dry powders, the sand employed should not be too coarse, nor too fine, when obtained in its rough state; it should be thoroughly washed in clean water, and, after draining, placed in an oven, or on some clean paper in front of the fire to dry, being afterwards kept in a jar ready for use. Sand should be scattered lightly on the disc at first, and a soft note sung, which may be increased in intensity, and the sand also in quantity, according to the conditions of the operations.

The lycopodium may be used in various ways: (1) By strewing it lightly over the surface of the membrane; (2) By rubbing it into the surface of the membrane; and (3) By sprinkling it thickly over the whole surface. These different modes of using this fine dust will yield some most interesting results to the singer who desires to study the effect of voice vibrations in this department.



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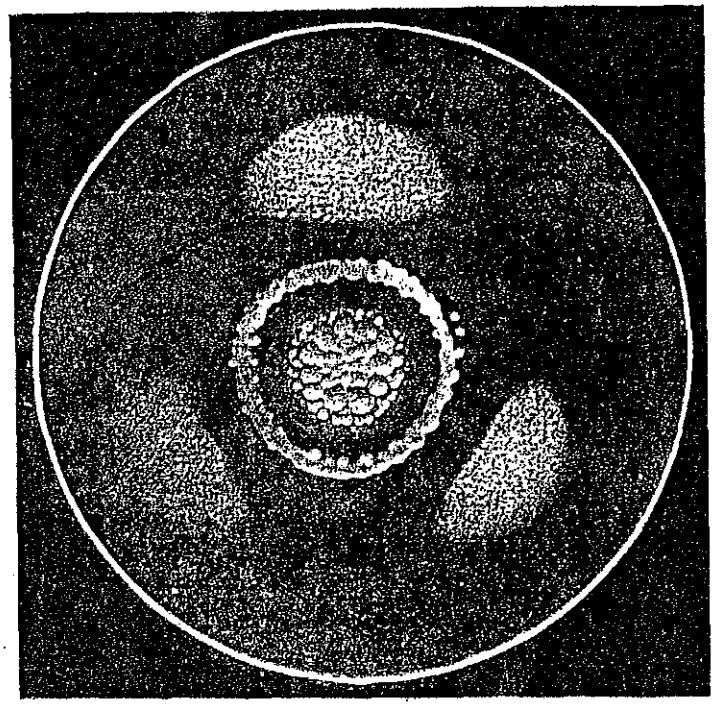


No. 10.

Figures in Liquids.

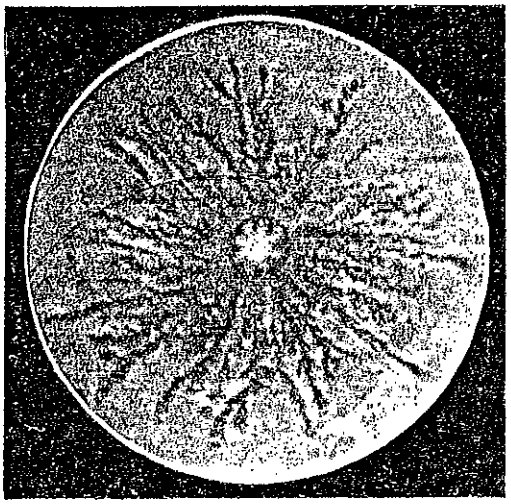
If we flood the surface of the disc with water or milk, and then sing through the tube, we find the liquid surface at once covered by regular crispations or wavelets, in straight or curved lines that form complex and beautiful patterns.

A little observation will show that these vary according to the number of vibrations of the notes sung, the tiny wavelets diminishing in size, but increasing in number and complexity of pattern, as the vocal pitch rises.

Figures in Semi-Liquids.

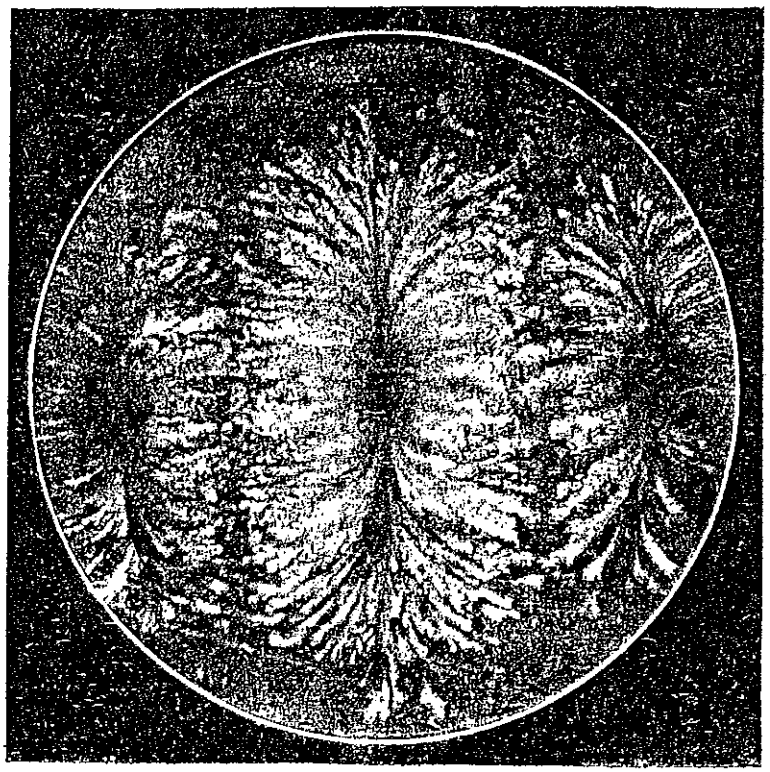
Instead of employing liquids, if the membrane is rubbed over carefully with moistened colour (such as flake white or red lead) and a powerful note is sung into the tube, some of the figures made visible by lycopodium may be witnessed in a still more interesting form. Not only are the centres of motion and their boundaries to be seen, but every movement of the disc may now be studied. Some of the curves are highly

suggestive of roots, branches, or foliage of plants, or, again, the beautiful curves such as may be witnessed on frosted window-panes on a wintry morning. (See illustrations Nos. 11, 12, 13, 14, and 15).



No. 11.

CENTRE OF MOTION IN SEMI-LIQUIDS.



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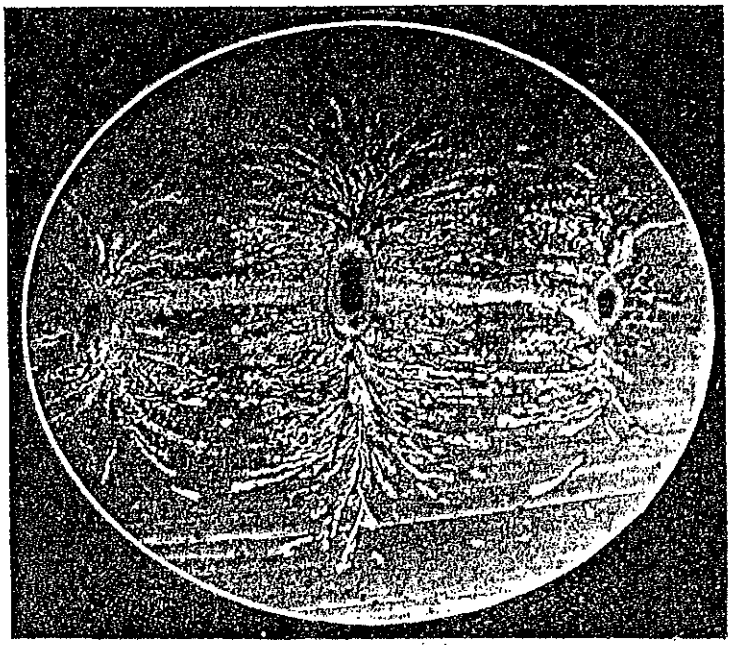

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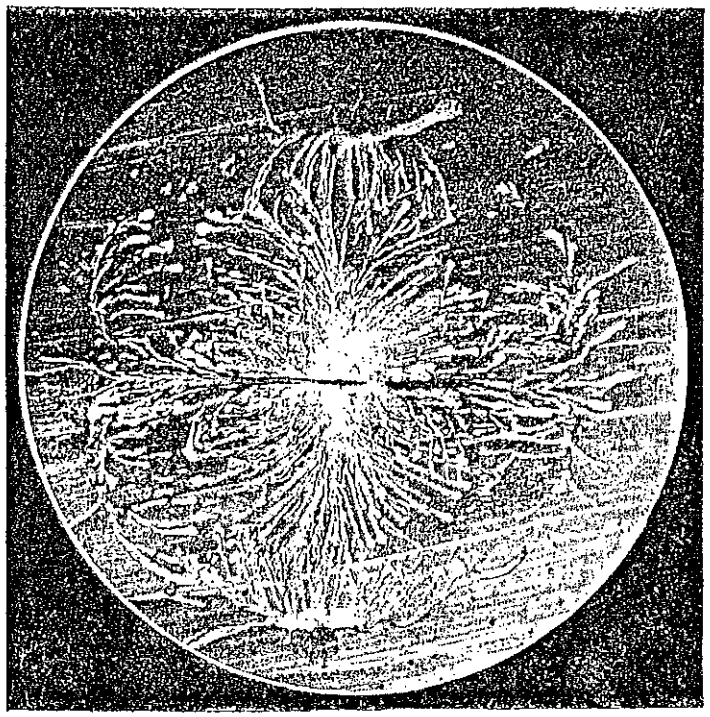

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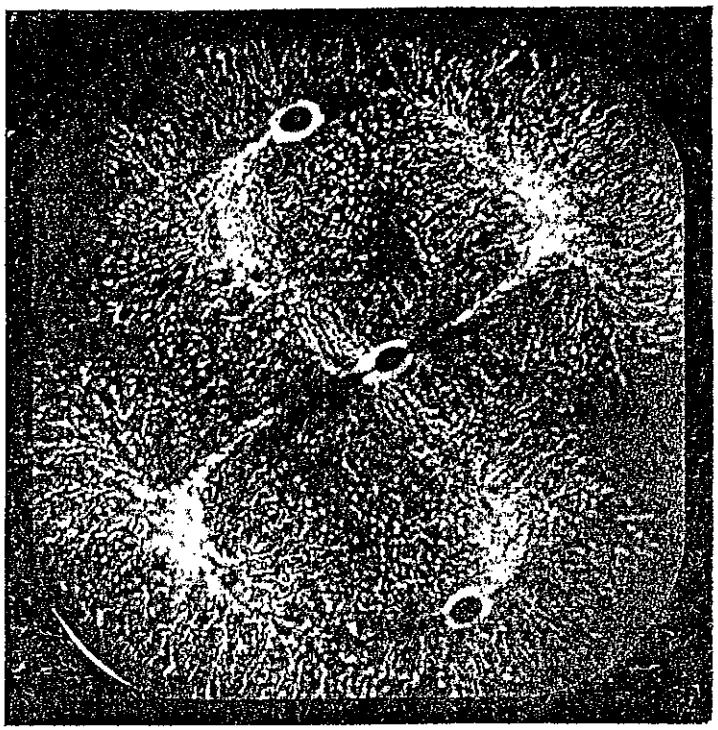


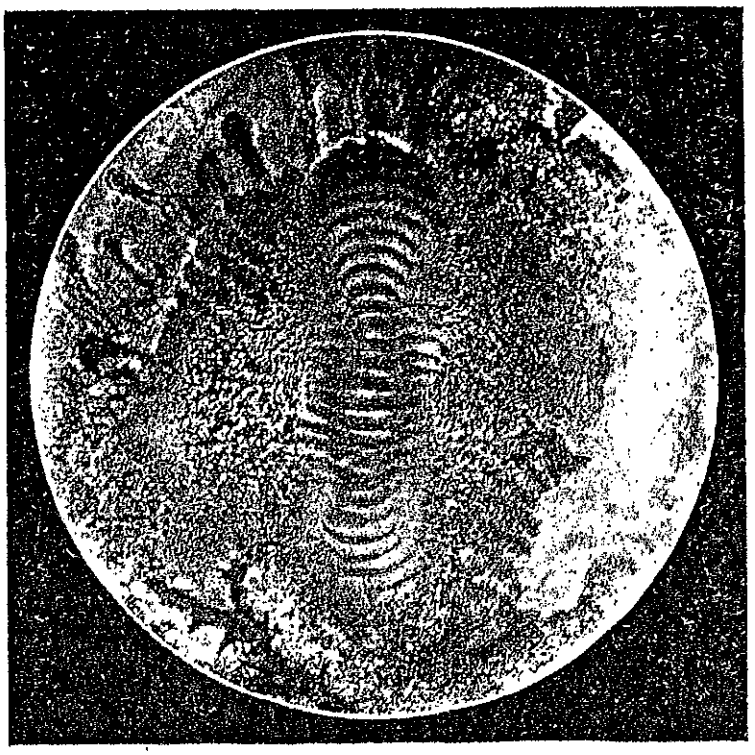
No. 15.

PRIMITIVE FORMS.

Taking now a smaller disc and flooding it as before, while slightly colouring the liquid with a small quantity of powdered water-colour, if we sing one of the lowest notes capable of affecting it, we find a result that is quite different. The coloured liquid changes its forms, not with change of pitch, as did the sand and lycopodium figures, but with each change of intensity.

To this class of figures belong a variety of highly interesting forms, so peculiar in behaviour that they seem particularly to invite scientific investigation.

They may be considered, so far as my own investigations extend, as primitive forms of the semi-liquid class, and are produced in a liquid but slightly removed from the state of water. They require extremely soft notes of steady *equal* power for their production. (See illustration on page 19.)



No. 16.

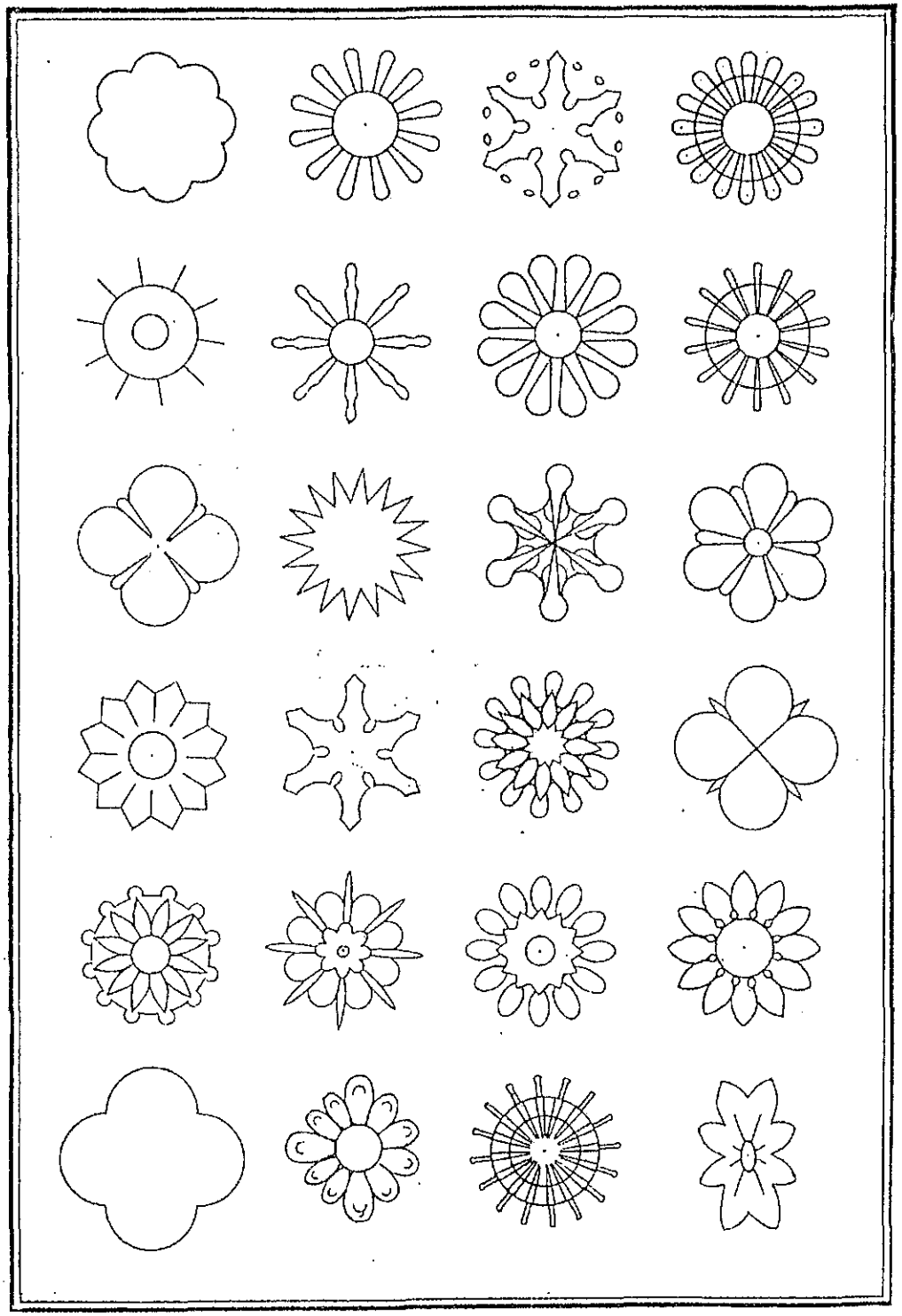
GEOMETRICAL FORMS.

