THE AMERICAN HISTORY AND ENCYCLOPEDIA OF MUSIC

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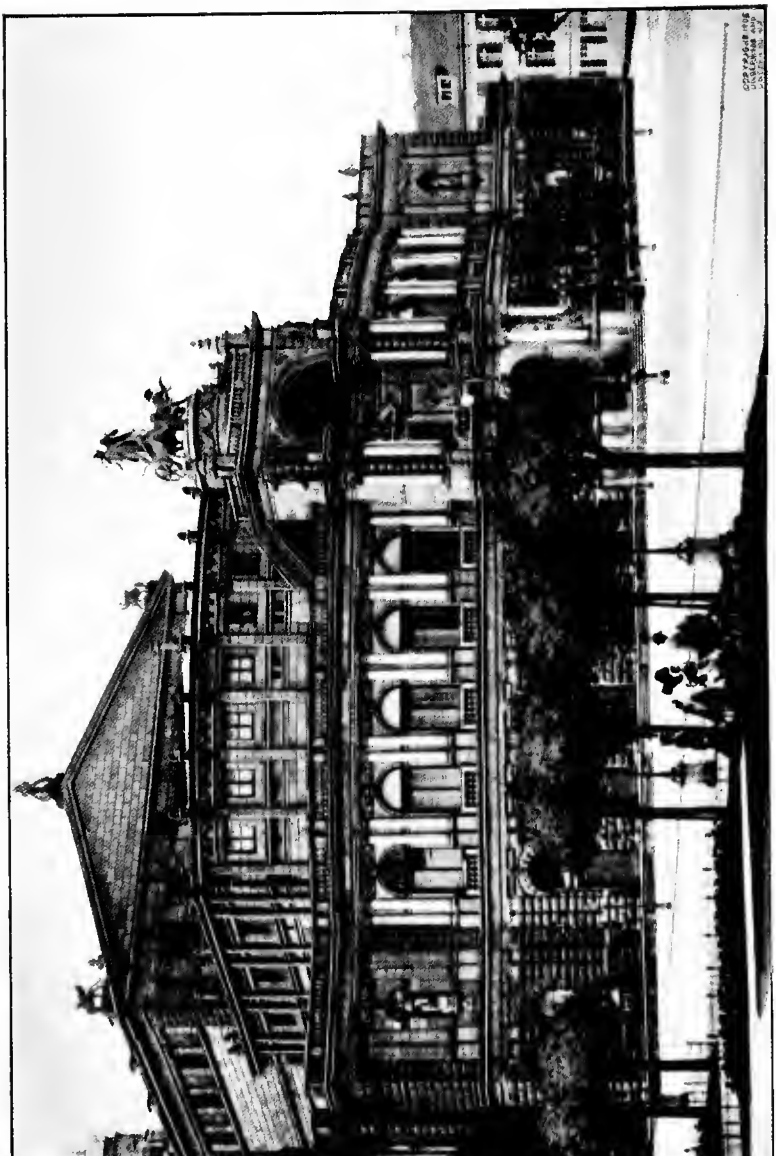
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UNDERWOOD AND

THE HOFTHEATRE OR COURT THEATRE, DRESDEN.

A magnificent Renaissance structure by Gottfried Semper, the architect of the old theatre that was burned down in 1869. It was opened in 1878 and is one of the finest theatres in Europe. It covers an area of 5550 square yards. The front of the building, containing the anterooms and auditorium, projects in semicircular form while the part containing the stage rises at the back to the lofty height demanded by the scenic requirements of the modern opera. The principal entrance is in the "Exedra," a castellated portico in front of the rotunda surmounted by a group in bronze by Schilling representing Dionysus and Ariadne. The entrance is flanked with statues of Goethe and Schiller. The balustrades that crown the facade on both sides of the exedra bear statues arranged in pairs. The interior seats 2000 spectators.

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MUSICAL INSTRUMENTS

WITH

INTRODUCTION

BY

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AND

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New York Chicago

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INTRODUCTION

INTRODUCTION

George W. Andrews.

The fact of the universality of musical instruments and musical expression among men will not fail to impress the attentive reader of this book. Differences of time, place, race and degree of civilization have modified the form of this expression, but have not eliminated the fact. The degraded African savage and the intellectual Greek are alike in this musical impulse. The Asiatic peoples, for ages shut away from the rest of the world, have had their own musical art and musical instruments. Such variations as are to be observed in the music and in the means of its expression among the different races of people are to be ascribed to their varying national characteristics, involving somewhat different demands and needs.

It seems plain that only with the beginning of the Christian era did music enter upon its real life of progressive development. That it had being and use in the earlier civilizations is true, but always in a very simple and rudimentary form. The possession of high intellectual and artistic culture, as in the case of the Greeks and Romans, did not include a musical art of such perfection and beauty as to hold our attention to it as an ideal; a homage which is at once paid in other fields of their artistic endeavor. It does not appear that their music was the vehicle of that ever increasing range of spiritual vision and apprehension which we recognize in our modern musical art. Their feelings were expressed in other ways with a perfection which we can hardly hope to emulate, but in music we feel more deeply and truly, and express far more fully and completely.

Music is the universal art of the modern world, and is in some form or other cultivated and enjoyed by all. Perhaps even less can be said for the music and the musical instruments of the Orient. If a certain effectiveness be granted the Orientals it is at once seen that their range of expression is very narrow. Their instruments could say but little, for little was required of them; personal and national life did not embody itself with freedom and fulness in musical forms. Among savage and uncivilized races of men, there is nothing that we can call musical art, and hence there are no developed musical instruments among them; nothing, in fact, but the rudest and simplest forms, such as are suited to their state of development. The spirit of music and the impulse toward musical expression, it is safe to say, is not felt in a strong and living way by men who know not the true God, and whose personal and social life is uninspired, save by the dimness and helplessness, even by the utter darkness of faiths not Christian. The ancient Hebrews in their worship of God made large use of musical instruments, simple though they were, and their love and gratitude to Jehovah were naturally expressed in the temple service with its bands of trained singers and players. Musical instruments have been used in the service of other religions, and in the life of races not knowing the true God, but it remains a fact that vital and growing musical art and musical instruments of steadily advancing type, able to express perfectly all that artists apprehend and would speak out, have been, and are coincident with, a living faith in and love for the true God. Without this men remain uninspired, and apart from inspiration art is impossible. With the coming into the hearts of men of faith, hope and love inextinguishable, every crude beginning was at once the starting-point for a development the wonders of which we admire and delight in today, and the end of which we well know has not been reached.

It will be observed that among all peoples there has been a reaching after variety of effect in musical sounds, and it is to this desire that the multiplicity of different instruments, with their diverse powers of expression, is to be ascribed. In civilizations other than Christian and in the case of savage tribes where there is little to be said through the medium of music, because it is certainly true that music will not live except in the atmosphere of a social order which is spiritual in its foundation, musical instruments are of the simplest order, having the most limited range of effect, and differing from one another by the broadest distinctions only.

It is not difficult to see why there has been, as history makes clear, a continual movement forward toward the perfecting of musical instruments, for it was inevitable that the widening and deepening spiritual life of men without bound vivified by the new love and hope which had come to them, should demand a means of expression adequate thereto. The old instruments served the ancient need, but could do nothing to sound forth the joy and praise of a new day with its unknown possibilities of blessing. For the new wine new bottles were needed, and thus began the long period of effort and experiment carried on through generations by one earnest worker after another, and always with the one purpose to provide an instrument of greater beauty of effect, more practicability of handling, and sometimes also something new and different from its fellows. Under Christian civilization, at least, the universal demand of men is for movement forward; that which we call progress. Things and conditions do not satisfy us; we would have them other and better, for we have seen in our souls a vision of that which is complete and perfect, and though but feebly grasped, we cannot be content, but must strive to realize it.