When a rather larger quantity of powdered water-colour is added to the water employed, figures are obtained which, for want of a better name, I call *geometrical*.

Placing on the centre of the disc a very small quantity of the thickened liquid, we find that, under the influence of a suitable note, it is capable of the most perfect and symmetrical arrangements, by division and subdivision.

This class gives a variety of very tiny figures of different sizes and shapes ; some starlike in appearance, varying in the number of their rays from six upwards, some having curved lines and delicate markings on their surfaces.

Many of these forms somewhat resemble snow crystals, both in appearance and in their behaviour (*vide* an article on Snow Crystals by J. Glaisher, F.S.A., in the *Leisure Hour*, 1872).



No. 17.

Figures of this class sometimes appear on the disc in rapid succession during the steady sustention of a single note of high pitch, changing form with kaleidoscopic effect, though I have not yet been able to ascertain the cause. The extraordinary rapidity with which they sometimes appear to whirl on the centre of motion on the disc, clinging to one particular spot, is even dazzling. Occasionally the tiny mass appears to the eye as though poising on the waves of a miniature whirlwind, some quarter of an inch above the disc, rather than resting upon its surface.

All figures of this description are produced by high notes and with a high tension of the disc. In size they range from that of a small pin's head to that of an ordinary-sized snow crystal.

Owing to the fragile nature of the most beautiful of these tiny forms, I have found it impossible to preserve them in their original beauty, as seen a few seconds after being sung. The illustrations (No. 17) have been sketched and enlarged in scale, and were sung with notes lying between the upper G of the Soprano and C Sharp.

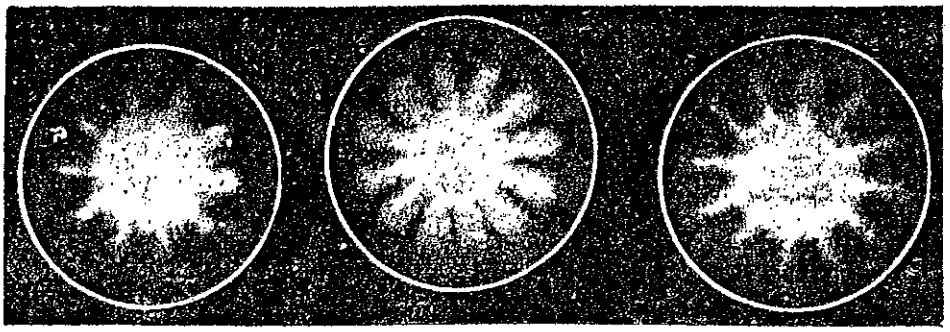
It is obvious that the alterations of form in this class of figures are due to the condition of the substance used, or, at least, to something other than a change in the number of vibrations.

By further increasing the quantity of colour in proportion to water, we have again different results, and the forms now produced we may call

Floral Forms.

First stage of the Daisy.

A small heap of colour paste, mixed to proper consistency, is placed on the centre of the disc, and a suitable note sets it in motion. The note is continued, and ere long we see the paste take the form of a little flower with petals. Instead, however, of altering its form like the "geometrical" figures, during the sustention of a single note, we observe this floral form remaining apparently unaltered while the note is held on, and apparently falling back every time, with each diminuendo of the note, into the same little heap from which it sprang, only to reappear with each renewal and slight crescendo of the note; and we further notice that it becomes each time more and more developed in shape, up to a point



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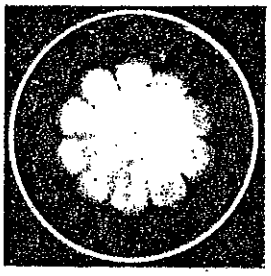

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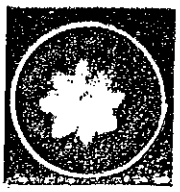

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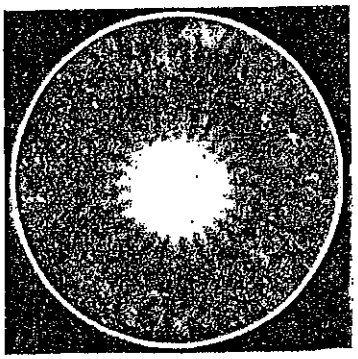

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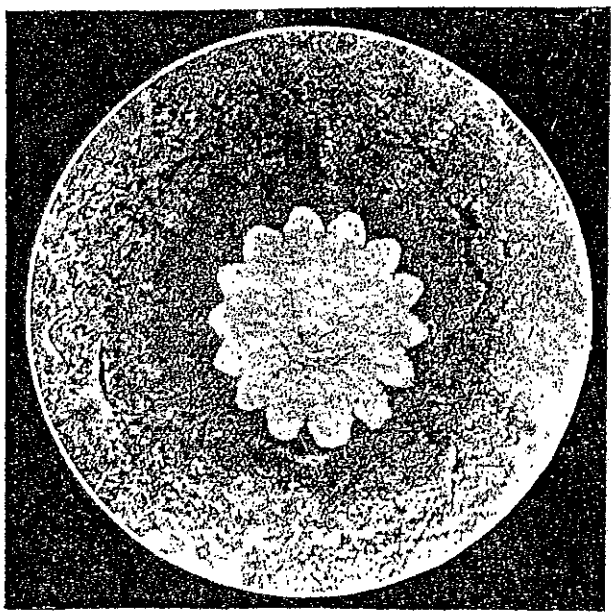
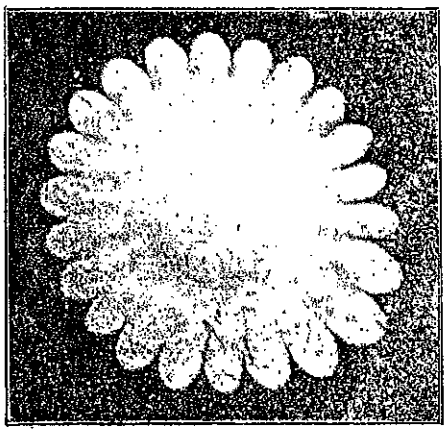


No. 22.

when the surrounding air has absorbed so much of its moisture as to leave it too solid for free movements. (See illustrations, Nos. 18 to 23.

Fully Developed Daisy.

If we now place on the disc a still larger quantity of this colour paste—*e.g.*, a mass the size of a small bean—exactly upon a centre of vibration, as before, and sing a suitable note, we first see the heap gather itself closely together. After a short time it will be seen slightly agitated around its edge, and, by continuing to sing, suddenly, in obedience to



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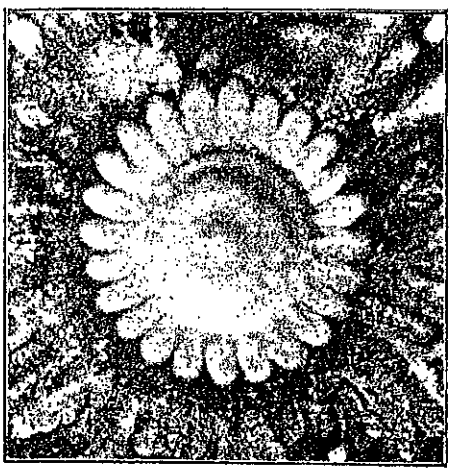

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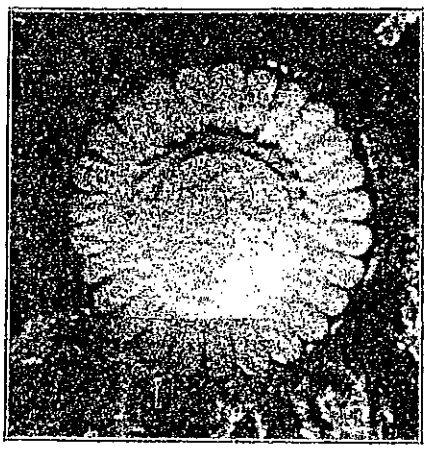
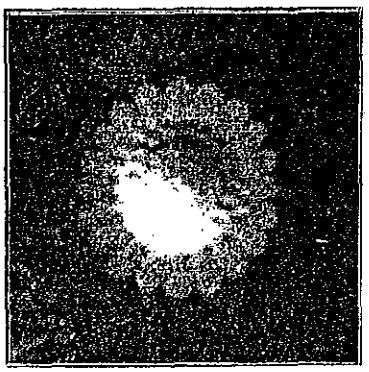


No. 25.

a careful crescendo, beautifully-shaped petals dart out, with perfect regularity and symmetry, in a floral form which, when fully developed, closely resembles a daisy.



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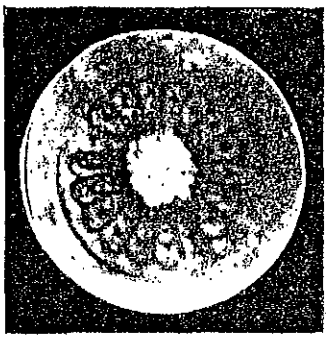


No. 27.

But here again we find stages of development. It is indeed very seldom that a perfectly-shaped daisy is obtained with the first crescendo. In order therefore to secure the full development of a figure of the daisy class, the note should be repeated diminuendo, when the petals will retreat into a central heap, and there remain so long as the note sustained is equal in power. Immediately, however, that a crescendo is again executed, the petals will dart out anew, more perfect in appearance than at first. Still continuing the alternate diminuendo and crescendo necessary to the involving and revolving movements which are to be observed in the central heap, in course of time we find the figure reaches its perfection. (See Nos. 24, 25, and 26.)

Some of the most perfect daisy forms are delicately marked on their petals with vein-like lines, both straight and curved. Others show around the base of the petals one or two rows of very tiny dots, which I am inclined to think are themselves centres of vibration, and capable (if one only knew *how*) of development into tiny flowers. Some daisy forms exhibit two, three, and even more rows of petals overlapping each other. I have failed to observe, while singing these more complex forms, any difference of note from those which produce the simpler daisy forms. I think there must be a difference, but the necessity of closely observing a number of other particul rs when singing these forms, especially some of them, has so far prevented me from determining this

and some other points of interest. The eyes are acutely watching the movements of the heap, the ear is noticing the character of the sound which is to influence it; intensity has to be controlled, the fixings of the vocal organs have to be considered, along with other points of delicate arrangement—all during the momentary crescendo of a note. To do all this with sufficient accuracy for exact comparison with another experiment is indeed almost impossible.

The singing of the daisy form is, however, in itself a useful study, which would well repay the vocalist. It affords scope for the practice of crescendo and diminuendo in almost every degree of intensity, and gives a rare opportunity to the vocalist of noticing the peculiar sensations belonging to the formation of notes of different character. Here I would remark that, although the action of the vocal organs must of necessity be the same in the crescendo of the semi-liquid heap as in that employed when controlling the lycopodium heap, the sensation felt, so far as my experience goes, is very different. I suppose this to be due to the difference in the substance upon which the vibrations of the note are directed to act. I wish I could clearly describe a sensation I have often experienced when singing these daisy heaps into shape, but I fear I can be understood only by vocalists who know something of the sensations peculiar to certain notes when produced in some parts of the vocal range with an adjustment of the organs that permits the character of the notes to be varied with the most perfect ease. I may say that the sensations now mentioned are something similar, but greatly intensified.

Other sensations experienced while singing these forms are equally remarkable, and quite unlike anything I have ever felt in ordinary vocalisation, but they are still more difficult to describe adequately.

At first, when directing the voice against the semi-liquid mass upon the centre of the disc, there is a feeling as if some impassable barrier were encountered, and that it would be as easy to move a mountain with a push of the hand as to set that colour heap moving by the action of a note. The next sustention seems only to confirm the first impression; but after several attempts one comes to feel that it *could* be done if only the right *kind* of sound could be employed. Persevering, the seemingly ponderous, inert mass is at last disturbed, and shows some susceptibility of control. Still continuing, it now begins to move, and

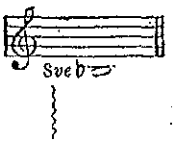
ere long comes under complete control, expanding in petals after every repeated crescendo. When the mass moves thus easily the sensation of the singer is completely changed. The feeling is now as if all at once the air in the tube, in the receiver, upon the disc, and all around, were acting in concert for the singer's purpose, and had taken possession of every corner of space.

During this state of things the apparent resistance of the semi-liquid heap upon the disc becomes so slight that it seems to move as if on wheels, and a most perfect physical control over the aerial movements is realised, the sensation of which is at the same time most peculiar and most agreeable.

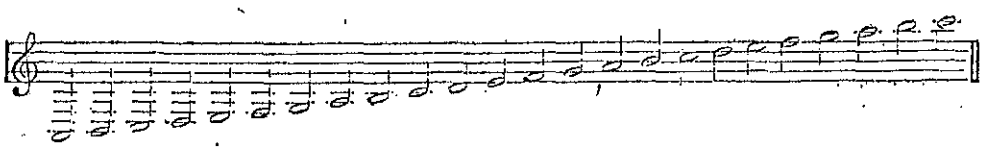
In some instances in which I have found the pasty mass gather itself together more compactly than usual, I have seen the whole, unaided by any crescendo of my note, suddenly quit its ordinary place on the centre of the disc and travel over the surface in a most mysterious way. During its movements about the disc, the mass has shot out its petals just as usual in obedience to the crescendo, and with as perfect a result as though it had been at rest in the centre of the disc.

All the larger-sized heaps require very low notes, varying in pitch according to their weight and mobility.

The lowest note with which I have been able to sing a successful daisy form has been B flat, an octave below.



Continued practice in the sustention of notes of different pitch and intensities has enabled me to produce a compass of notes which I had no idea could have been obtained with my own vocal range, or, indeed, that of any female voice. I have been able to form figures on every semitone, and indeed, I may say, on almost every shade of tone, within rather more than three octaves—*i.e.*, from



I look forward to further results whenever this subject is taken up by vocalists with voices differing from my own, as voices *do* differ from each other, in almost every point connected with vocal sounds. It

would, for example, be interesting to see a figure produced by a bass voice singing a note an octave below the usually considered limit of the bass vocal range, and to observe also a figure produced by the highest *soprano sopracuto* notes of the female range.