It is possible that the musical instruments of other days and of past generations of men were, speaking broadly, as satisfactory to them as are those of our day to us. They did not, nevertheless, so fully realize the ideals of beauty and of effectiveness in the thought of those that used them that they ceased to make effort for their further development. Almost without exception they were found imperfect tonally and mechanically. A richer, fuller tone was demanded, together with wider possibilities of execution. Besides this, the imagination dreamed of other lovely tone qualities not yet heard, and of instruments with new and far greater capacities not as yet made actual, and thus the older inevitably gave way to the newer. Composers too could not be satisfied with the expression of their advancing thought and feeling upon the instruments which were fitted only for the presentation of the ideas of an earlier day. The musical composer and the musical instrument maker are both alike responsible for the unbroken movement onward in the development of musical instruments. Perhaps the composer's need for a more adequate, or at least a different expression, has been the stronger influence, but in any case this influence has been and remains mutual.

As an immediate consequence of the sharpening of the intellectual and spiritual sense of men by inheritance from earlier generations, and by education and training, came the feeling after finer differences in the character, scope and effect of musical instruments. The broad distinctions furnished by instruments of wholly opposed types no longer satisfied the poetic need. Not stringed instruments simply, nor wind instruments, nor instruments of percussion were sufficient, but many kinds of each of these were called for, each possessed of its own especial quality of tone, range of pitch, and degree of power. It being required of musical art to give voice to a human life constantly finer in its discriminations, it could do nothing else than require musical instruments of greater, finer, and more complete capacities.

It is manifest that musical instruments have remained fixed in certain defined types for very long periods of time. The violin as we have it today has been in its present perfect form, as we feel it to be, for many generations. Our contemporary grand pianoforte has been a fixed type for a long period. This is not less true of other instruments as well. The organ is distinguished among musical instruments for its exceedingly long and unbroken history. It has not, however, been equally successful with some others in reaching a fixed and satisfactory type. From the beginning it has been the subject of unending experiment, and it cannot at all be said that the organ is in any such sense as the violin a perfected instrument. Older organs were usually of majestic, broad and rich tone, but were difficult to handle, and frequently without much variety of tone color. The best organs of today are easy to manage, of much variety of tone quality, sensitive and expressive, but not infrequently of a certain trifling effect when real grandeur and nobleness of tone is demanded. The ideal organ will not fail in either of the characteristics described.

As is to be expected, the effort of the most progressive organ builders is towards greater variety and richness of tone, and constantly finer discriminations in the various shades of tone color, which would not be noticed nor appreciated but for the cultivated and highly trained ear of the modern hearer. Immense inventive skill is also being directed to the perfecting of delicate and responsive mechanisms whereby the utmost range of effective use of the tonal forces of the instrument shall be instantly obtained. The result is that a really perfect modern organ is a very grand musical instrument in the best sense of the word. To predict the exact line of future development of the organ, or, indeed, of other instruments, is a very difficult if not impossible task. Change and movement there will be beyond doubt, and as it has been in the past, toward greater perfection as the minds of men shall apprehend it. The temper of the time will affect the course of this forward movement, since all that men do is thus affected, almost without their being conscious of it. The demands of the composer of today upon the instruments which are to voice his musical thought are greater than ever before, and in contemporary music may be found that which earlier writers would not have asked, simply because it could not have been granted.

There can be no question whatever but that composers in their efforts to give musical expression an ever increasing fulness, clearness and richness, will write for the different instruments quite up to the limit of their present powers of execution and interpretation, even perhaps pressing a little beyond. Musical instrument makers as well, recognizing the points in which the present forms of their instruments can be improved upon, will, even without the incitement from the composer labor for an advance on their own account. It may be felt that large progress in the variety of musical instruments and in the capacities of those already in use is hardly possible when one looks at the wealth of this field as it is displayed today. It must be admitted that cerain instruments have reached a type which, with our present requirements, we accept as perfect. These will not change until the prevailing ideas and feelings of the time are altered wholly. When or how this may occur we cannot prognosticate.

For a period of somewhat more than seventy-five years organ builders have brought out numberless inventions designed to make the organ a more easily handled instrument, and to render its forces more quickly and completely available. This has been accomplished by the use of pneumatic power, and later by a combination of pneumatic and electric energy in place of the purely mechanical action of earlier organs. To describe all of the various pneumatic and electro-pneumatic actions in use by the prominent builders of the present day is beyond the scope of this article. These actions are still the subjects of constant experimentation, and it is hardly possible to say that the final, most perfect type has been fixed. Each and every one of them have the general purpose named above. Adjustable combination pistons or pedals, as the case may be, are of great value and of universal application at the present time. There are many forms of these, but the principle involved in them all is the providing of means whereby combinations of stops may be arranged beforehand and used as desired without removing the hands from the keyboard. The number of combinations that may be set is limited only by the number of pistons or pedals provided. Older organs were furnished with fixed combinations, but as these could not be altered at will their scope was very narrow. A recent device is known as the double touch, an arrangement whereby the key falls under pressure of the finger a certain distance, giving the tone of a single manual or subdivision thereof, but which with additional pressure of the finger, falls a little further to its final resting-place, giving thus the tone of the other subdivision or of another manual. In place of the usual register-knobs at the sides of the keyboard, many present-day organs are provided with a series of stop-keys in the form of an additional keyboard over the upper manual, with the names of the stops engraved upon the ends of the keys. In other instances tilting tablets are used. It is possible, in instruments of the most advanced type, to obtain from a designated manual stops in other divisions of the organ, without the use of couplers.

DEVELOPMENT
OF
THE ORCHESTRA

THE DEVELOPMENT OF THE ORCHESTRA

FREDERICK STOCK.

As has frequently been pointed out, no other art can show such an absolutely logical and plainly traceable gradual development as can the art of music. And when the development of orchestral music in general, and of the orchestra in particular is considered, a veritable mine of interesting facts is revealed. Italy, the home land of all the beautiful arts, and especially of music, can boast the distinction of having been also the "leader" where the orchestra is concerned. Blest with all those advantages which have to do with the unfolding of artistic principles, blest first of all with that wonderful, heart-ensnaring atmosphere which contributes so greatly toward the creating and fructifying of artistic talent, Italy was destined to be the motherland of musical art, and for a long time to play the leading role not only in the domain of choral and solo song, but also in the realm of the instrumental. It is indeed significant that from the very first, composers and poets expressed the desire to blend or at least to associate for mutual advantage their respective arts, and because of this desire it is found that along with the sense for the actualizing of dramatic incidents upon the stage — scenery and properties being utilized as external means for the enhancing of the actor's art — there was developed gradually the wish for a particular kind of music which not only would satisfy the finer emotions of the hearer, but also would rouse and charm to the last possible degree his sense for tone beauty. Thus from small and insignificant beginnings there came into being and was developed orchestral music — that music which more than any other tonal utterance serves, or should serve, not only to express musical thoughts, but by the expressing of these thoughts becomes or should become able also to establish a kind of spiritual relationship among such persons as are susceptible to the peculiar power possessed by the language of tones, the power of bringing attuned souls more closely together.

Thus we find orchestral music at the close of the Sixteenth Century in the process of formation. The instruments then existent were of a very primitive kind, and were not numerous, but even at this time there was most plainly shown the desire to blend with the tone of that most beautiful and oldest instrument we call our own — our singing voice — the tone of such instruments as human thought and skill had fashioned. We know of the existence at the end of the Sixteenth Century of a "real" opera composed by Jacopo Peri (born in Florence, August 20, 1561). What would be more natural then, than that the Italians should for many years remain lords and masters in the realm of opera? They had at their disposal an inexhaustible wealth of dramatic material, and they were aided and supported by their wonderful language which, in itself a beautiful melody, satisfies and conforms to the needs of song as does no other language in the whole world. And thus it came that Italian music and the old Italian opera made its way out beyond the boundaries of the homeland, and that Italian style and Italian manner of expression were most zealously imitated and copied by all composers of that period.

Giovanni Battiste Lulli (1633-1688) a Florentine who as a boy left his native town and emigrated to Paris, performed notable service in the developing of the orchestral music of his time. As his worthy peer and almost as his contemporary stands Henry Purcell (1658-1695) who should be named as the direct predecessor of Handel in the domain of song. Lulli's successor in France was Jean Philippe Rameau (1683-1764) who did more than all his predecessors and contemporaries to widen the orchestral horizon. He it was, for example, who was the first to employ in his compositions the clarinet, the new wood-wind instrument which was invented in the year 1690.