Vocalists will certainly find many points of special interest in connection with these figures, whatever may be their value or claims for enquiry in relation to natural science.

Before quitting the subject of floral forms, I wish to refer to another variety, belonging to a different condition of the material employed.

The Pansy.

This figure has its own special behaviour, and will take shape only under particular conditions.

A small quantity of water-colour, mixed to proper consistency, is placed on the disc, and water is poured around the colour mass. Then, if a suitable note is sung into the tube, the colour paste in the centre shoots out in petals through the surrounding water, but, instead of emitting small petals all around, as with the daisy form, in this case the petals are larger, and there are only three, six, or nine. These pansy forms vary both according to the condition of the colour paste and the character of the note which influences it. Some are composite, having two or three rows of overlapping petals. Owing to their tenuity, however, the upper layers of petals are unavoidably effaced as the water dries off, so that I have been unable to preserve the most elaborate specimens. It is, indeed, only when the thicker layers of petals are sufficiently solid to bear gentle pressure that they can be fixed at all.

The pansy is peculiar, in that its divisions are always three or a multiple of three, and that it will expand only if surrounded by liquid. As the petals spread out in the water, there is left in the centre of the disc a smaller triangular heap the points of which are connected with the bases of the larger petals. Sometimes around these three points, as well as on the surface of the heap, and on the petals, there are delicate patterns. Both upon and around the petals there is often a succession of curves, and streaks, and fluted markings. Sometimes the larger petals are partially divided at their outer edges. In other cases a narrower petal appears between each large petal, adding considerably to the beauty of the figure, and to its floral appearance.

The notes that produce the pansy figures are softer throughout, and require a more *gradual* crescendo than those which produce the lycopodium and daisy forms. It is only, however, by much practice that a singer can become acquainted with, and gain control over, all that is necessary for their formation. It is requisite to learn how far to use crescendo, and *when* to cease, for while the petals are spreading out through the water, the crescendo must be kept up; and it requires as much art to know when and how to stop as it does to sustain the note. If the note is not terminated at the right moment, and *carefully*, without a jerk, the central heap will give out another set of petals in a different direction, before the first has been completely withdrawn into it, so rendering the figure imperfect. (See Nos. 28 to 31.)

The floral figures afford a considerable variety of forms, taking into consideration the different degrees of consistency in material, and the different quantities which can be employed.

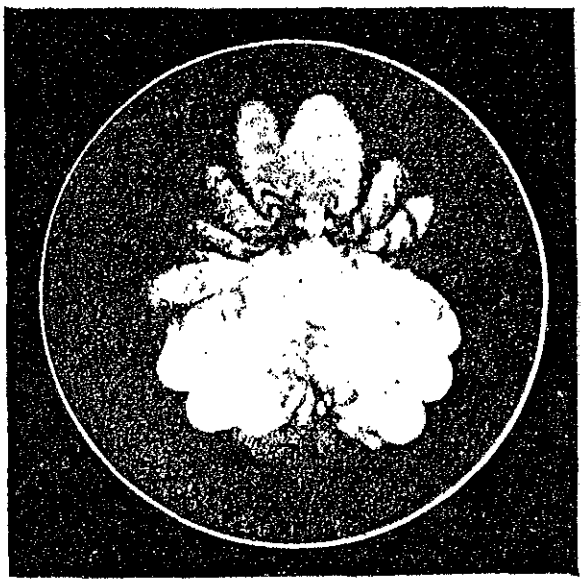
The quantity of colour paste used in the tiny floral forms is, of course, very much less than that for the larger daisy forms. The most noticeable difference resulting is in the petals of the figures, of which many are strikingly like some of our well-known flowers, both wild and garden.

I have observed, in addition to the daisy and pansy forms—which represent two distinct classes of figures—others of various sizes, and with petals resembling those of the primrose, the buttercup, the chrysanthemum, the rose, and the geranium.

The general appearance of some of these figures, immediately they are sung, is also remarkable. If the moist colour be thoroughly mixed, so that every particle of the heap can be set in regular vibration, the surface of the mass displays a delicate softness, of such perfection that I can compare it only to the bloom on a beautiful flower.

Other interesting figures can be obtained by means of moistened *plaster-of-Paris*; these are of a different character, although produced in the same manner as some of the previous figures.

In closing my remarks upon the *simple disc figures*, I may say that I have found the study of them absorbingly fascinating. From the moment that I have sung a note into the Eidophone, one suggestion upon another has persistently crowded into my thoughts. In the



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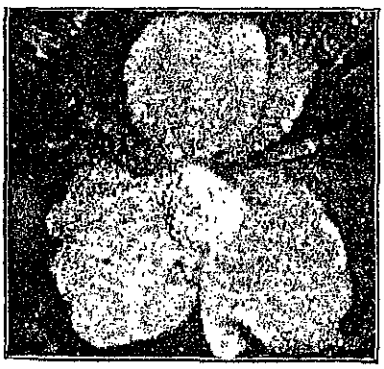


No. 29.

No. 30.

No. 31.

act of singing shapeless matter into such symmetry and beauty of form, one cannot help feeling the presence of a power that is very strange, and greatly admiring the simplicity of the laws ruling the production of these figures, and the multiform variety of the results.

PART II.—IMPRESSION FIGURES.

Soon after the production by singing of the semi-liquid forms, a great desire took hold of me to find a method of rendering them permanent, for it seemed obvious that if the whole motion of the disc under the influence of vocal notes could be preserved, this might prove not only interesting and pleasing to the sight, but also of advantage to science. But how to proceed to this end? After many attempts and many failures, it occurred to me to experiment by way of glass. I therefore took a small piece and coated it with colour, and the disc in a similar manner. I placed it downwards on the membrane, at the same time singing a note into the tube. On lifting it up I found the glass covered with some interesting adhesion vein lines, but showing no trace of the vibrations of my voice. After continued practice, both in singing and in manipulating the necessary operations, on a certain occasion, when the plate was lifted up from the disc, the underlines showed that the note I had sung had been sufficiently powerful to leave a distinct impression on the glass, which could be retained and made permanent.

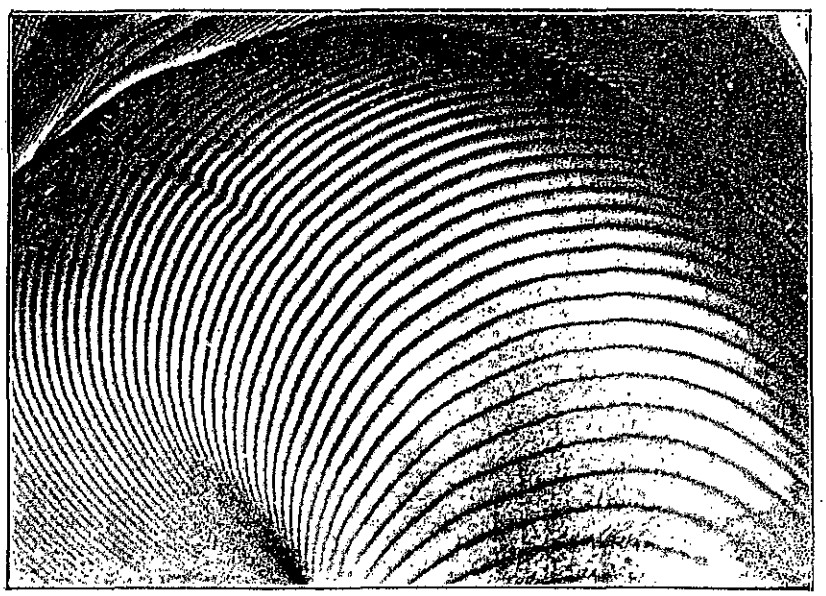
This experiment, with the practice it involved, led to the discovery of all the classes of figures and their variety belonging to this department, including those named trees, ferns, cross vibrations, and the forms which will now be described under the name of

LINEAR CURVES.
(FIRST METHOD.)

Having succeeded in obtaining impressions of the linear curves on glass, my next step was to ascertain what would be the effect of moving the glass in straight or curvilinear directions on the surface of the mem-

brane. I found great difficulty in obtaining satisfactory results until it occurred to me to do one thing—to blow into the tube *before* singing, so that the pressure of the air in the receiver might cause the membrane to rise slightly above the level of its edges. By so doing the glass could be moved in any direction freely and unfettered.

After some considerable practice I found it was possible not only to retain the lines, but also that with every change of pitch the number of the lines varied. If, therefore, the glass is moved in straight or curvilinear course, at the same rate, an approximate record of the number of vibrations of the different intervals of the scale may be obtained (Nos. 32 to 36).

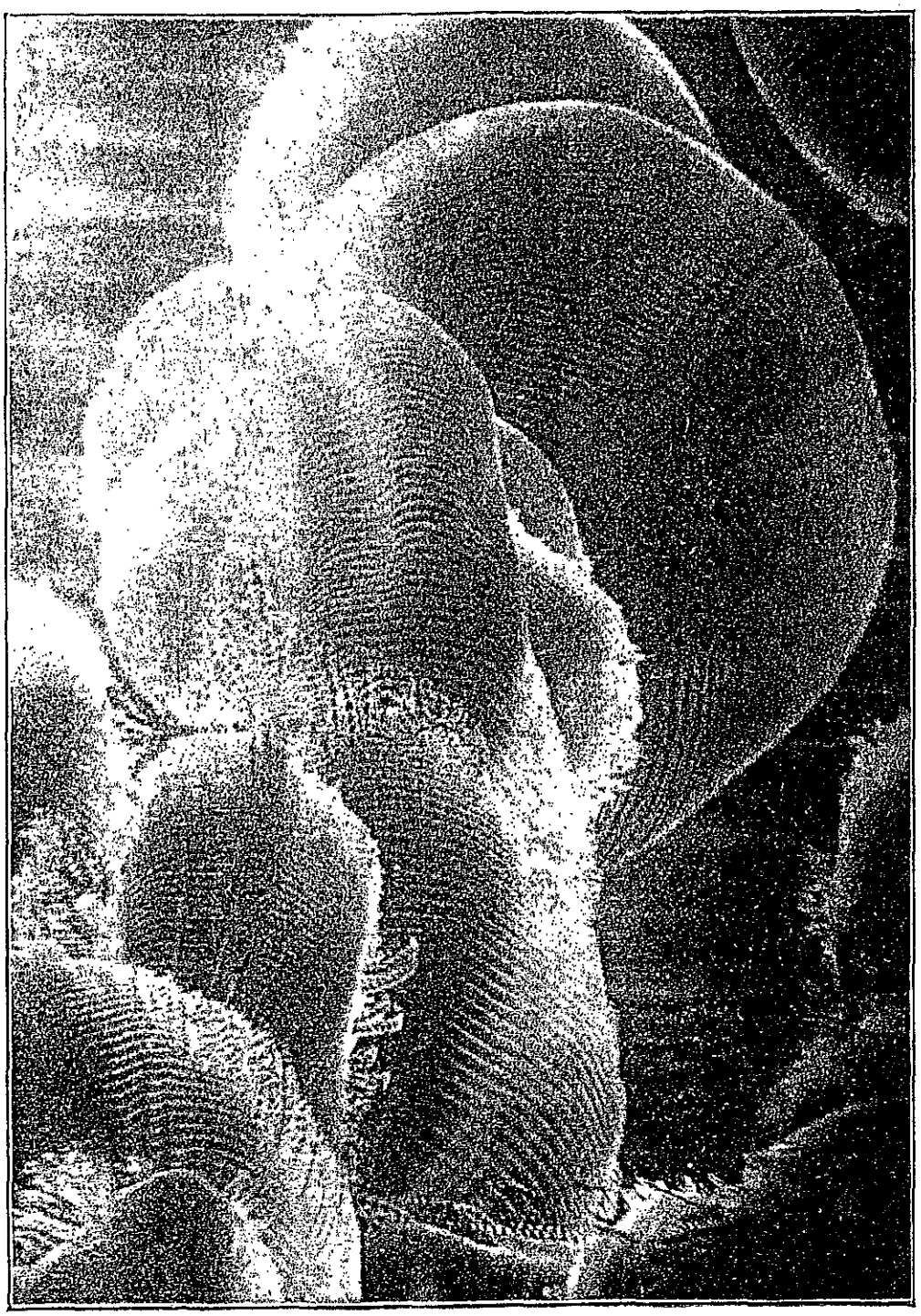


No. 32.

LINEAR CURVES.

(SECOND METHOD.)

On finding the disc capable of recording the line impressions by moving the glass over its surface, I was wishful to see if it were possible to leave the line impressions on the glass by bringing the membrane into contact with the plate from above. After much practice I have found this reversed order in the operations to be more satisfactory than the



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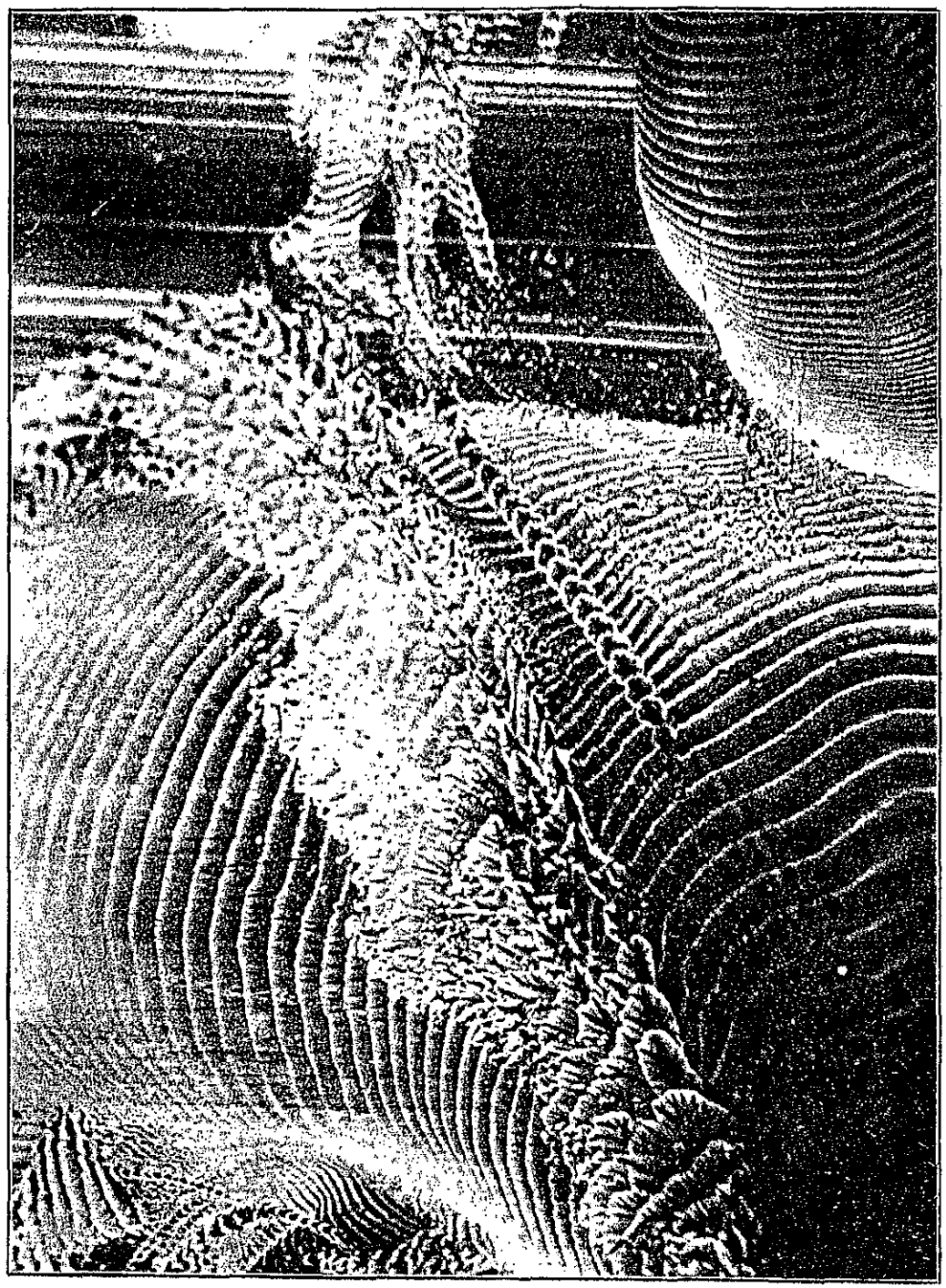