Meanwhile musical life began to manifest itself more and more in Germany, at first also along opera lines. Reinhold Keiser (1674-1739) deserves to be most honorably mentioned as the actual founder of the German school of opera. In the realm of the purely orchestral, however, Germany accomplished nothing of any significance at this time. Even the influence of Handel on German art in general, and orchestral music in particular, was in nowise of vital or epoch-making effect, a fact which in no way detracts from his greatness as master of oratorio, or his importance as a factor in the development of musical life in England. Handel's orchestra was and remained a medium subservient to the vocal element, and Handel himself was too greatly under the influence of the Italians ever to be in a position to do away with the antiquated, or to create anything actually new.

The musical art of the Italians advanced more and more toward its decadence. Every possibility along vocal lines had been exhausted, and new means were not to be found. Furthermore, there appeared no one who had aught that was new to say. Apollo's beloved goddess seemed to have wearied of heavens eternally blue, and now turned her face toward the cold, gray Northland, and there she chose Johann Sebastian Bach, the greatest master of all nations and all time, as the one who should give forth a new tonal language, even a whole new tonal world. In place of the antiquated and worn-out song-principles of the Italians there came into use through him the instrumental element; in place of the old showy shell there sprang into being through him a living, feeling and inspiring art. He created new forms, and by means of these forms a musical science which will endure so long as humanity sings and speaks.

Through Bach the way for the free and independent development of the orchestra was first cleared, and his followers were enabled because of his achievements to apply still farther the instrumental principle and make it serviceable. In Bach's own son, the talented Philipp Emanuel (1714-1788), orchestral progress found a notable worker, and it is interesting to find that even at this time the desire for good orchestras was so keen that the orchestra of the court at Mannheim was regarded for a considerable period as the best in Europe. The director of this organization was a Bohemian violinist, Johann Carl Stamitz by name, who as the composer of several symphonies enjoyed a goodly measure of celebrity.

It would lead too far afield to attempt to describe in detail what the direct successors to Johann Sebastian Bach accomplished in the domain of the symphony, or to try to show how gradually, and step by step, the orchestra was built up, and how its technic developed and matured, thus making possible the countless orchestral compositions of our "Grandpapa" Joseph Haydn (1732-1809), the humorist and miniaturist among the symphonists, and preparing the way for the wondrous creations of the divine Mozart (1756-1791), who was the lyricist among classic symphony writers. The great services performed by Christoph Willibald Gluck, the reformer in the opera field, also can be given only passing mention. The time was ripe, and the orchestra had been sufficiently developed through Haydn and Mozart, for the appearing of the Titan among the classicists, Ludwig van Beethoven (1770-1827), the greatest symphonist of all countries and all time. It may seem strange that Beethoven was thirty years of age before he wrote his first symphony. Richard Strauss, the greatest musician of our day, was about twenty-five when he gave to the world a work so sensational and epoch-making as his "Don Juan." But a kind of sacred shyness doubtless kept the young Beethoven from entering earlier into the symphony realm. It may also impress one as peculiar that the youthful master, who already had spoken in tones the passionate quality of which never before had been dreamed of, should in his first symphony follow so exactly in the path of Haydn and especially of Mozart. He regarded the orchestra in an entirely new light, and he wished to give it a wider, deeper and more powerful eloquence than had they, but for this very reason he toned down to the level of his predecessors all that he voiced in both his first and second symphonies, and also all the means of expression which he employed. He did this in order that deliberately and intentionally he might strengthen his powers. Therefore it is that not until the third symphony, the "Eroica," do we meet the real Beethoven in his veritable titanic greatness, a true hero proud and conscious of victory. Beethoven in each of his nine symphonies teaches us a new lesson, and discloses to us a new and mighty wisdom. In his opera "Fidelio" he created a work the tones of which voice the greatest dramatic power and the deepest passion of which human sensibilities are capable. And in his "Missa Solemnis" and his ninth symphony — his last great choral and orchestral works — we contemplate with wonder and awe how the highest and maturest mastery in the handling of musical form is combined with a glowing creative power such as is bestowed only upon him who stands on the topmost peak of genius. The mightiest and supremest achievements of any musician, these are works whose greatness and significance can be measured only by the standards of the eternal.

Much has been accomplished along orchestral lines since Beethoven, and it would almost appear that the real development of the orchestra began with or after him. His orchestra-technic however, his mastery in the handling of the different instruments — the individualizing of the tone of each of them in such a way that, for example, it would be impossible to think of a passage which he wrote for the oboe as being for the clarinet — this mastery was developed to an extraordinary degree for the time in which he lived and achieved, and undoubtedly would have been developed still further had he been spared from the most awful fate that can befall a musician — the fate of growing deaf. The ancient German proverb, according to which care is taken that no tree shall grow till it touches heaven, found in him its application and its man. Aside, however, from all instrumentation art which stands and always will stand within the caprice of the fashion of the day, and which is an element dependent upon the technic and capability of players; upon the number and character of the various kinds of string, wood, brass and percussion instruments at disposal; and upon the skill in the devising of new instruments — aside from this art — Beethoven, as a symphonist, was excelled by no one, and has not been excelled by anyone up to the present day.

The greatest symphonist of all time had spoken his last word, and it was but natural therefore that after him there should be a silence in the symphonic realm. Surely it would not be well if works of such overwhelming greatness as are J. S. Bach's B-minor mass and "St. Matthew's Passion," Handel's "Messiah," or "Beethoven's "Missa Solemnis" and ninth symphony were created every ten or twenty years. That would be exactly like building a house from naught save corner-stones. Their frequent appearing would be contrary to the enduring and eternal worth of these works which are the great corner-stones in the temple of art. After the chaste goddess, our immortal muse, had yielded for a short time after Beethoven's passing to deepest and hopeless mourning, she came forth one fair day with a smile upon her ever-youthful lips. "It can accomplish naught" she said, "longer to hang our head in sorrow. Beethoven is no more, and it would seem that our art is done forever with the classic — the folk complain already of there being too much of it." "Eureka!" she exclaimed rejoicing, "we now will try the romantic. That is something new, and surely will please at least for a little while." And thus came the romanticists into the tonal kingdom, first Carl Maria von Weber (1786-1829) as master over the realm of the romantic opera, and then Franz Schubert (1797-1828), Felix Mendelssohn (1809-1849) and Robert Schumann (1810-1856) as sovereigns in the domain of absolute music. The claim certainly may with justice be made for these four chief representatives of the romantic school, that they are still the most popular composers of our day, and that they would have been so even had Weber composed nothing more than his "Invitation to the Dance," and "We Wind the Bridal Wreath" from the opera "Der Freischütz," or if Schubert had created only his "Unfinished" symphony and the song "Am Meer," or Schumann only the "Träumerei" and "Ich grolle nicht," or Mendelssohn only the wedding march from the "Midsummer Night's Dream" and the song without words commonly known as the "Spring Song." Weber was the first German opera composer who understood how to employ in "Der Freischütz," "Oberon" and "Euryanthe" a wealth of folk-song-like melodies, and to employ them in skilful and oftentimes in highly artistic manner, thus creating music which, while it was perfectly suited to the dramatic situation on the stage, was at the same time fully in compliance with the tonal laws of that time. His employment of the leitmotif which later Richard Wagner brought to the highest possible development as a means of characterization, is deserving of the widest recognition and commendation, for its use was for Weber's time a daring innovation.

Much might be written of the achievements of the other three chief representatives of the romantic school, especially of Schubert and Schumann, who not alone performed epoch-making service for the German lied and created imperishable works in that line, but also followed a progressive path in the orchestral and particularly in the chamber-music field. The same is true of Mendelssohn, albeit the admission must be made that his music contains something too much of the amiable, and is wanting in depth.