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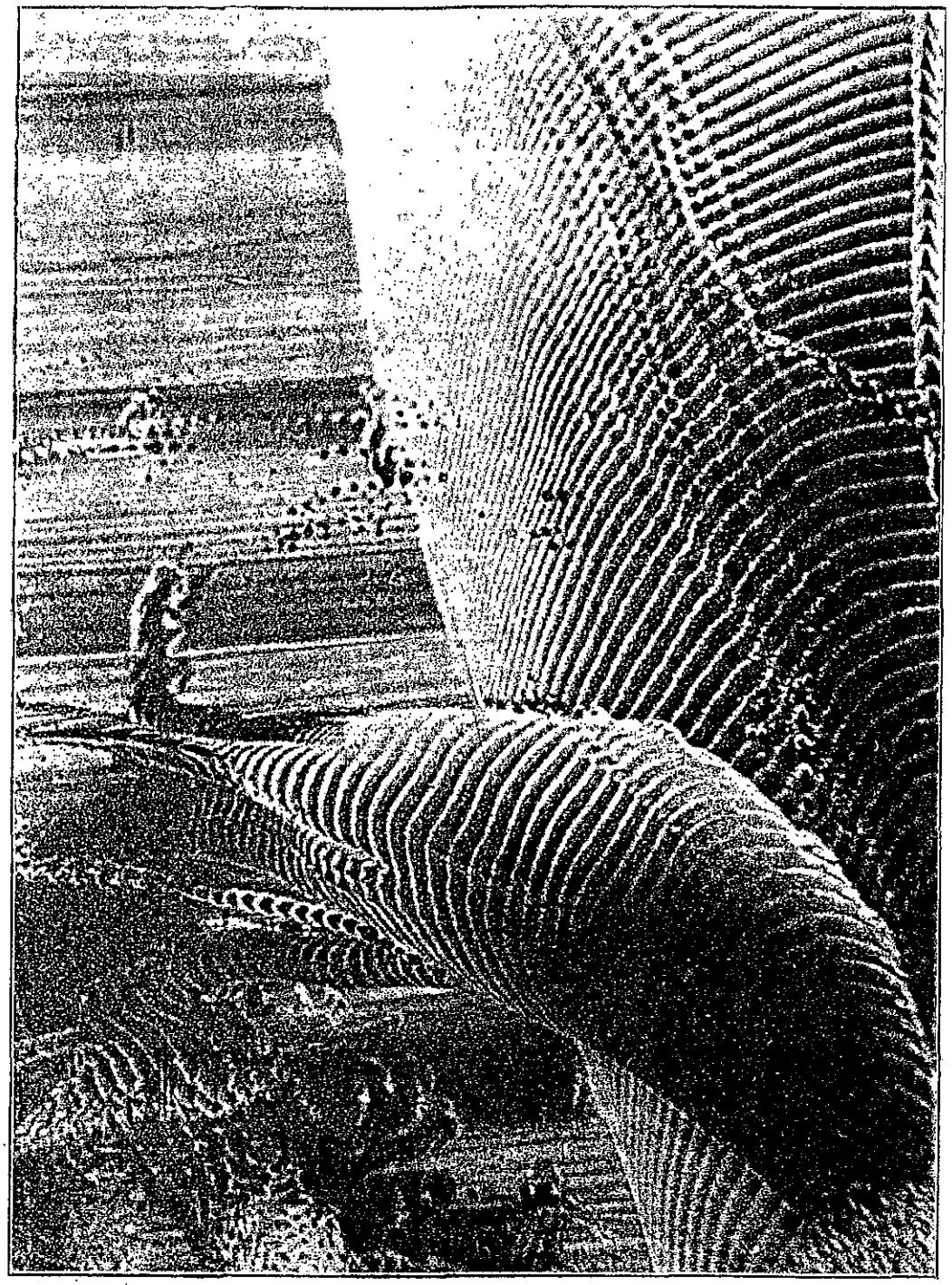
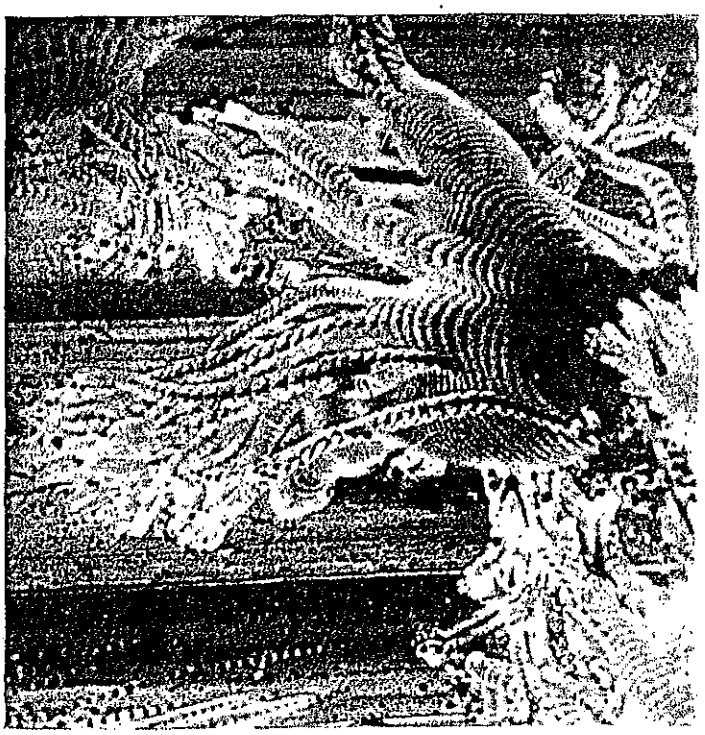


No. 35.

former, and that the hand Eidophone has become indispensable in producing these interesting figures.

The plate and disc being both coated as before, the plate is laid upon the table, the wet colour side uppermost. The disc is now reversed, set vibrating, and, while vibrating, is moved along the surface of the wet plate. As it glides over the moist surface, while a steady note is sustained, it leaves behind it a register of every vibration, recorded with the strictest accuracy.



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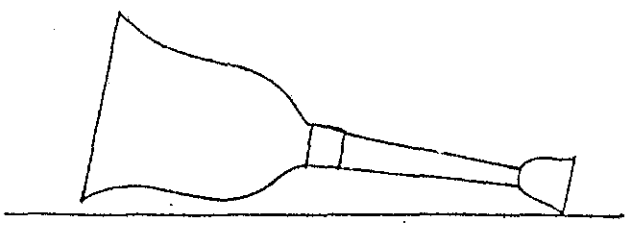
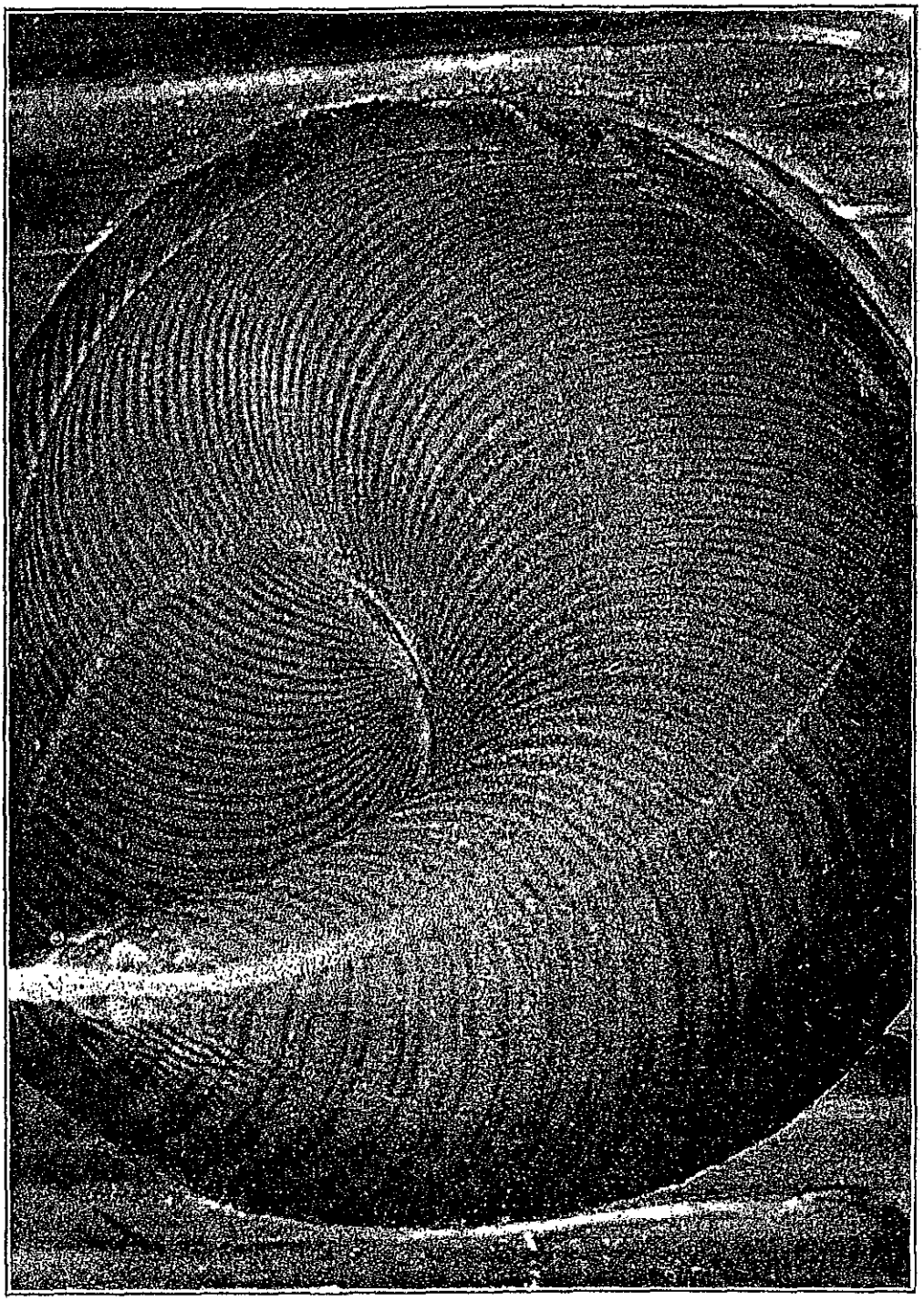


The Hand Eidophone. (No. 37.)

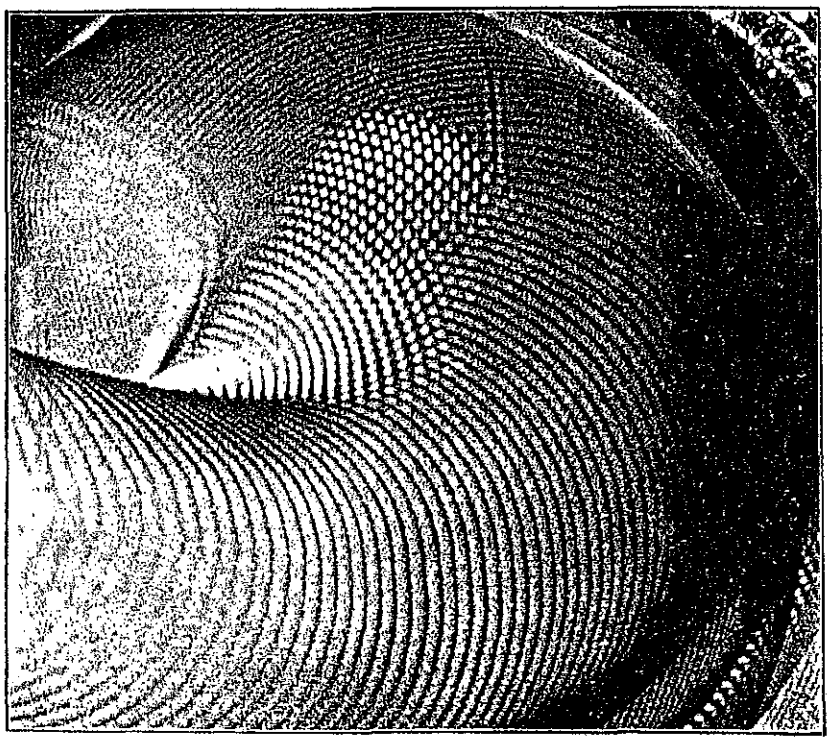
Using this form of the Eidophone, we are able to deal with a much larger plate than could be conveniently held above the disc, and by



No. 38.

passing the disc over the plate in curvilinear directions a much larger figure can be obtained than any straight course would permit. The gradations of shade in these figures are strikingly beautiful, and some curious perspective effects are produced, arising, I presume, from differences of pressure as the disc travels over the plate.

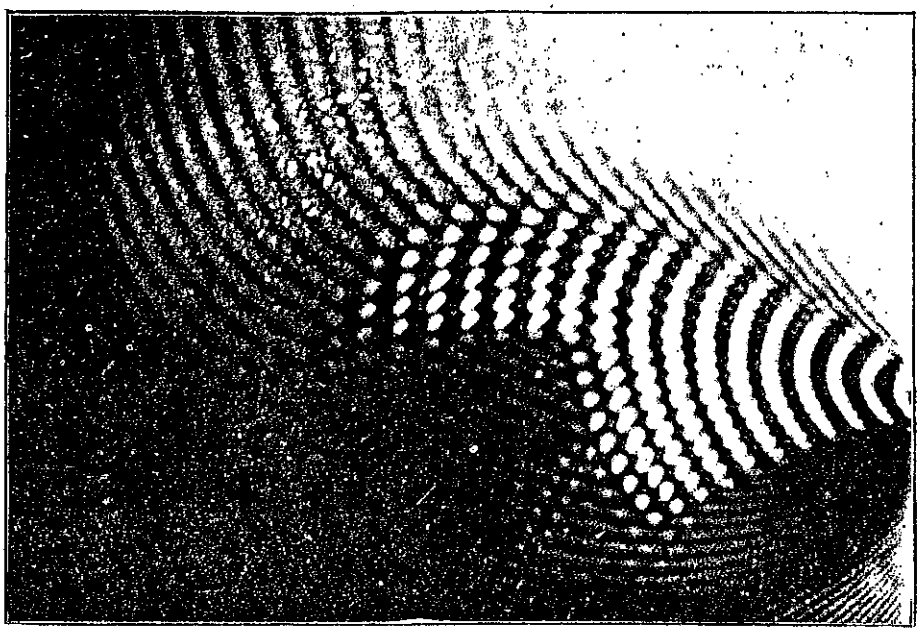
By being careful to move the Eidophone at equal speed over the plate, it is easy in this way to obtain a series of figures giving pictorially, with approximate accuracy, the ratio of vibrations of each note of different pitch. (Nos. 38 and 39.)



No. 39.

Cross Vibrations.

The same method is proceeded with in the production of these figures. The plate of glass, after being coated with colour, is moved lightly over the membrane, and according to the character or condition of the colour, and the quality of the note sung, some interesting forms are produced, specimens of which are seen in Nos. 40 to 44.



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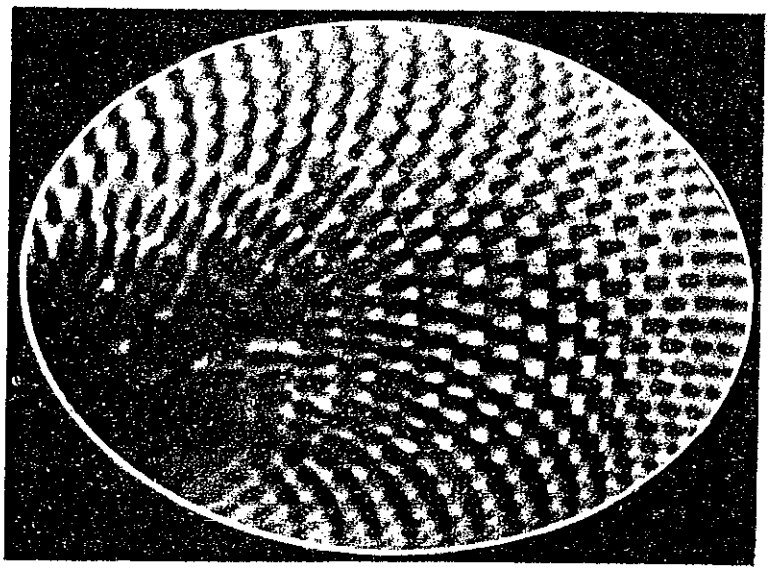

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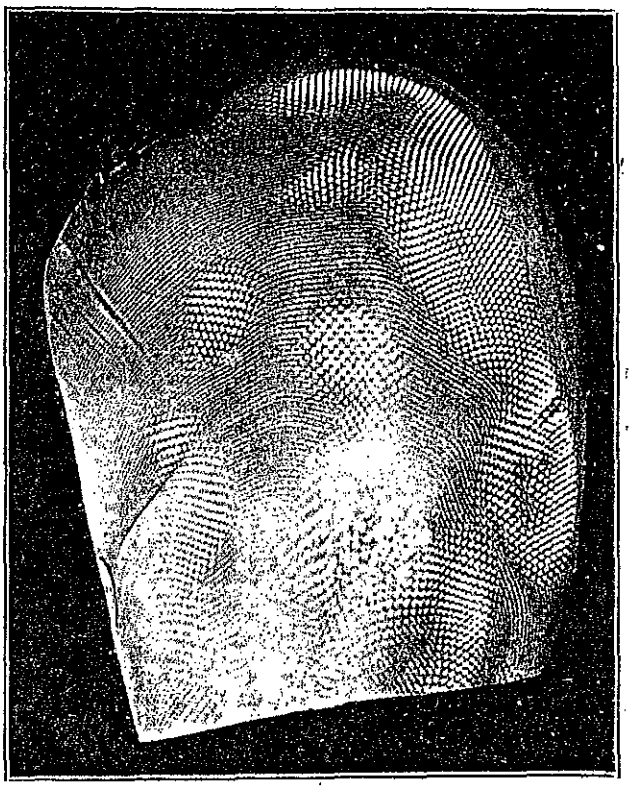

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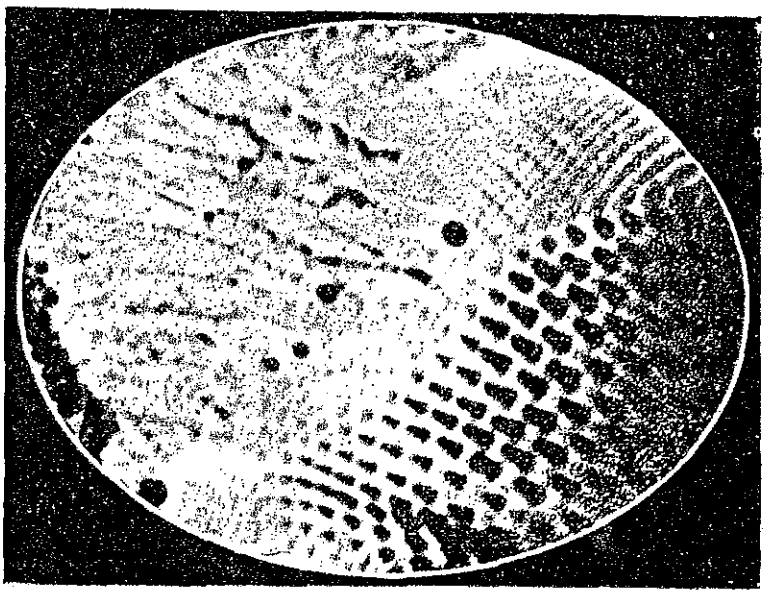

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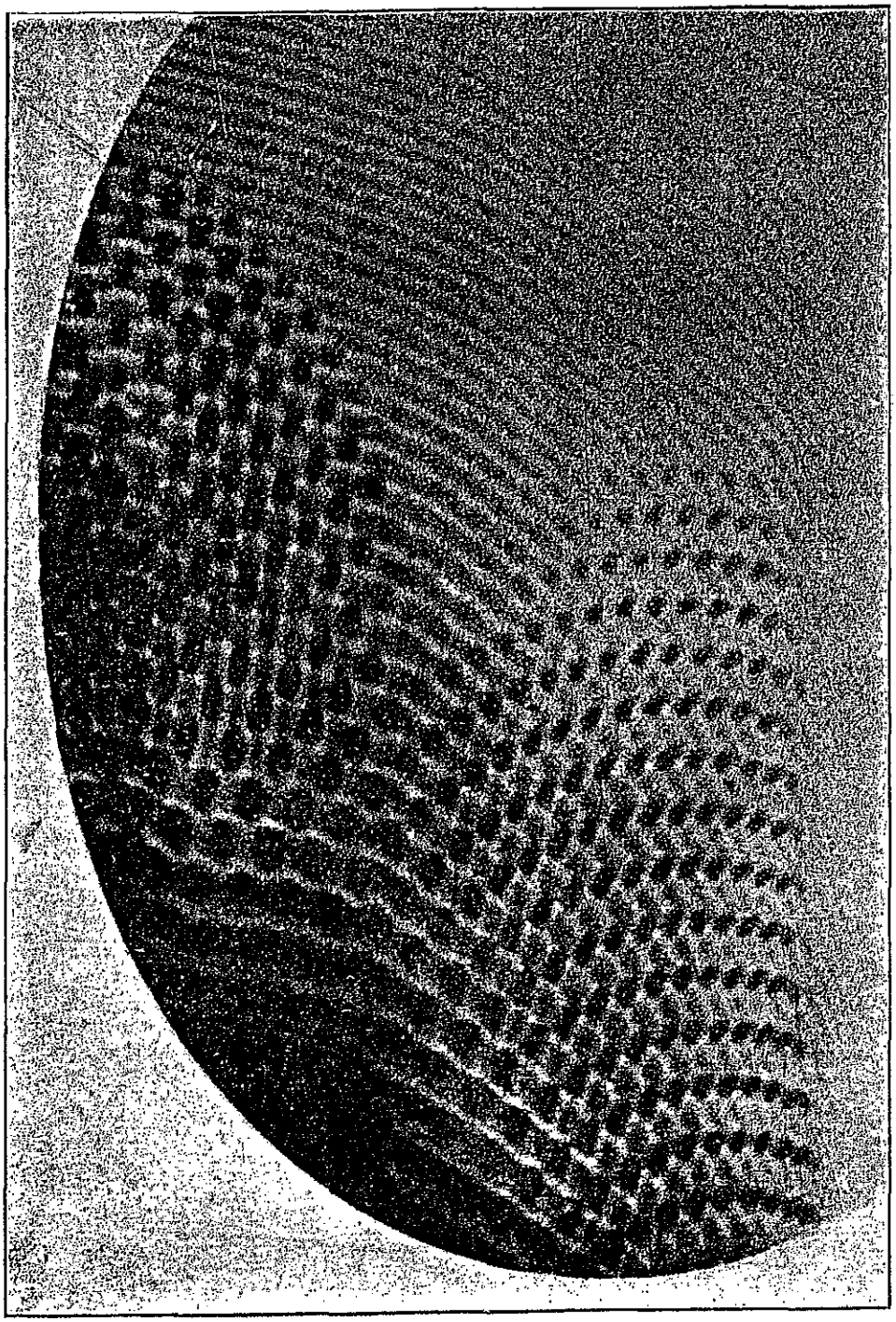
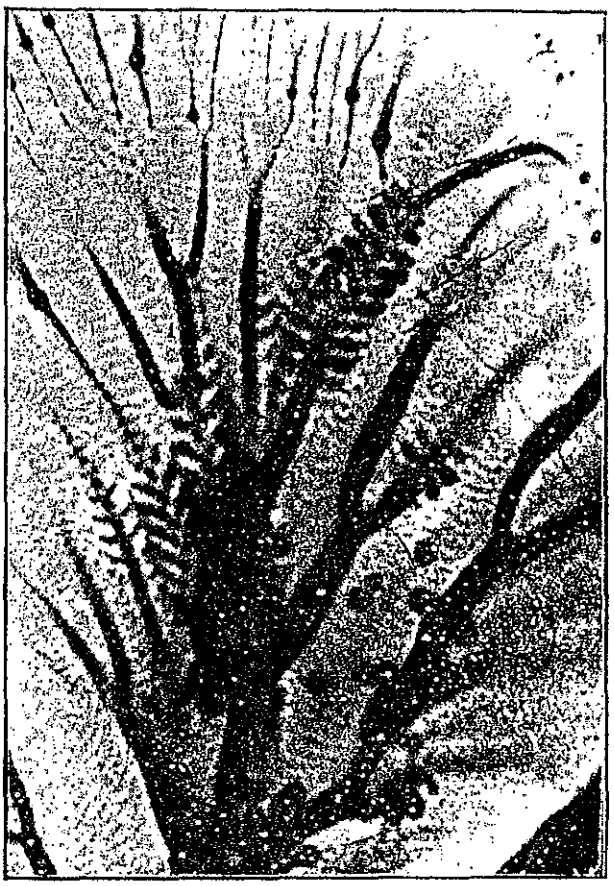


No. 44.

THE HUGH-LLOYD FERN VARIETY.

If the plate be coated afresh with colour in a more liquid condition than that described in the first method of the linear curves, in response to the singing of a powerful note the result will again differ. Here we find an appearance resembling a fern or catkin, the moist colour showing as it were an inclination to arrange itself in a form resembling some vegetable growth. With suitable notes and skilful manipulation a variety of such forms can be produced. (See illustrations Nos. 45 to 52.)



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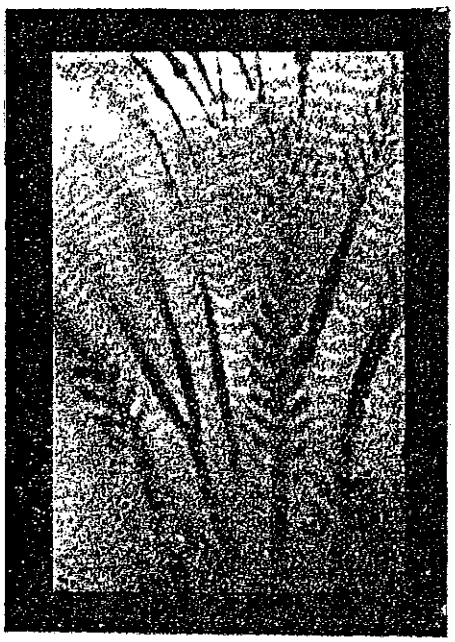

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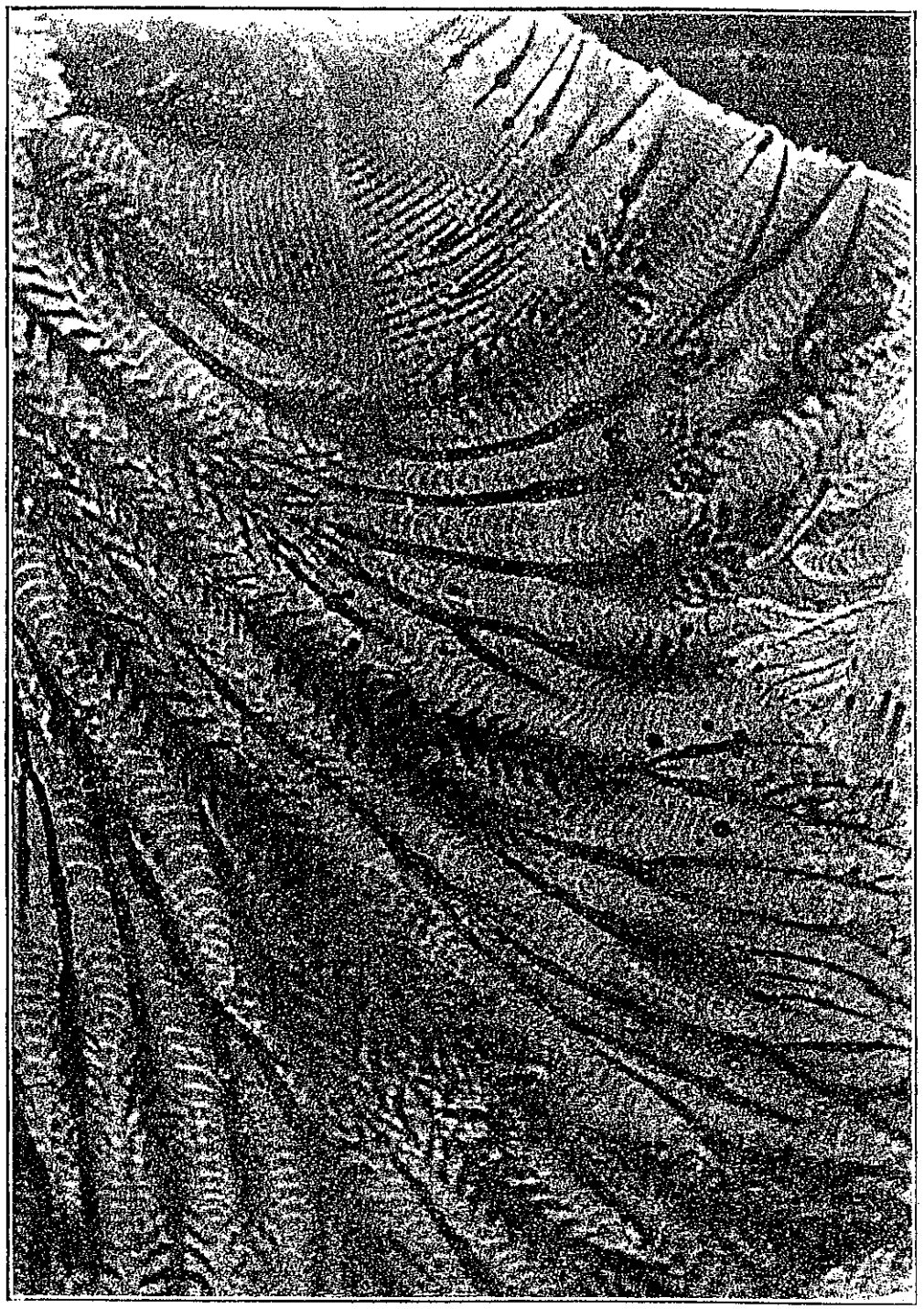