It is now time to turn our gaze from Germany toward other lands, and first of all toward France, where events and conditions were ripe for the appearing of the "French Beethoven," Hector Berlioz (1803-1869). It is beyond doubt that no musician ever possessed greater originality than did he, and but few had the liveliness of fantasy and the glowing imaginative powers which were his. His influence upon the development of the orchestra cannot be estimated too highly, for so far as all technical questions are concerned, he was constantly striving to think out new sound combinations, to bring new instruments in the orchestral body, to develop the technical possibilities, and to widen the capabilities of every instrument. To him must be accorded the credit of having founded, or rather created, the modern orchestra. But Berlioz was not only the greatest progressionist and pathfinder of his time so far as all orchestral technical matters are concerned — his influence in this direction has made itself felt in fullest degree among people of every nation in the world, and is still being felt — in another field equally important his influence has proven of the most wide reaching effect. This field, it is true, is one which is to be regarded with one laughing and one weeping eye, in other words, with distinctly conflicting sentiments. It is the field of program music, that form of art which has as its aim the suggesting, through tones unaccompanied by the spoken or sung word, of certain emotions, or impressions created by a colorful painting, a poem, a historical occurrence, a psychological moment in the life of a poetical or historical personage, or by some fanciful mood in the existence of a plant or of even an animal. The intent is so to influence the imaginative faculties of the listener that he will accept the composition in the way in which its writer wishes, and will hear the music not only aurally, but will see it mentally, and thus find it a richly colored picture in tones, the meaning and expression of which correspond to and fit the program design of the composer. It often has been pointed out, and not without justice, that Beethoven in his

"Pastoral" symphony wrote program music, that even his "Eroica" is in large measure of this kind, and that had he lived the ninth symphony would have been found to mark a turning point in his creative life, for after the ninth there would have remained nothing for him to produce other than program music. Long before Beethoven, program music had been known and written. Little of it, it is true, is deserving of consideration, since in the majority of instances the attempts on the part of composers consisted chiefly in the securing for a spiritually weak child of the muse, a name which would be as fine sounding and as interesting as possible. Beethoven in his "Eroica" wrote hero music, especially in the first two movements wherein most happily inspired themes are employed and developed in heroic and grandiose style. We all know that Beethoven created this symphony while under the influence of the admiration and reverence he felt for the greatest hero of his time, Napoleon Bonaparte, but that when a few years later this hero permitted himself to be proclaimed emperor by the French people, Beethoven's admiration and reverence came to an end, for he felt the "liberator of all mankind" had shown himself as the greatest of egoists and tyrants, and the composer was through with him. He tore to pieces the title-page of the "Eroica" which bore the dedication to Napoleon, and replaced it by another containing a new dedication. But the music of the "Eroica" remained unchanged in character. It is hero music, and he who inspired it could just as well have been Alexander the Great, or Frederick the Great, or George Washington. The "Eroica" music is not dependent upon any program, it is "absolute."

The "Pastoral" symphony is somewhat different. There Beethoven expresses in tones what we experience when in the presence of nature — our emotions at the sight of a charming landscape while watching a little love-scene beside the brook, with birdsong obbligato, or when beholding the passing of a heavy thunder-storm. All this is in truth very rural and proper, all within the limits of a mood which will be understood in but one way by all persons, no matter how widely different they be in character; a mood stolen from nature itself, and by means of art reflected in a manner absolutely natural. Beethoven thus proved that music, and orchestral music in particular, is able to a certain degree to affect different people in a uniform way, provided of course that the limits of musical means of expression are not overstepped. Mendelssohn, too, manifested a great preference for conventional program music. His extraordinarily rich fantasy, coupled with his truly romantic sensibilities, produced those peculiarly happy moments in his creative life wherein he was led and inspired to compose his "Midsummer Night's Dream," "Hebrides" and "The Calm Sea" overtures. Music of this kind might well be classed under the title of "conventional program music," for it is absolute music so far as the strict observance of form and rule is concerned, and yet on the other hand music of distinct programmatic suggestive power. But Berlioz went a decided step further. His program music means tone painting in the modern sense of the word and his fantastie symphony, for example, is the best proof that he had little time for the considering of the æsthetic and ethical problems of musical art. The "French Beethoven" wrote little or nothing that in some way is not most closely associated with a program idea. It is indeed unfortunate that when listening to most of his works one cannot avoid the impression that Berlioz as composer was more an experimenter and an educator, and this solely along purely technical lines, than a creator. His art in instrumentation must be wondered at, especially when the time in which he wrote is considered, but there is too much technic and too little music. The heart remains untouched. Wise moderation in the choice of means ever remained foreign to Berlioz. The orchestra could not be large enough and numerically great enough for him; to have under his baton hundreds of string, wind and percussion instruments was his highest aim and greatest ideal. His eye was kept too much on external effects, and too little on inner depth. Yet, despite this, he was qualified to achieve much that even for our time possesses importance and worth. His "Requiem," his splendidly colored "Te Deum," his symphonies and his "Damnation of Faust," while they contain much that is bizarre and much that is empty and showy, include also much that is intensely interesting and is artistically satisfying.

Meanwhile, a new genius of truly gigantic greatness and importance had been given to German art, a man who more than any of his predecessors in the musical realm was destined to attract the gaze of the entire civilized world, and whose works even today, or rather just today, are the object of the most undisguised admiration and wonder — Richard Wagner (1813-1883) the greatest musician-dramatist of all countries and all times, a universal genius in the highest sense of the word. Übermensch, philosopher, magician, seer, such was the poet-musician Richard Wagner. His art created a new world for the artistic perceptions and ideals of his own time and ours. Not alone that, but in every direction far beyond the boundaries of the German nation — one might with truth say throughout the entire civilized world — his art has acted as an inspiring, furthering and ennobling force upon the creative activity of the productive artist, the man who is the beautifier through color and form of our every-day existence. The achievements of Richard Wagner in the developing of the modern orchestra, after Berlioz, were of the greatest, for first through him was the orchestral body organically formed and every single organic part raised to its highest possible degree of capability. Since Wagner the musicians of the orchestra must possess not only the greatest of musical ability, but also a far higher degree of culture and intelligence than was demanded of them before. Therefore throughout the whole world today positions as orchestra players are filled and sought by musicians and artists of the first rank. The perfected presentation of a Wagnerian music-drama is dependent first and foremost upon the quality and qualifications of the orchestra, and it was but natural, therefore, that also as regards the artistic leadership of the orchestra itself a great change should have been brought about through Wagner's achievements, a change which received its first impetus through Wagner's true Eckehardt, the standard-bearer in the fight for the great Wagner question, Hans von Bülow. Bülow was the founder and furtherer of the modern director school, out of which, however, there has grown an element which also has to be regarded with one laughing and one weeping eye, the present-day virtuoso attitude at the director's desk.

But to return to Wagner and his art. The Bayreuth master frequently has been styled a "revolutionist of music." The charge is not wholly unjustified, perhaps, for through him many things which formerly were on top have been relegated to the bottom. If, however, the period in which Wagner lived and worked be taken into consideration, it will be seen that the time of his activity was a veritable storm and stress period, a season of general political ferment, and of revolutionary strivings which were not confined to France alone, but made themselves felt throughout all Europe. Under the influence of revolutionary ideas, Wagner created his "Faust" overture; and his "Rienzi," which had its first presentation in Dresden, Oct. 19, 1842, under the composer's own conductorship, he having been engaged at that time as Court director there, is pervaded by the same spirit of elemental storm and stress. War against the oppressors of humanity, freedom in fact, and freedom in the ideal sense of the word, was Wagner's motto at the time when he, the youthful master scarce thirty years of age, wrote, composed, prepared and directed his "Rienzi." That "Rienzi" itself made unheard-of demands upon the executive abilities of the orchestra need scarcely be stated. Still greater were those made by "The Flying Dutchman," which a couple of months later (January 2, 1843) was brought forward in Dresden under his direction, and still farther went "Tannhäuser," which had its initial production in

1847, also in Dresden, and under Wagner's baton. Each of these operas represented such a mighty advance over all that had gone before, an advance in musical as well as dramatic content, and in scenic structure as well as development of stage technic, that there is little wonder that the orchestra, the soloists and the chorus felt that Wagner had given them wholly new nuts to crack and wholly new problems to solve. The individual treatment of each instrument, from the first violin down to the drums and cymbals, the hundreds of things of which no one even had thought at that time, the overpowering sound of a Wagnerian fortissimo such as we find in his overtures to "Rienzi," "The Flying Dutchman" and "Tannhäuser"—all these things must have been in that day the cause of a vast amount of headache and head-shaking. And then, as regards all purely technical questions in his music, the unusual leading of the melodic line and the harmonic progression, which were exceedingly bold for that day, the astounding modulations, the leit-motif problem and its skilful applying and proving, together with the new "tone language" of the orchestra and the unbounded wealth of instrumental color, must have been confusing and perplexing for most of those who heard. It was but natural, therefore, that the Dresden success of "Rienzi," "The Flying Dutchman" and "Tannhäuser" was little more than an expression of local esteem for the "very talented, peculiar, but also extremely independent opera composer and Court director."