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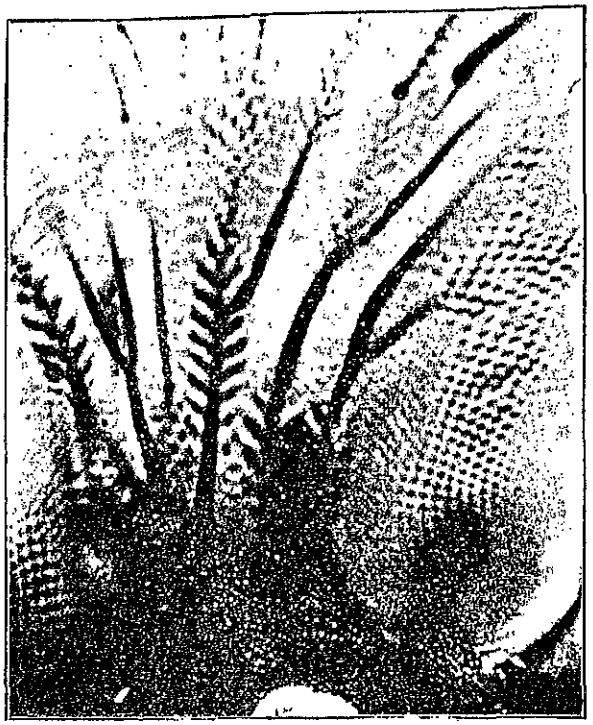


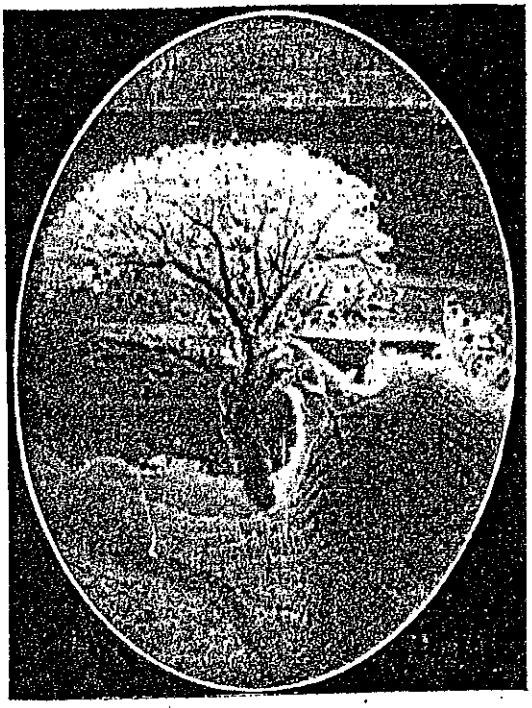
No. 51.

No. 52.

Tree Forms.

Taking now a smaller disc and a smaller plate, and thinly coating these with moist colour in a similar manner, the result of singing into the tube a powerful note of suitable pitch is the instant formation of a figure resembling a tree. (See illustrations Nos. 53 to 56.)

No. 53.



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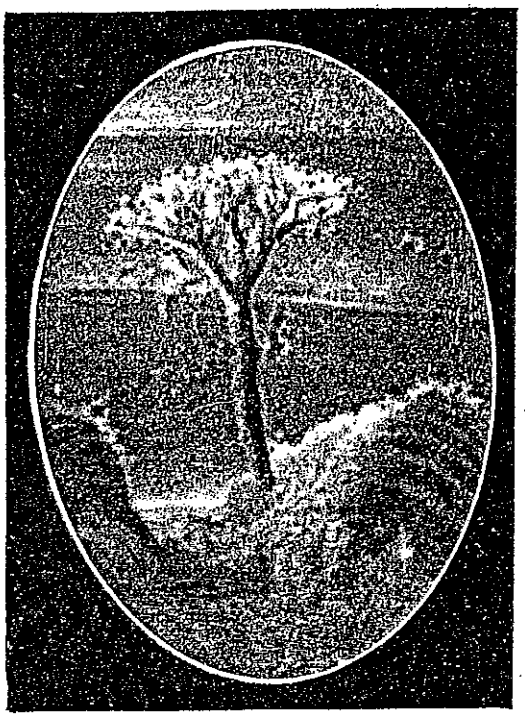

No. 55.

No. 56.

Although these tree forms appear very simple in the mode of their production, they are perhaps the hardest to evoke of all the impression figures, owing to some practical difficulties which can scarcely be explained without experimental demonstration.

This subject, as a whole, is far too wide to be treated here exhaustively, but I have now given an outline sketch of the different classes of Voice Figures that I have been able to produce.

As already said, the principles of their production are quite simple, but, in concluding, I must add that their successful production demands, in addition to such an explanation as given above, very considerable practice in singing, and untiring perseverance in its employment.

MARGARET WATTS-HUGHES.

Appendix C

Sound in Relation to Health

by

Horace Leaf

Sound in Relation to Health.

By Horace Leaf.

IMPORTANCE OF SENSORY IMPRESSIONS.

There are two factors in every experience, namely, a living organism and an object.

The object may be external to the mind, as a table or chair; or it may be in the mind as thought, recollection, or imagination. With few exceptions thought, recollection and imagination have been originally derived from external objects through the physical senses, and thus we know that sensory impressions contribute greatly to our mental states. The things we see, hear, taste, touch, and smell are the foundations on which we build our conscious existence, and they affect us much more than we realise, many of them influencing us subconsciously. This is no doubt why people often dislike others whom they have never seen before and about whom they know nothing, and feel that a certain house or place which they have never before visited is familiar to them, although they are unable to explain the reason. In the past they probably knew a person like the newcomer who displeased them or visited a place or house similar to the present one, but are unable to recall the fact.

Retained but forgotten experiences are the cause of many prejudices and do much towards forming character. Many of them are wilfully forgotten, repressed because they are unpleasant, but they continue their influence in a subtle manner. Dr. Wolf records an instance of this. When travelling to college one morning he saw a gruesome sight which his tutorial duties

quickly forced from his mind. Although he thought no more about it his colleagues noticed he was depressed and asked him the cause. Being a psychologist he carefully thought over the events of the day and recalled the unpleasant experience of the morning. Quite unconsciously the shock had affected his mood to a noticeable degree. Had the accident he witnessed befallen a personal friend or relation it is conceivable that the shock being greater, the effect on his moods would have been greater also.

Repressed ideas can produce extraordinarily bad results. Dr. S—— of Brisbane, relates the case of a young woman who suddenly developed acute eczema which for four years proved obstinate to all ordinary medical treatment, no assignable cause of the malady being discovered. Finally Dr. S—— treated her psycho-analytically and discovered that the disorder was due to a shock she had experienced shortly before the disease appeared. The experience had been so distasteful to her modesty that she repressed it and the normal consciousness quite forgot it, but it worked like a mental cyst in her subconsciousness. The effects of repressions are nearly always pathological because we incline to forget only unpleasant things. Anything which contributes to our happiness we naturally incline to remember.

Sensory impressions often affect us in a more obvious way. One individual cannot eat tomatoes because ten years ago he became bilious through eating too many. The mere sight of them now tends to upset him. Seasickness is often a matter of expectation, and many people having suffered *mal de mer* once feel it return simply by boarding a ship on which they intend to travel. The sight of familiar objects or the smell of a ship's cabin, are sufficient to recall the previous sick-

ness and this reacts unfavourably on the liver and stomach.

Instances such as these are common although their full significance is seldom realised; but they should contribute greatly to our knowledge of human nature and help us better to understand the importance of environment and self-control. The more we know of our power of response to impressions the better we shall be able to adapt ourselves to them and select the kind which will most benefit us.

A good deal of attention has already been paid to vision, the first in importance of our senses, and excellent results have been obtained in experiments in chromopathy. Colours influence mental and emotional states considerably, even mental and nervous disorders responding favourably to carefully selected hues, much in the same way as a bright sunny day affects ordinary people by toning up their moods and increasing their general sense of satisfaction, while a dull wet day depresses them. Much less attention has, however, been paid to the influence of sound although it ranks nearly equal to sight.

A judicious study of sound in relation to intellect, temperament, emotions, moods and health will demonstrate how this form of sensory impression can be used for the general improvement of the individual. In a dim sort of way it has long been recognised as capable of expressing human feelings and reacting on them, and it has, in consequence, entered in an organised form into all phases of life, but little has been done to make us *aware* of its significance in an intellectual way.

SIGNIFICANCE OF SOUNDS.

Sounds may be divided into noises and musical notes. A mere noise is an irregular disturbance, while

a musical note always arises from a source which has a definite regularity of vibration, and which sends equally spaced waves into the air, so that the hearer receives the same number of waves per second whatever the source that produces it. It is this form of sound that is most appealing and important. Few social functions are complete without it because music both expresses the emotions felt and generates the kind desired. It enters into almost every aspect of life, even commerce not being exempt as is shown by the firm position professional musicians hold in civilised communities, and in another way by the introduction of music into restaurants. Military life is never complete without it, a special type of music having been evolved because of its psychological and physical effect, stimulating the desired emotions and energising the body.

Oratory is as much a matter of sound as of ideas, the voice and manner of speech being important factors. One man's delivery of the same words often produces a very different effect from another's because of the quality of tone and manner of expression. The effect produced on audiences by emotional speakers devoid of depth and lucidity of thought is well known. The decline of Ancient Greece has been ascribed partly to this cause.

No religion appears to be without some form of music although it may consist of nothing more than a monotonous drone or the rapping of a drum. Anyone who has heard the peculiar rhythmical beating of drums common to most primitive races at religious ceremonies and in the East, knows what a peculiar psycholgical effect this produces even in an unbelieving mind. Sacred music is another example of the relationship of tone, rhythm, and musical form, to intellectual and emotional states. The kind of music required differs

markedly from social and military music, and its effect is equally obvious. All religious revivals seem dependent to a considerable degree upon music, a fact realised by great evangelists. Moody's preaching would not have been so effective without Sankey's singing. All great religious leaders have regarded music as indispensable to success.

In the same way that musical tones energise the "soul" they likewise energise the body. Primitive races have always appreciated this. The Maoris when working in the fields with their primitive wooden implements acted in a way common to other primitive races; they sang and worked in rhythm as this made work easier and production correspondingly better on the same principle that sailors sing when hauling a rope. The beneficial effect has been noticed among modern manual labourers. Recently in London during the demolition of a large building the contractors engaged a band to play appropriate tunes for a whole day within the hearing of the workmen. The music so stimulated the men that it was found the amount of work done on that day was greatly in excess of any other corresponding period. It has been proved that if pupils learning typewriting practise to the tune of a gramophone they acquire speed more quickly and produce better results.

The study of sound in relation to primitive races is highly instructive and makes one wonder whether in the course of development civilisation has not lost some important secrets which may one day be found again. To suppose that progress has been accompanied only by success is not justified. While gaining greater mastery over matter, attention has been keenly concentrated on the primary objective, and other things, including certain knowledge concerning sounds, have dropped out of view.

"LAP READING."

In 1924 I had the good fortune to meet in Stockholm Mr. Karl Tiren, the greatest authority on the manners, customs and beliefs of the Laplanders, and was enabled to get a good insight into the psychology and religious practices of those interesting people. Mr. Tiren has lived among them for many years and won a unique place in their confidence, for they came to regard him as one of themselves and revealed to him many of their most sacred and secret beliefs, even initiating him into their magical rites. He is the only white "Shaman," as they made him a priest. This is extraordinary as, in common with other primitive races, they jealously hide their religious ceremonies from the unsympathetic white man; but for Karl Tiren we should be almost entirely ignorant of the religious beliefs and practices of Laplanders. No foreigner has ever before been taken into their confidence like this charming man. Out of sheer admiration and affection they initiated him into their mysteries. So strange are some of these that Mr. Tiren has decided they shall not all become public property until after his death. He informed me that he considered it would be useless to broadcast them at present as no good would come of the revelation.

Centuries ago Laplanders were noted for their magical powers, their repute extending over Europe. That was why Ivan the Terrible of Russia sent to Lapland for magicians to explain the cause of a comet; and why Eric Blood-axe, son of Harold Haarfagen, found, when he visited Bjarmaland in 922, Gunhild, the daughter of Asur Tote, living among them. She had been sent there by her father to be trained in magic.

Karl Tiren is to be congratulated on the valuable work he has done in giving us an idea of the psychological and ethical standards of the Laps. They are

not only almost without guile, but actually possess powers which might well be called magical. "I agree," he assured me, "that a good deal which is capable of natural explanation has been surrounded by Laplanders with superstition, but it is their sincere belief and they do not mean to deceive."

"Do you think," I asked, "that the so-called natural explanation is the correct one?"

He confessed he did not, in the sense of the popular meaning attached to the term "natural," but the meaning could be considerably extended. Their mysterious power to heal physical disorders by sound is an example.

What is known as "Lap-reading" is practised throughout Norway and Sweden, even in big centres like Oslo and Stockholm. The practice is based on the Laplander's belief that every condition of body and mind is related to certain sounds or words. These words are believed to invoke the aid of powers independent of the patient and thus restore the desired health. I made the acquaintance of a number of highly educated men and women who had benefited by the practice. Mr. Loev, a well known Swedish engineer and inventor, assured me that he had been instantly relieved from most severe pain arising from a terrible scalding, simply by a woman Lap-reading to him. Karl Tiren is the possessor of some of these remarkable phrases and has found them work successfully. He knows also the form in which they must be applied, for in addition to the utterance of each particular formula, a certain manner of touching the patient's body is often introduced.

Massage sometimes plays a part. Mr. Tiren once severely injured his thumb and applied to a Lap-reader for treatment. The man intimated that he would like to be alone with the patient, took him into a wood and then commenced delicately massaging the injured

member. After a while he began to Lap-read in a low tone, blowing gently upon the thumb, and in a short time all pain ceased and the injury quickly healed. This man was not a Shaman and was therefore in possession of only a limited number of sound formulae.

This practice is to be found among other primitive races, including the Veddahs of Ceylon. Their witch-doctors, or Vedaralas, often perform "magical" cures "beyond the skill of white men." These doctors are neither mystics nor magicians. They live a life of study and research, and add to the stock of medical skill and knowledge handed down to them from their predecessors. When applying remedies to their patients they hum little melodies which are definite parts of the treatment.

Lap-reading when performed by the Shaman, or Noaide, is very remarkable. By means of it the blood-stream can be immediately affected, as Karl Tiren has proved. The effectiveness of the formula for stopping blood flowing from open arteries has been successfully demonstrated on various occasions. One evening, news was brought to Tiren that a man had had his arm torn off in a railway accident. Doctors had been sent for but would be unable to arrive in time to save the victim who must have died in a few minutes through loss of blood. Mr. Tiren rushed to the spot where the man lay, arriving just in time to see him turn up his eyes and his lids drop, and saw that the arm had been torn off from the shoulder, the blood pumping out from an exposed artery. Placing his hand in the approved fashion on the man's spine, he uttered the Lap-reading formula, and to the astonishment of all present, including himself, the hæmorrhage stopped and the patient opened his eyes and gasped, "The pain has gone. I feel better." When the doctors arrived they were

astounded to find the man still alive, the severed arteries and veins being exposed but no blood escaping from them! They admitted that had they not seen it, they would not have believed such a thing possible.

On another occasion Karl Tiren was called to help a woman injured by an Elk horn which had inflicted a terrible wound by penetrating the upper part of the forearm, descending to the hand. The poor creature was in a terrible state and losing a great deal of blood. The hæmorrhage and pain ceased immediately Tiren Lap-read. The stopping of blood flowing out from an open artery is regarded as impossible from the ordinary physiological point of view.