The producing of "Lohengrin," which meanwhile had been completed, was declined by the directorate of the Dresden royal opera, and greatly to Wagner's sorrow, for he had written the opera for that house. Rarely has the truth of the old proverb, that "the aims, works and achievements of a genius can be completely and fully appreciated only by a genius," had finer confirmation than in the case of Richard Wagner. Fortunately for the saving of his art such a genius was at hand, Franz Liszt, the noblest, most unselfish musician of all ages. He who himself was a genius in the boldest sense of the word, was one of the first to grasp in its full significance and to appreciate the Wagnerian "music of the future." And he vouched for Wagner in the truest and most beautiful manner, for what could say more for Liszt's unshakable belief in Wagner's cause, or tell more plainly of his nobility of spirit and his broadmindedness, than that in Weimar itself, the place where Goethe and Schiller had lived and strived, and the place which was one of the noblest culture centers of German art, he should produce the "Tannhäuser" and the "Lohengrin" of a composer who in the meantime had become a revolutionary fugitive. Presenting "Tannhäuser" on Feb. 16, 1849, Liszt, who at that time held the musical scepter in Weimar, followed it on Aug. 28, 1850, with "Lohengrin," and by so doing made public in the plainest possible manner his attitude toward the art of Wagner.

"On the mountains dwelleth freedom." This fair word of Schiller's, the revolutionary fugitive, Wagner, well may have considered. It was a kindness of destiny that permitted him safely to reach the free mountains of Switzerland and there to prepare, like a hero, for new deeds of greatness. And a new deed was entered upon, a veritable gigantic work of pure Germanic origin, which tells of the gods, a free race that dwelt on the mountain tops where the eagles have their home, a work that embodies within itself all those primal elements of fire, water, air and rush of storm which breathe forth the wonderful poesy to which the German heart is so responsive and so susceptible. The air of woodland and of mountain, and the freedom of the Swiss Alps — they all played a helpful part in the creating of Wagner's mightiest and biggest work, "The Ring of the Nibelung." In this work the musician-dramatist Wagner made known to the world the real nature of the "music of the future" and he also showed that all his earlier productions, "Rienzi," "The Flying Dutchman," "Tannhäuser" and "Lohengrin," were but advance couriers which he had sent out into the world to prepare the way worthily for that which was to come. Soon, however, was given forth another mighty musico-dramatic creation, "Tristan and Isolde," that overpowering love drama in word and tone which in the strength of its eloquence has no equal, and probably never will have. It was written and composed in its entirety in two years. Then came a new master-stroke of a wholly different nature, "The Mastersingers of Nuremberg," that humor-filled, brightly colored work which well may be considered as the most satisfying and most complete of all the Wagner creations. It would lead too far afield to point out here the really fabulous development of the orchestra accomplished through these works. In every creation of the master, beginning with "Rienzi," the musician is found wisely deliberating with the poet, and it may be of interest to quote here what Wagner himself once stated on this point. "No material," he says, "can attract me, except such as appeals to me not only in its poetic but simultaneously in its musical values. Thus before I even start to fashion a verse, I already am filled with the musical perfume of my creation; I have all tones, all charactertistic motives in my mind, so that when I then have the verses completed and the scenes in order, the actual opera for me is ready. The detailed musical treatment is then little other than a quiet and thoughtful afterwork which the moment of actual creation had preceded." This statement probably more than aught else gives a light upon the wonderful secret of Wagnerian creation, for it shows why with Wagner the tonal, orchestral element so complements and vivifies the sung word that the two form a complete and harmonious whole.

The mighty Wagnerian structure, the art work of the future was completed, and when finally after long years of bitterest disappointments, severest deprivations and crushing hopelessness, the royal friend and benefactor came into the life of the master, and the time of true liberty dawned for him, permitting him, freed from all material cares and hindrances, to create and to actualize that which his mind conceived, then for the first time was it granted to him to see and enjoy in reality that which he had achieved in tone and word. It must indeed have been not alone the feeling of unspeakable satisfaction and the gratifying of his pride as artist that inspired him to the creating of his last monumental work, but rather the emotion of an inexpressible thankfulness and almost reverent joyousness. Thus Wagner with his "sacred stage festival play," "Parsifal" completed his tremendous and unparalleled activity in the domain which he created for us all, the art work of the future, the music-drama.

Not quite twenty-five years have passed since his death, and who shall say what is to come? Wagner's art work and the mighty influence of his masterly creating and perfecting of it are but beginning gradually to mature within us and to bear fruit. His works are of the most enduring and widest reaching significance, not alone because of their artistic worth, but because they prove by their free and independent style the existence of a universal art-ideal, which requires no fixed or conventional form in order to make itself understood, an art-ideal which causes and enables us to receive with new and keener pleasure and enjoyment the creations of all the great masters in the realm of the dramatic-musical, the works of Gluck, Mozart, Beethoven and Weber.

Meanwhile it had been the destiny of the German people to live through that period which rightfully has been called "Germany's greatest, holiest time," a time resultant from the fraternizing of the many small states, and later their coalescence into the one and, it is to be hoped, the eternally united German fatherland, thus forming what is the actual center and, if one cares so to designate it, the heart and soul of Europe. This great event, although wholly an extraneous one, did much or rather contributed much toward the rapid unfoldment of all art life, and especially of that of music. Then began the florescence of musical art. Wagner was more and more endured, then more and more understood, then he became the style, and then his art entered upon its triumphant progress throughout the world. Many masters came with Wagner, through Wagner or after Wagner, and every nation has contributed its quota to this great company which has assisted in the further developing of modern art. To Johannes Brahms was vouchsafed to be Beethoven's successor in the realm of symphonic music, to advance the beloved German lied along the lines laid down by Schubert and Schumann, to discover new fields in chamber music and to be a true and worthy successor of the classicists. Anton Bruckner, who in orchestral matters was most strongly influenced by Wagner, applied the Wagnerian style to the symphony, and achieved results from which we of today and particularly those who follow us may hear and learn much. Hector Berlioz found in Franz Liszt a mighty champion and combatant for his program music doctrines, and these doctrines soon were carried farther still by the creation of the Liszt symphonic poems, and the "Faust" and "Dante" symphonies. And finally in our own day they have been brought to a veritable *gradus ad Parnassum* through Richard Strauss.

If we are justified in calling Hector Berlioz the Beethoven of France, César Franck certainly merits the title of a French Johannes Brahms, for he achieved much both in the orchestral field and in that of general composition. Vincent D'Indy is perhaps the best proof that César Franck "made a school," and it would be a sin of musical omission to speak of orchestral music without mentioning another Frenchman who "made a school" and still is "making" it, George Bizet (1838-1875), the genius-composer of "Carmen." It can be stated with all confidence that seekers after knowledge can derive a hundredfold greater practical good from the study of the score of "Carmen" than from a dozen instruction books on instrumentation; sources of similar value are his orchestral suites and other compositions.

Still greater would be the sin of omission committed were there left unmentioned the notable achievements of Verdi, who with his operas placed new laurels on the fame of Italian opera, and who in the course of his genius-progress from "Ernani" and "Il Trovatore" to "Otello" and "Falstaff" developed epoch-making tendencies which have been of such importance for the art of his people and his nation that they are o'ertopped only by the similar achievements in Germany of the master-creator of "Rienzi" and "Die Meistersinger." Verdi was the mastersinger, the eternally young, and therefore immortal Walther von Stolzing of Italy. His successors, especially Mascagni and Leoncavallo, devoted themselves to the sensationally realistic and shudderingly brutal. Their works for a brief period remained triumphant masters of the operatic battle-field, but later were forced to capitulate before the greater and more substantial capabilities and achievements of the gifted Puccini.

In darker Russia musical life during the last thirty or forty years has been making itself more and more manifest, the chief impulse being given by Tschaikowsky (1840-1893), whose masterly orchestral works represent an inestimably valuable enrichment of modern literature. The saying that Tschaikowsky's music sounds much better than it really is, is perhaps more than a half truth, but whether it shall be taken in a praising or a faultfinding sense is for every judging person to decide for himself. His music, so far as his symphonies are concerned, is extremely rich in mighty and compelling moments that are filled with a fairly overpowering elemental passion; recall but the first and last movements of the "Pathetic" or the andante of the E-minor symphony, a glowing, self-consuming passion, and the absolutely hopeless yearning of a man terribly unhappy, or perhaps of a nation sunk in misery. These seem to be the fundamental moods of the symphonies of Tschaikowsky. His handling of the orchestra is that of a genius; his music is of the kind in which every note sounds and sings. The Russian school, albeit young, has been wonderfully prolific. Its founders and adherents have been marvelously industrious, and many of them uncommonly gifted. Rimsky-

Korsakow (1844-) has produced numerous operas besides a large quantity of orchestra compositions, and nearly all of these are pronouncedly national in matter and manner, being builded largely upon the folk-song of the country. Alexander Glazounow (1865-) has adhered less closely to the purely national, but is already the author of eight symphonies and a large number of ballets and orchestral concert works. Both he and Rimsky-Korsakow are consummate masters of instrumentation, and the scores they have penned have helped to widen and enrich the possibilities of the modern orchestra.

Even to the cold Northland musical development has spread, and much is yet to be expected from this quarter, especially from Finland, where Sibelius and Melartion are active, and with extraordinary success. England, too, has brought a notable genius into our sphere, Edward Elgar (1857-) whose orchestral technic includes much that is new and interesting. Avoiding the ultra-modern tendencies of a Richard Strauss, he succeeded in blazing his own pathway, and achieving something "new" in the strictly artistic sense of the word. His choral work "The Dream of Gerontius" is unique of its kind, the work of a genius, who even in this so-called enlightened age has the free courage of a golden conviction, a truly great artist who in his living and creating expresses that which two hundred years ago Johann Sebastian Bach repeatedly manifested in his mighty works: "I am a Christian, and I am proud of it."

"All art is artist self-confession, striving to be heard." Mozart, Beethoven, Schubert, Wagner, Liszt, Tschaikowsky, Hogo Wolf, all laid bare in their art the inmost heart of their existence, each in his own way. Their sufferings, their needs, their misfortunes, as well as their joys and the secrets of their passions, all these we feel and experience with them in their art. But they all created with artist hands, with a deep and holy reverence for the art which they served. Thus it has always been in every line of art, thus it ever will be. It would be premature, fearsomely, to spread abroad the thought that Dame Musica just now is in direst need, that the art of our day is going to decay and destruction, and that the Strauss-Wilde "Salome" furnished the best proof that a music-morality police-control should be established at once. To Richard Strauss, the greatest musician of our time, belongs in any case the credit of having after Wagner and Liszt developed the orchestra to a point where it seems to have been brought to the highest possible stage of technical capability. By him has been spoken the most important — and unfortunately possibly also the last — word where the symphonic poem as conceived by Berlioz and Liszt is concerned. His "Don Juan," "Death and Transfiguration," "Till Eulenspiegel" and "Zarathustra" are acknowledged today by the whole musical world, and are admired as the creations of a heaven-gifted genius, but his "Don Quixote," "Life of a Hero" and "Domestic Symphony" are regarded by many with conflicting emotions, for they leave the feeling that in them the musical Hercules of our day was approaching the dividing line in his course. And after the putting forth of these last named works, the change in his creative activity was unmistakably disclosed. Out of the symphonist came the musical dramatist, and all in all it was but natural that Strauss should turn to that line of work for which his native talent and his creative endowment so peculiarly fit him. Richard Strauss lives and works in color sensations, he thinks and sees in colors. That which Vincent D'Indy and Claude Debussy, the two chief representatives of modern French music since César Franck, are striving to attain in the realm of color-music has enabled Richard Strauss, by means of his setting of the Oscar Wilde "Salome," to bring about the greatest or at least the most sensational musical event of our day. With the appearance of the Strauss "Salome" we enter upon a new phase, a new epoch in the development of the orchestral idiom. It is a new art element which we could regard with something closely akin to disapproval were it not for the fact that this new art product has been evolved under the high pressure of modern overculture, and is therefore the true child of our time. Our time is under the influence of nervous excitation, and the Wilde-Strauss "Salome," the most sensation filled art product of our day, is nothing more or less than the faithful reflection of psychological experiences familiar to present-day humanity — soul stirrings of inexpressible import which dominate our modern emotional life, moods and sense tingles of the excessively refined kind possible only to beings whose nerves are like the finest electric wires, nerve quivers which are felt only by creatures who are approaching the topmost peak of cultural life. Ten or fifteen years ago Strauss' "Salome" would have been instantly and flatly refused, today it is accepted with rejoicing — "at last another 'real' sensation!" The optimists, and especially the "Straussites," turn somersaults in sheer joy and exhaust their every resource in trumpeting forth the glory of this mighty deed of their hero Richard II. The pessimists sit in sackcloth and ashes, and, lamenting, proclaim the approaching end of all musical art. It is not impossible that "Salome" — and especially her dance of the seven veils — may have brought a few gray hairs to the brow of the fair goddess of our beloved art, but let us console ourselves with the fact that Richard Strauss is still a young composer, and no hearer of any of his works can as yet make the claim that the listening was tedious and devoid of interest. That is at least something, and the future will tell the rest.

Little that is worthy of mention is being accomplished at the present time in the domain of "absolute" symphonic music. It might almost be said that modern orchestral works are distinguished by bodily wealth and mental poverty, or to use a witticism which unfortunately is not without its hint of seriousness, "nowadays nothing is the most that comes to the majority of our composers, and then they proceed at once to orchestrate and instrumentate it in the most brilliant fashion possible."

To be an artist in the true sense of the word means "to live within and to strive upward." And it is just this which at the present day is so difficult for the artist to do; just what is made hard for him through the modern mode of living and through the necessity that it puts upon him of complying with and observing the social obligations of existence. This it is which more than all else stands in the way of the free development of American native art. There is no lack of talent; on the contrary, there is talent in abundance. There is a very great deal of music-making in America, and good music-making too, and it is all done with a large percentage of true talent and with much artistic pride and real earnestness. Of composing there is also a great deal (in notes) but there is lacking in it soul, inner depth, and spiritual greatness and maturity. "We" are still very young, or as Theodore Thomas once very aptly said: "We Americans in all questions and in all departments are not yet past the baby-disease age; all (or at least most) of the nations of Europe have passed that age long ago and have fulfilled their culture-mission; in Europe everything has matured and now is firmly planted and rooted in tradition." But we at least are warranted in rejoicing in our youth in the face of what we already have accomplished. The "baby-disease age" we will put behind us in time, and it may be set down as a certainty that with increasing maturity and greater spiritual deepening American native art will have a great future along musical lines. The steadily increasing number of symphony orchestra and of chamber music organizations is the best possible proof that even in this land of the "almighty dollar" the sense for genuine serious art and the desire for true music are taking root more and more.

DEVELOPMENT OF MUSICAL INSTRUMENTS

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Science teaches that the air which we breathe, and which surrounds us in such apparent quietude, is constantly disturbed by waves or vibrations, which convey to us the impressions of the natural phenomena such as sound, light and heat. The vibrations travel at various rates of speed, sound waves having the slowest rate of any phenomena of which the senses take cognizance. The slowest perceptible heat vibrations pass through the air at a rate of one hundred and thirty-four trillions per second, and the slowest visible light vibrations at a rate of four hundred and eighty-three trillions, while the approximate rate of audible sound waves is from sixteen to thirty-six thousand five hundred per second, although physicists differ in their estimates. Sound vibrations traveling at a much higher or lower rate have no effect upon the normal ear, although the power of appreciation differs in individuals.