That suggestion plays some part in the cures made by Lap-reading Mr. Tiren admitted, as he had seen remarkable healing produced when words other than the prescribed formulae were used, the patient believing them to be correct Lap-reading. There remains, however, the interesting fact that, on the whole, the correct formula is usually more successful than any other combination of words, even when the patient is ignorant of the proper formulae; while some cures well within the province of Lap-reading are unlikely to respond to unaided suggestion. Another interesting feature is that some are better able to apply the treatment than others, even among Shaman, some of whom are noted for their healing skill and much sought after in consequence. The Laps attribute this success partly to the quality or tone of voice possessed by the Noaide, enabling him to produce more correctly than others the *sounds* appropriate to the cure, in much the same way as famous actors or singers affect their audience deeply by the timbre and modulation of their voices.

The basis of Lap-reading, according to Shamanism, is to be found in a certain little known fact in nature.

Everything, it is maintained, has a relation to sound which varies with its state and age, and whoever can produce these sounds is enabled to influence and even control the object. Thus grass, trees, rivers, mountains, lakes, animals, and human beings each have appropriate sounds related to them in this occult way. Karl Tiren has studied this aspect of Shamanism closely and gave me a private demonstration of these beautiful melodies and *harmonies*; for they are nothing less. There was the harmony relating to birch trees, to single peaked mountains, double peaked mountains, a person in sorrow, a dying dog, and many others: sweet, plaintive, powerful, commanding, all of them revealing a wonderful sense of natural concord. To the Laplander they are but fragments from the great symphony of nature, which in its entirety is a harmonious whole. These combinations of sounds, virtually, *leit motifs*, have for these children of nature a spiritual significance, for they believe that in addition to belonging to the scheme of visible things they are related to invisible which, by means of these harmonious melodies, can be recruited to the service of mankind, to create, renew, and destroy.

PRIMACY OF MENTAL STATES.

Life is, of course, related to the invisible world. The tendency of fifty years ago to regard mind as a product of matter and to attach chief importance to phsyiological states has been checked. We now realise that although there are probably physiological aspects to all psychological states, mind is the primary factor, for no psychological condition can be explained satisfactorily in terms of matter. To attempt to explain life, mind, and intellect as due to vibrations, molecular motions, and nervous and cerebral changes does little

more than suggest the mechanism through which life works; to regard them as adequate explanations of thought, feeling, and emotion, is like confusing the engine with the steam or a violin with its music. Philosophers long ago realised this, and concluded that mind and matter are so unlike that the mystery is how they ever came together. Matter has form, weight and dimension; mind appears to be devoid of them. To attempt to define the emotion of love or the idea of justice as oscillations of physical substance soon reveals the inadequacy of the materialistic explanation.

Not even the commonest of mental functions can be expressed in physiological terms. There never has been found an efficient materialistic theory to account for the mental span, i.e., how many things we can cognise at the same time; the apprehension of experience, or the immediate knowing of the characters of experience; the recognition of relations and of correlates, all of which enter into the perception of nearly every experience that occurs to us.

There is much more reason for believing that mind can act independently of the body than that the body can act independently of the mind. Mental quiescence is accompanied by a corresponding physical inactivity; in sleep the body's activities are greatly reduced; the application of an anaesthetic, deepening the lethargy of the mind, advances still further into inactive bodily states; while the total withdrawal of consciousness at death is followed by a complete break up of the physical organism. Telepathy, which proves the possibility of transmitting thoughts, emotions, and physical sensations from one mind to another independently of the recognised channels of sense, affords scientific evidence of the power of mind to overcome the natural limitations of the body, while the occasional phenomenon known as

the "transposition of senses" appears to reveal the mastery it can exert over the physical senses.

There is reason for supposing that instead of the body making the mind, the reverse is true. Certain facts indicate that the soul has woven around itself the physical body which every desire and thought probably modifies. The poet Spenser seems to have intuitively realised this when he wrote:—

"For of the soul the body form doth take
And soul is form and doth the body make."

It is certain that the mind maintains the body after birth, sustaining the important functions of breathing, circulation and metabolism.

The growing realisation of the supremacy of mind is one of the most important features of the present age and is influencing mankind beneficially in numerous ways, principally in connection with self-culture and the maintenance of health. We know now that mental states influence physical condition; that one may feel well because he thinks he is well, and ill for no other reason than he thinks he is ill. In some instances where the mental outlook has been profoundly altered the general effect has been so remarkable that one is tempted to say that if you change the mind you change the world.

Probably every mental state reacts on the body. Psycho-physiology is replete with examples that only close scientific analysis can reveal. It has been proved, for instance, that extreme emotions release adrenin, which in turn liberates sugar stored up in the liver, and glycosuria results. Even the effects of word reactions have been traced by the following method. A few drops of blood are taken from two individuals who are then placed each in a different room. One of them does a certain act about which the other knows nothing, and

they then return to the experimental room. The experimenter has to discover who did the action, and for this purpose takes a few drops more blood from the two men and then determines the percentage of blood sugar in the four specimens. The blood taken from the individual after he has committed the act shows an increase of blood-sugar.

PHYSICAL IMPORTANCE OF SOUND.

Experiences which involve direct physical as well as mental effects are liable to produce more powerful reactions than those which are mental only. Sound belongs to the former category, as, in addition to giving rise to the sensation of hearing, it exerts a physical pressure which, if very strong, may produce disastrous results. This is owing to sound waves being composed of air. They exert pressure on any surface on which they impinge. With very loud explosive sounds the normal velocity and consequent pressure are considerably exceeded, and may become destructive. This was frequently demonstrated during the war when, not only were auditory organs shattered, but unfortunately the whole body experienced the effects of the shock. It is difficult for people with normal hearing to appreciate the significance of sound pressure, but some very deaf people can "feel" and distinguish sounds one from another by their different vibration rates.

A famous male toe-dancer is a striking example of this. Nightly this uncanny dancer spins, pirouettes and whirls madly through his amazing dances in perfect synchronisation with the orchestra, yet he can neither hear nor speak—he is totally deaf and dumb. The most sensitive musician, it is said, has not a "keener ear for music" than this afflicted man. In a way almost incomprehensible to anyone with hearing he is

able to receive air vibrations from the orchestra, and if the time is ever so little out he knows at once. But the air vibrations mean more to him. He never misses a bar of the tune. Merely by placing his hand on a piano when it is being played he can receive through the nerves of his fingers the music it produces.

In that way he can tell discord from harmony as surely as a trained pianist. It is said that the only time he was really angry was when the orchestra played out of tune, and he stopped dancing because of it. In hyperæsthesia of the auditory nerve the over-sensitive person may feel the shock of sound waves as distinct from the sensation of hearing.

The Laplander is, therefore, not without good reason for attaching importance to the effect of sound on the body through the mind, and the direct effect of sound waves. Similar ideas have been held by races as far removed from the Laplanders as modern Hindus and ancient Hebrews and Egyptians.

Hindus have made a study of the occult, spiritual and physical significance of sound and, as a result, a complex and detailed scheme of sound has grown up in connection with their religion. The yogis devoted to this aspect of their faith claim that a proper understanding and use of sounds, especially when produced by the human voice, will suffice to keep the body in perfect health as well as raise the intellectual tone and induce spiritual ecstasy. One Sanskrit word in particular, Om or Aum, has been adopted throughout Hinduism and practised because of its remarkable effects on mind and body. It is said to be the "manifesting word of God," and the substratum of all sounds.

The first letter, A, is the root sound and is pronounced without touching any part of the tongue or palate; M represents the last sound in the series, being

produced by the closed lips, and the U rolls up from "the very root to the end of the sounding board of the mouth." Thus, Om represents the whole phenomena of sound producing, and is the matrix of all sounds. It denotes the whole range and possibility of words that can be made. The yogi maintains that sound has a natural relationship to the thing or idea it expresses and must not be regarded as accidental, a tendency which springs from there being different words or synonyms to express the same ideas. Just as the same object appears different from different points of view so ideas may be expressed in different sounds, but the sound is always in orderly relation to the idea. The study of philology supports this notion. Each word has its own vibration rate which not only affects the air, but the speaker also. If you put your hand on your chest while speaking, the vibration can be distinctly felt, and it passes through the entire body as concentric rings develop on the surface of a pond after a stone has been thrown into it.

The repetition of Aum is partly to set up a regular vibration through the body, and partly to occupy the mind with good thoughts, for with the utterance of the word *its meaning* must be attended to. These are essential to yoga, which is said to be a scientific and practical method of attaining truth.

Unhealthy people cannot be yogis; perfect repose of body and mind are first necessary, and these can come by the careful practice of the science of sound. An Indian ascetic may give up the study of almost everything else except the meditation of Om, the root of the tree of the Vedas and its essence. By this means he may become united with Brahman. As with the Laplander the use of appropriate words is essential to the performance of magic, preparation of all magical rites being

accompanied by certain mantras—combinations of words —and Om. Even Jainism and Buddhism have adopted the same idea, their adherents often using the same words as the Hindus, particularly the word Om, which by repetition they also claim removes all obstacles and brings right knowledge and perfect health.

The pronouncement of Aum is very like a hum, commencing low down the throat and rolling gradually through the nose and mouth, ending on the closed lips. The sound is musical and corresponds with the hum heard outside a busy town, where every variety of sound from the shrill whistle of a train to the broken murmur of children's voices mingle and form one sound. Almost any mixture of natural sounds on a large scale produces it: the soughing of the wind through the trees, the distant roar of the sea, the hum of insect life.

EFFECT OF SOUND ON INANIMATE OBJECTS.

In the Bible there are references to the effect of sound on human beings and inanimate objects. David is said to have cured Saul of a mental disorder by playing on a harp. An even more remarkable case is the destruction of the walls of Jericho by the power of sound. The story reveals a carefully devised plan for capturing a city which seems to have been too strong to be taken by ordinary methods of assault. Priests were commanded to blow on trumpets for several days on and off, and on the seventh day the people were to join in by shouting: "And it came to pass on the seventh day, that they rose early, about the dawning of the day, and compassed the city after the same manner seven times. . . . And it came to pass at the seventh time, when the priests blew with the trumpets, Joshua said unto the people, Shout. . . When the people heard the

sound of the trumpets, and shouted with a great shout, the walls fell down flat.''

There is a scientific basis to this story which brings it quite within the realm of possibility. Sound requires a material medium through which to travel. Air is usually the medium, but it can also travel through solids and liquids. This fact may be easily realised by placing the ear against a table and scratching the wood at some distance, or by keeping both ears under water in a bath and tapping the side of the bath. In both instances the loudness of the sound will be found to be intensified. Solids and liquids also inhibit sound and reflect it. When a sound meets a surface separating two different media it is in part reflected, travelling back from the surface into the first medium again with the velocity with which it approached. Echo is an example of this. In large halls the words of the speaker are echoed or reflected from the walls or roof or floor, and the reflected sounds of spoken words follow the direct sounds at such intervals that syllables and words overlap.

Flames and jets of water give excellent proof of the effect of sound on tangible objects. When a flame is just not flaring, any one of a certain range of notes sounded near it may make it flare while the note is sounding. If a piece of fine wire gauze is put above a pin hole gas-burner and the gas is ignited above the gauze, on adjusting the gas so that it burns in a thin column, just not roaring, it will be found extraordinarily sensitive to some particular range of notes, going down and roaring when a note is sounded. The flame of an incandescent gas-mantle if turned low is frequently sensitive to a certain range of notes, and it may be made to jump up and down to the tick of a neighbouring clock.

If a jet of water under a few inches pressure issues at an angle to the horizontal from a round pin-hole orifice it travels as an apparently smooth cylinder for a short distance, and then breaks up into drops which travel at different rates, collide and scatter. But if a tuning-fork of appropriate frequency be set vibrating with its stalk in contact with the holder of the pipe from which the jet issues, the water appears to go over in one continuous thread. Close examination, however, will show that the jet is really broken up into drops, one for each vibration, and that these move in a regular procession.

A still more striking example of the influence of sound on matter is the well-known acoustical experiment of breaking a wine-glass with the human voice. The natural note or vibration number of the glass having been ascertained, someone with a powerful voice leans over and sings the same note strongly. The effect of the accumulated impulses will often cause the glass to break. The voice is said to possess the same natural time period as the glass. If the voice of one person can break a wine-glass it is conceivable that a shout in unison by tens of thousands of people of the right vibration number or natural note, might cause a wall to fall down.

Stonehenge affords an instance in support of this. A certain stone at Stonehenge was found to be sensitive to vibration and warning notices were posted up forbidding sudden noises to be made in its vicinity. A military officer disregarding this warning, fired his pistol, whereupon the whole mass, weighing several tons, fell to the ground, and had to be replaced at the officer's expense. Another well-known instance is that of the roof of the Albert Hall, London, the metal frame work of which is bolted together with large tie-

rods, some of which tend to become loosened by unscrewing of nuts as the result of resonance in sympathy with certain notes of the organ. At regular intervals these nuts have to be tightened up. If they were locked into position it is anticipated that the destructive resonance might be transferred to some other portion of the structure and for this reason it is not done.

The principle is recognised in connection with suspension bridges which have natural periods of vibration, and because of this, columns of soldiers are always ordered to break step when marching across them, as there is a possibility of the regular impulses approximating to the natural period of the bridge and thus causing damage. It has been suggested by authorities that this phenomenon of resonance might have been the cause of inexplicable losses of vessels at sea where it is known that they did not encounter bad weather. One has only to assume that the vessel broke her propeller or in some way became unable to steer, and that she was caught broadside by a swell having a period equal to the natural period of the ship. The ship would gradually oscillate more and more until it would capsize. Professor Perry in his book, "Steam Engines," mentions how a young engineer on receiving a complaint from a householder regarding the excessive vibration of a certain room in a house due to the traffic of a near railway, contrived to give the room another vibration number by moving slightly a heavy piece of furniture—an easier solution than making alterations to a railway track.

The war revealed how terribly destructive high explosives could be in relation to the terrific sound they cause apart from the projectile, shattering objects a considerable distance off, leaving objects much nearer untouched. The firing of a gun at a distance will often

make windows rattle and even break them. The registering of sound waves is rendered possible by the power of sound to make impressions on sensitive surfaces. Paper, parchment, or any other thin membrane stretched over a square, circular, or other frame, when in the vicinity of a sufficiently vibrating body will, through sound, be itself made to vibrate in unison, and by sprinkling sand lightly over it, the sand will form into patterns or figures varying in shape, number, and position with the pitch of the sound. The wax disc of the gramophone is made on this principle. The drum of the ear in like manner repeats the vibrations of the external air which it communicates to the internal ear and thence by means of the auditory nerve to the brain.

It is possible that Joshua knew something of the mechanical nature of sound and applied his knowledge to the destruction of Jericho. He may have obtained his information from Moses who, the Bible informs us, "was learned in all the wisdom of the Egyptians and was mighty in words," for by laying his hands on Joshua he is said to have made him "full of the spirit of wisdom." This may be taken as the scriptural way of saying Moses taught Joshua some of the things he had learnt from the Egyptian priesthood, who attached extraordinary importance to sounds and words. They had, according to their own religious texts, a "Lord of divine words," and the priests possessed "mighty words of power." By means of these words "faults and defects" of body were cured and even the dead restored to life. We have no need to accept such a miracle as the latter, but this far-fetched claim conveys an idea of the tremendous importance they attached to sound in relation to health.