Races and even individuals variously determine the periods or groups into which sound vibrations are to be divided to form musical sounds. The periods in Chinese music are so unusual to western ears that they are unpleasant, and the music is wrongfully termed noise, although the mere fact that the vibrations occur in periodic groups in accordance with the established Chinese scale prove it to be musical. The same reasoning applies to western music from the standpoint of the Chinese and other Asiatic nations, some of whom can appreciate periods so small that they are not apparent to other races.

No rules can determine what a musical sound is, for music, like language, is governed by laws created by man, and are constantly undergoing change; and because the language of one country is at first unintelligible to the people of another, makes it no less permissible for them to affirm that it is no language, than for the European to speak of Chinese music as noise because he cannot appreciate what are to him unusual groups of vibrations. However, the mind can be trained until the language can be understood and spoken, and the music can be enjoyed and produced. Furthermore, all the musical sounds possible in the European scale are not pleasant to all European ears, and music is subservient to taste as well as to race and training. In the same manner a word, or a combination of words, to individuals may be entirely lacking in euphony, although conforming to all the laws which govern the spelling and grammar of their native language.

The great importance the training of the ear assumes regarding the qualities of musical sounds is forcibly exemplified in a comparison of the delight with which a musician listens to the intricacies of classical music, which to the uninitiated are exceedingly uninteresting, with the disgust which he feels when hearing much of the popular music. Only with training can the ear distinguish between the correct and incorrect combination of groups of sound vibrations, and which groups and combinations are considered proper depends upon whether the training was received in Asia, Europe, or Africa.

The vibrations in the air which affect the ear owe their existence to the vibrations of a substance, i. e., a string, a column of air, a membrane, or a solid body. The body must be elastic, and the greater the degree of elasticity, the greater will be the regularity at which the groups of vibrations may occur, and the more exact will be the tones which they produce. This peculiarity is considered by piano-makers in their selection of wire for piano strings, and has figured in the improvements which have been made in wire manufacture, the tendency having been toward a wire having the least body and the greatest strength.

The vibrations of strings present themselves as most easily to be examined as they are visible to a certain degree, although the motion of the string generally appears more as a quiver than as a series of vibrations. The vibrations can be clearly seen when the string is fastened so loosely between two points that its vibrations are not audible. The position of rest of such a string will be a straight line. If pulled to one side, and the hand removed, the string will not remain in its second position, but will immediately return to its position of rest. However, the power of motion will not be gone, but will carry the string equally as far in the opposite direction from the position of rest. This double motion is a vibration, and until the force of the impetus is spent the vibrations will continue, growing shorter until they cease. As the string is stretched tighter, the vibrations occur in greater numbers per second, and the pitch of the resulting tone is higher, for there are two fundamental laws which govern the vibrations of strings.

The shorter, finer, lighter, and tenser a string is, the more rapid are its vibrations, and the higher is its tone; hence those strings which are designed to produce acute sounds are short, light, and thin. The longer, thicker, heavier, and slacker a string is, the slower its vibrations and the lower its tone; hence those strings designed to produce grave sounds are longer, heavier, and thicker.

When the string vibrates freely in its entire length it produces its lowest tone, called its fundamental, or first harmonic. At the points where the string is fastened there are no vibrations, and these points of rest are termed nodes. That part of the string which vibrates is called the vibrating segment.

The second harmonic of a string is an octave higher than the first, and may be produced by lightly touching the string at the middle when it is to be set in vibration. The string will not vibrate in a single segment as before, but a third node will be formed at the point of contact, and the one vibrating segment will be changed to two, which, as they are shorter, will produce the higher tone. If the string be touched or stopped at a point a third of its length from one end, a node is formed at the point of contact, and a second node forms spontaneously at a point two-thirds from the end. This creates three shorter vibrating segments, and the third harmonic, five tones higher than the second, is produced. The existence of nodes and vibrating segments can be made apparent upon a string stretched to a tension great enough to cause sound vibrations.

Four narrow strips of paper may be folded in the middle to form riders, and seated upon the string, one in the middle, one at each point one-sixth of the length from the ends, and one at the two-thirds point. If the string is stopped and set in vibration as indicated, the first three riders will be unseated, while the fourth will remain in its place, proving that at that point the string is at rest, and that the fourth node has formed spontaneously, dividing the string into three vibrating segments. The fourth harmonic is formed by touching the string at a point one-fourth from the end, which causes two additional nodes to form spontaneously, producing a tone a fourth higher than the third harmonic, and an octave higher than the second. In a like manner the succeeding harmonics are formed, although the amount of difference in pitch lessens as they ascend in number. These natural harmonics are also known as overtones, because of their higher pitch as compared with the fundamental, or as partials, because they are the results of the vibrations of fractional parts of the string.

The double-bass produces the tone which is considered the lowest musical tone proper, and contains forty-one and one-quarter vibrations. However, the thirty-two-foot pipe of the organ produces a still lower tone, whose vibrations occur at the rate of thirty per second, but its pitch is so low that it resembles a rumble more than a musical sound.

Pythagoras, a mathematician, living during the Sixth Century before the Christian era, discovered partial vibrations of strings by means of his monochord, an instrument which is still used by experimenters. It consisted of a long narrow box over which was stretched a single string, either between two pegs or by means of one peg and a weight.

Differences in degrees of loudness are due to differences in the amplitude of the vibrations, and not to differences in their formation. In strings the amplitude depends upon the force exerted in causing the vibrations. The more forcibly it is struck the farther will the string depart from its normal straightness, but it will not vibrate any more rapidly. The higher tones affect the ear more forcefully than the lower tones, and the acute tones of a musical production will be heard at a greater distance than will the grave tones. The greater speed at which the vibrations of the higher tones occur causes this effect.

Musical tones having the same pitch and the same degree of loudness when produced upon the violin, have a much different quality than when produced upon the flute. The individual quality is so marked that, after having been heard, the voice of either instrument is readily recognized. This quality is termed timbre, and owes its existence to the shape which sound vibrations assume. A tone is a compound affair. The vibrations which produce the fundamental of a string are accompanied by a number of the shorter vibrations, which produce the partials. That which causes a string to vibrate in its entirety also causes it to vibrate in its sections. The number of accompanying vibrations determines the quality or timbre of the tone, which would otherwise be without life or individuality. A tone which is theoretically pure is absolutely without character, for it is merely a simple group of sound vibrations, and given the same number per second, and the same amplitude, would be the same upon all instruments.

The prime reason of the existence of the various musical instruments is that each has its individual voice, owing to the varying number of accompanying vibrations or partial tones governed by the mechanical construction of the instrument. It has been stated that the timbre of a tone depends upon the shape of the sound waves. The several vibrations cannot exist separately in the atmosphere, but combine into a complex form of wave. Nevertheless, with proper training the ear can distinguish partial vibrations from the fundamental, for it is the duty of the auditory nerves, situated in the membrane which forms the ear drum, to analyze every sound wave that reaches them. The mammoth complex wave that is formed by a chorus and orchestra, combined with the noise of a large audience, must pass through a needle-like entrance to the ear drum, where the nerves analyze it until the voices, the instruments, and the noise are heard separately.

The number and intensity of partials accompanying a given tone depend upon the elasticity of the sonorous body, upon the manner of causing it to vibrate, and upon the point where the impact is made. The same tone of a string will have a different timbre when the string is struck, plucked, or bowed. Partials that have a tendency to make the tone rich and full, are produced when the string is set in vibration near one of its fixed extremities. Although a general knowledge of acoustics or of this property of strings was not possessed by early piano-makers, yet, unknown to them, for this reason they took great care in determining where the hammer was to strike. All partials that have nodes at or near the point of contact cannot sound. The hammers in pianos generally strike at one-seventh to one-ninth of the length of the string. This excludes all partials that are inharmonious, for some of the partials, if allowed to sound, would detract from the purity of the compound tone.