In common with the Hebrews the Egyptians attri-

buted the creation of the world to God's word, the utterance of which caused the world to spring into being. "What His heart conceived came to pass straightway, and when He had spoken His word came to pass." He made His voice to sound, and the deities came into being, the gods sprang into existence after He had spoken. In this way He formed mankind also. With that charming disregard of logic which characterises all theologies, the ancient Egyptians make the First Cause bring Himself into existence by a sound: "I uttered my own name, as a word of power, and I straightway evolved myself."

Ra, the Sun-god, was supposed to have been evolved from the "primeval abyss of water" by the agency of the god Khepera, who brought this about by pronouncing his own name. Certain words were supposed to exert a protective power, a belief still widely held. Most races have their prayers and incantations, certain combinations of words which are usually of more importance than the ideas they express. Christianity is not exempt from this notion. How else shall we account for the insistence with which priests utter certain prayers and services in Latin when they know their congregation do not understand that language? Obviously the prevailing idea is that words or sounds are as important as their meaning, and of themselves capable of producing the desired effect.

Persistence among the Jews of the occult significance of sound is found in the opening sentence of St. John's gospel: "In the beginning was the Word and the Word was with God, and the Word was God."

DIFFERENT EFFECTS OF MUSIC.

There is ample evidence in common experience of the power of musical sounds and noises to influence

human beings; and to influence them differently. The same sounds will make one individual "hot" and another "cold." Some people are so affected by some music that they "shiver" from their feet upwards while others "shiver" from their heads downwards. Emotional disturbances are often as divergent, one person being moved to tears, a second excited, a third unaffected by the same music. Noises similarly produce varied results. A creaking door will irritate some people beyond endurance, inhibiting thought until the nuisance ceases; others will not be annoyed or even disturbed. Regular tapping sounds will cause some to fall into a normal sleep, some into hypnotic sleep, while others will be unaffected.

The energising power of martial music is well-known. A regiment of soldiers exhausted by a long march and too fatigued to go much farther will, on the introduction of a band, stiffen their shoulders, lengthen their stride, and appear to become rejuvenated. Many military victories have been made easier by the presence of stimulating notes or music. Marshal Saxe, the famous French general, maintained that the Romans were generally victorious because they were made to march to the beating of a drum, for so potent can such sounds become that even the regular tapping of a drum will invigorate those who hear it.

Dancing affords a striking example of the stimulating effect of rhythmical music. Under the influence of dance music, individuals who feel thoroughly exhausted and too tired to exert themselves will become so energised that they will dance for hours and feel much fresher and stronger at the end.

MUSIC, MIND AND EMOTION.

In every instance if beneficial results are to be

obtained, the music or noise must either correspond with or counter-balance the physical, mental, or emotional states of the individual. The beneficial effect of dancing is mainly dependent on rhythm suitable for harmonious muscular action, just as military and sacred music must be related to the mood, otherwise contrary results may follow. This principle is fundamental in all kinds of music; and it springs naturally from the relationship of sound to human beings. Italians, who are said to be the most musical of all races, have so realised this that even the uneducated apply the rule as, for example, at the funerals of children, when they play cheerful strains because they alleviate sorrow. But the habit is in strict accord with their belief that children who die without sin are better off and joy can in consequence reasonably be expressed even by the bereaved. As the same belief does not exist in the case of deceased adults, such music would be out of harmony with the prevailing sentiments of the mourners, and more solemn music is accordingly played.

SOUND AND HUMAN NEEDS.

There are therefore indications of a science of sound in connection with human requirements, one of which has been somewhat neglected, but may be studied to our lasting benefit. The chief difficulty in the way is the varied and unstable nature of human beings, but it is not insuperable. The medical faculty has had to face the same problem in a different way, and has made progress. The complete solution rests in personal experiment, and a pleasant solution it will doubtless be found to be. To discover what kind of music reacts most favourably upon one's mental and physical states is one of the most delightful tasks that can be undertaken, and

the mere cultivation of musical taste which must result from such experiments will add considerably to one's general "tone."

Nothing is more capable of education than the eye and the ear for the perception of the beautiful in form and sound. It is a mistake to think that men have learned to appreciate the beauties of music as they have learned to appreciate heat and cold. This is just what marks the difference between sensation and the sentiment of the beautiful, for men do not *learn* to appreciate heat and cold; they are appreciated as soon as felt. It would, however, require an audience of musicians to appreciate Bach, or other great composers. Therefore, the cultivation of musical taste involves an important step in the unfoldment of our higher qualities.

"PERSONAL EQUATION."

The necessity for personal experiment arises from the fact that each individual appears to have his own "natural tone" or "vibration number," which cannot however be regarded as a single period as in the case of a wine-glass or a suspension bridge. It is probably as complex in comparison as is the human being when compared with inanimate objects. Our natural equipment of instincts, tendencies, and capacities, linked up with experience, emotions, sentiments, temperament, disposition and moods make up a formidable array of complex factors; but we must not forget that these qualities are not isolated, but are only arbitrary divisions of a central unit, that in its ultimate nature our consciousness is a single thing. Even if we cannot find a complete solution to the problem of sound in relation to health, we can partly solve the problem.

The individual vibration number is evidently complex and varies with moods and health, but over all

will be a principal note to which each one particularly responds. This is shown by people responding to particular scales and different classes of music. Some people prefer oratorio, others operatic music; some instrumental, others vocal; but no matter how widely tastes may differ there is always something personal in the response, and in all such cases the effect is good if only because it affords gratification and through that reacts on the body. Change by growth or by degeneration of musical taste occurs constantly, an important and instructive fact which should be noted. It will be found that such changes correspond with other alterations of mentality, taste, or even disposition and temperament, and the physical organism is influenced accordingly.

"Personal equation" has long been observed in connection with sound and has proved a serious stumbling block to exact observation. When the measurement of a time interval is dependent on an observer, his personal equation affects the estimation of the quantity, i.e., the interval between the arrival of the event and his perception that it has arrived; or it may be between the arrival and his record of the arrival.

The equation differs considerably with different individuals. Because of this, efforts have been made to eliminate it by dispensing with the human element altogether in ordinary scientific experiments. In connection with health, however, the personal equation is not merely a matter of time interval, but one of the most important things to be studied and it has at least three significations —

a. A purely psychological effect.

b. The psychological effect reacts on the body.

A third factor combines with these, namely,

c. Sound has a direct mechanical effect on the body.

The first two factors are fairly obvious, but the third is little understood. All sound is due to waves travelling at various velocities through air or some other medium. These waves are therefore substantial things producing reactions on anything they strike, animate or inanimate. Their velocity, shape, and size have been carefully examined, and it is known that only some of them are registered by the human ear, the limits varying greatly with different individuals. Sounds differ from each other only in the three aspects of loudness, pitch, and quality. Loudness depends on the extent of the to and fro excursion of the air particles; pitch on the degree of rapidity of these vibrations, being "low" or "grave" where they are slow, and "high" or "acute" where they are rapid; quality or timbre, that which differentiates a note sounded on one instrument from the same note on another instrument, appears partly to depend on the amplitude of the wave length.

The effect of sound passing from one medium to another has been measured. When a wave of sound travelling through one medium meets a second medium of a different kind, the vibration of its own particles is communicated to the new medium, so that a wave is excited in the latter and is propagated through it with a velocity dependent on the density and elasticity of the second medium. The direction in which the new wave travels is different from the previous. Thus, sound is reflected towards the perpendicular when passing into air from water, or to carbonic acid gas from the air, and the converse is the case when the passage takes place the opposite way. This law holds good in regard to the human body, doubtless to a considerable extent as it is largely composed of water and other refracting elements.

Deaf people may therefore be able to benefit by being present when suitable music is being played although they may not hear a note.

A PERSON'S "NATURAL VIBRATION" OR "TONE."

Our bodies are always in a state of intense activity owing to atomic motion alone, but through environment and our own voluntary and involuntary activities other movements are introduced. These have a good deal to do with our "natural vibration" or "tone" and cause different sounds and combinations of sounds to affect us differently. This may be largely a matter of wave shape as well as of intensity and of velocity. There is reason for believing that sound waves vary in formation with the nature of their source. The waves from a tuning fork on its resonance box, or from the human voice sounding *oo*, are nearly smooth and symetrical, as in figure 1. Those from a violin are probably as in figure 2. Their reactions on the physical body are doubtless therefore very different with different individuals.

This is probably one of the reasons why even unmusical people nevertheless prefer one musical instrument to another. Musical people show similar preferences, one prefers a wind instrument, another string, and so on; the same piece of music played on different instruments (i.e., piano or organ) will vary in its appeal accordingly.

It is therefore important not only to find the class of

music most helpful for the desired end, but the most suitable kind of instrument or instruments.

What Newman says of music is worth meditating upon:—"Is it possible that the unexhaustible evolution and disposition of notes, so rich and yet so simple, so intricate and yet so regulated, so various and yet so majestic, *should be a mere sound* which is gone and perishes? Can it be that those mysterious stirrings of the heart, and keen emotions and strange yearnings after we know not what, and awful impressions we know not whence, should be wrought in us by what is unsubstantial, and comes and goes, and begins and ends with itself? It is not so; it cannot be. No; they have escaped from some higher sphere; they are the outpourings of eternal harmony in the medium of created sound; they are echoes from our Home; they are the voice of angels, or the Magnificat of saints, or the living laws of Divine Governance, or the *Divine Attributes*; something are they beside themselves, which we cannot compass, which we cannot utter,—though mortal man, and he perhaps not otherwise distinguished above his fellows, has the gift of eliciting them."

The human voice is often best, especially one's own, for singing is undeniably a great tonic; its effects can be almost as invigorating and soothing as sunshine. One of the reasons why it is an ideal tonic to the singer is because of its varied effects. In addition to generating and expressing emotion, and producing sound waves in the air, it produces vibration directly in the body by means of the vocal cords, sending waves throughout the whole organism. Ill-health probably gives rise to inharmonious molecular activity in the parts affected. Repeated exercise of vibrations of a musical character may tend to restore bodily harmony and thus dispel disease.

The remedy is much more pleasant than many orthodox remedies, and is not usually tried because people are unaware of it or lack musical education. Other things being equal, musical people ought to be more healthy than unmusical, particularly if, in addition to frequently listening to music, they themselves play and sing, or do one or the other.

COSMICAL SIGNIFICANCE OF MUSIC.

Music appears to be a partial reflection of a universal language, little understood by mankind because of its cosmical significance. As we know it, it conveys little more than occasional symbols by which a few gifted souls have attempted to give expression to the unutterable beauties which belong to man's superconsciousness and a supersensible world.

Perfect adjustment to *real* music requires a perfectly harmonious self, and a perfectly harmonious self will include perfect health. This superman may exist somewhere in the future; but we may hasten his arrival by adopting the principle: The harmonious soul maintains the body in perfect health. The rule is quite practical, and we may enlist the aid of music, the best earthly symbol of cosmic harmony, to conquer physical and mental ills.

Suggested Exercises.

When performing exercises connected with sound in relation to health, the importance of concentration cannot be overestimated as concentration is essential to the attainment of the deeper aspects of knowledge and self-control. Curative suggestion is a kind of spontaneous act of concentration, usually for a brief period only. Equally good results can be obtained by determined and sustained effort. Hindu ascetics have always attached great significance to concentration when uttering the sacred word Aum, thinking of it as the divine word, the primordial sound containing power to elevate the soul and heal the body and maintain it in good health.

We must turn to Hinduism for information as it appears to be one of the few institutions that have seriously and scientifically studied sound from the health point of view. In India there was a sect called Râsayânas who believed that the body was the only instrument by which ideality, knowledge and spirituality could be attained, and they adopted methods by means of which they thought the body could be maintained in perfect health and never die; included in these methods was the use of certain sounds. There can be no doubt that these people were able to exert a remarkable mastery over their physical organism.

Even the obverse to physical comfort and health illustrates the wonderful power of sound over the body if accompanied by an appropriate mental state, including powerful concentration. Many Hindu and other ascetics have gone to extremes by adopting severe

methods of physical mortification. Sometimes they will stand with their hands above their heads all their lives until these extremities wither and die, or they will stand up day and night until their legs swell and become so stiff that they can no more bend them. I have seen an extraordinary case of leg deformity in India brought on by these mistaken notions, and have marvelled how the agony such practices must cause could be tolerated and the individual survive the ordeal. Hindus claim to have survived by virtue of "the power of sacred words," called Mantrams. There is, they contend, no limit to man's power if he produces the proper sounds under suitable conditions.

We cannot hope to know all the "words of power" these people use, as they regard them as secrets to be revealed only to those who are worthy to tread the "right path;" but one word—Aum, has been made common knowledge.

In undertaking to perform the following suggested exercises it will be advisable, after the Yogi fashion, to meditate on a famous Hindu Mantram called Gayatri, taken from the Vedas:

"We meditate on the glory of the Being who has produced this universe; may he enlighten our minds."

Having done this for a few minutes, concentrate for a similar period on the particular object of the exercise,—the strengthening of a weak chest, the improving of the hearing, purifying of the blood, curing of catarrh, or improving the memory, making stronger the will, and so on; for psychological as well as physical states are amenable to the method. Then sit quite still, with eyes closed for preference, and repeat slowly and forcibly one hundred times the word Aum. The number of repetitions may be increased or decreased

according to the experimenter's discretion, for the practice may be regarded as experimental, requiring careful observation if the best results are to be obtained.

The exercise should be performed alone in a quiet room immediately on rising in the morning and just before retiring at night. In this way benefit will be felt during the day, and at night, during sleep, still greater benefit will accrue.

Another excellent method is to stand in a pure atmosphere and take deep breaths, repeating the word Aum while slowly expelling the air from the lungs. The duration of the exercise is a matter of personal discretion, but it should be gradually prolonged from day to day.

For stimulating the nerves and muscles the march movement will be found effective.

To induce a light care-free mental state and a feeling of simple pleasure accompanied by physical activity dance music should be adopted.

Music is often an excellent aid to digestion, a fact which at least one Continental country has long realised. In Germany music is played during meals for the express purpose of aiding the digestive organs by stimulating a

feeling of satisfaction and encouraging conversation. Agreeable conversation during meals stimulates the salivary glands and "tones" up the body.

Insomnia may be cured in several ways by the aid of sound. It has been erroneously thought that the old habit of constantly repeating a word induces sleep through sheer monotony, no attention having been paid to the fact that the production of the sound sends wave after wave of physical vibration through the body which must contribute to the desired effect. Insomnia may be cured by the constant repetition of a single moderately pitched tone, or by soft music such as a lullaby.

It is not always advisable to introduce an air directly opposite in nature to a person's prevailing mood as it may irritate and make the mood worse. In mental depression—which invariably lowers the "tone" of the physical organism—it is often advisable at first to play a simple melody of a sympathetic nature, gradually changing to quicker and livelier airs.

Careful examination has revealed that persons may be deaf to a few isolated tones only, or may hear only in very limited regions throughout the tone range. These

"tone gaps" and "islands of hearing," as they are sometimes called, are readily explained. Certain basilar fibres have ceased to vibrate properly, or the hair-cells and nerves, which these vibrations should stimulate, no longer behave as they ought. Once this process of aural laxity has started it may extend. A good method for stimulating relaxed fibres, cells, or nerves is constantly to repeat the tones to which they fail to respond. In this way the advance of deafness may be checked and defective hearing restored. To produce the sounds oneself is better than merely listening to them.

It is unnecessary to extend these examples as there can be no absolute rule owing to the difference of temperament and even physical make-up. Each must experiment for himself and hold fast to that which he finds to be good. There are, however, certain general principles, some of which have been indicated in the foregoing pages; but nothing seems more clear than that sound is related to our physical and mental states and with care may be recruited as a valuable and pleasant agent for the destruction of disease and the wooing and winning of good health.