The material which causes the string to vibrate also has a great effect upon the quality of the tone. The hammers of the piano may be too hard at the point where they come in contact with the strings, in which case they create too many audible partials. A string that is long and fine is much more elastic, and will create more easily the correct number of primary and secondary vibrations to form a perfect tone. The higher partials are much more apparent in wire strings than in those of gut, for the material of the latter naturally smothers those which are very high. If the string is plucked with a hard substance the higher partials will be produced, as when a hard hammer is used. The gut strings of the harp and guitar are plucked with the fingers, and the fundamentals are accompanied by the lower partials, causing the tones to be rich and full. On the other hand, the wire strings of the zither and mandolin are plucked with a plectrum, calling forth the upper partials, and creating a more tinkling tone. Bowing creates more partial vibrations than any other method, and the higher the tension to which the hair of the violin bow is stretched, and the less sparingly the rosin has been applied, the more easily will the higher harmonics be sounded.

The vibrations of the column of air in a pipe are much less easy to study, but many of the statements which have been made regarding strings are equally true of pipes. The pipe itself only serves to imprison the vibrating column of air, and has nothing to do with the production of sound except as to its length and the peculiarities of its bore. Longer pipes, like longer strings, produce lower fundamentals. The harmonics are produced by increasing the force of bowing.

In open pipes a node always occurs in the middle, with a vibrating segment at each end, and the column of air can be divided into infinite vibrating segments in producing partials. A closed cylindrical pipe produces a tone an octave lower in pitch than that of an open one of the same dimensions, and the number of partials of any closed pipe is limited to those having odd numbers. When the vibrations reach the stopped end of the pipe, they cannot escape into the outer air, but must return to the open end. As they turn the corner, a vibrating segment is always formed, and there is never a node at the middle of the series of vibrations, and without it there cannot be an even number of vibrating segments. The limited number of partials renders the tone of stopped pipes dull, although they are often used in the organ to economize space. The old flutes, or recorders, had conical bores stopped at the smaller end. These peculiarities produced the same fundamental as an open pipe of cylindrical bore having the same length. Because of the inferior quality of the tones produced, due to the lack of partials, the bore was changed to cylindrical.

In cup mouthpiece instruments, such as the trumpet or horn, a narrow bore brings out the fundamental, accompanied by only a few partials. On the other hand, with a wide bore the fundamental is less pronounced, and the partials as high as the sixteenth can be easily produced. The extreme brilliancy and acuteness of tone of many of this class of instruments are due to the presence of numerous higher partials, which, because of their greater speed in vibrating affect the ear more forcibly. By increasing the force with which a string is set in vibration, the amplitude of the sound waves is increased, and the tone produced is louder; increased force in blowing into a pipe will merely heighten the pitch, the degree of loudness increasing with the diameter of the bore.

The vibrations of a column of air within any tube owe their existence to the vibrations of some material thing, which, by vibrating, causes the current of air directed against it to divide in such a manner as to reach the column of air in the form of a series of little puffs, each of which, by compression, communicates an impulse to the column. This leads directly to a discussion of the manner in which sound waves travel.

Sound travels through the air without displacing it. Its passage is like that of motion in water which has been disturbed. The troubled surface seems to be advancing constantly in waves that mount higher and higher, and then subside. These statements refer strictly to waves, and not to currents, tides, or the various other phenomena of water. A cork that is placed in the disturbed water will rise and fall with the waves, but it remains in practically the same place, serving as a proof that the water is not advancing. In reality the motion is not horizontal, but vertical, and merely affects the molecules which form the water. Certain molecules are compressed, and transmit an impulse to the molecules adjoining without changing position. The billowing surface only indicates the onward transmission of the impulse.

Following an understanding of this characteristic of motion, it will be seen plainly that sound requires an appreciable time for its transmission through the air from the point of its creation to the hearer. A well-known example of this is the manner in which, at a distance, the report of a cannon is heard several seconds after the flash is seen, the condition of the atmosphere governing the speed with which the sound travels. Sound waves lose strength as they are transmitted through space, but it is interesting to note the distances which they can travel and retain their force. Two tuning forks, whose vibrations had been enlarged by means of a resonance box, were placed one at each end of a conduit, a mile in length. One was set in vibration, and the vibrations traversed the entire distance to the second, causing it to produce a distinct sound. A similar experiment can be tried with two tuning forks, or two resonant plates, situated not far apart.

Without air there is no sound. If a sonorous substance was caused to vibrate within a space where a vacuum had been created, no sound would be audible, for there would be nothing to receive the vibrations and carry them to the hearer. However, as air was allowed to enter the vacuum, they gradually would become audible.

Reflection by which the echo is produced is one of the most interesting of the phenomena of sound. If a speaker pronounces a syllable in a large, empty room having bare walls, the sound of his voice will be returned to him after a short period in a repetition of the syllable. In a succession of words this produces a very confusing effect, and many public speakers affect a slow enunciation in order that one sound and its echo may die away before a new vibration is produced. Caves, tunnels, and irregularities in the outlines of buildings also create echoes. The distance of the reflecting surface from the speaker has a peculiar effect. If the distance is about one hundred and ten feet the sound is repeated once, but if this distance is doubled, the repetition will occur twice, and in like ratio up to about five repetitions, when the number will be limited by the time required for sound to travel. When there are several reflecting surfaces, the echo will be a multiple echo, that is, the sound may be repeated as often as forty times, although it has been observed that the number depends somewhat upon the condition of the atmosphere; for instance, more will occur at night than during the day. The causes of echoes are not thoroughly understood, and they cannot be made to order. An Englishman took great delight in an echo which was produced in an European country house, and he determined to carry it home. Complying with his orders, the building was taken apart, each piece marked and carried to England, where they were set into place again, but the echo was missing. In some minute detail the structure had been changed and the power of reflection was lost.

In whispering galleries the sound vibrations are not only reflected, but they are increased in amplitude, so that a whisper inaudible to some one a few feet away will be very distinct at a distance of a hundred or more feet. There are a number of famous structures which have this peculiarity, among them the dome of St. Peter's at Rome. The Mormon Tabernacle in Salt Lake City, Utah, is perhaps the most striking. The lines of the walls and ceiling are curved, and when the building is empty a whisper can be heard the entire length, over two hundred feet. The ear trumpet is a species of whispering gallery. The sound which enters the large end is increased, until it issues from the smaller end with a force capable of affecting the ear drum, which could not perceive the original vibrations.

Although many important observations have been made concerning the acoustic properties of buildings, it is impossible for architects to arrange plans which will produce proper results. It is a matter of chance, and the circumstances producing the best effects cannot be copied. Rooms in which the reflection of sound is too pronounced may be improved by covering the walls with hangings, or irregularities of surface. The architect who was in charge of the restoration of the hall of the Conservatory at Paris so feared marring the almost perfect acoustic properties that he would not change even a box partition or a hanging, such minor details having been found to be of great importance.

Reflection is the fundamental principle of the speaking tube, which enables persons in different parts of a building to communicate. The smooth interior, and the elastic material from which it is made, do not detract from the strength of the sound vibrations, and they reach the end of a long length of tube in much the same condition as when their journey was begun.

Sound vibrations which encounter obstacles in their passage through the air, bend about them, and either lose or retain their power. Acute sounds, whose vibrations are short, lose by the encounter, but those which are grave, and have longer vibrations, are much less affected. For this reason the music produced by a brass band will assume a very changed character if the band is situated at a distance from the hearer, and objects of various descriptions intervene.

Certain substances, for instance membranes and wood, are very susceptible to sound vibrations. A violoncello hanging on the wall of a room will vibrate strongly without having been touched if a tone corresponding with one of its strings is sung within the room. The vibrations created by the voice pass through the air and come in contact with the susceptible wood and strings, which again translate the vibrations into sound by sympathetic vibrations. This is similar to the case of the two tuning forks placed in opposite ends of the conduit, as mentioned above.

Much of the sound produced by musical instruments that reaches the ear is due to sympathetic vibrations or resonance. This principle is applied with greater nicety in the violin. The sound given off by the strings alone is very small, but is first transmitted to the bridge, thence to the belly, and through the sound-post over which the left foot of the bridge rests, to the back. The fibers of the wood must run smoothly in order that the transmission of the vibrations will be uninterrupted, and none of them lost. The delicate voice of the instrument is due to the unity in which the vibrations of the back and belly occur. The vibrations of the strings of a piano are transmitted through a bridge to the sounding board, which vibrates sympathetically, much as does the body of the violin. Nearly all the stringed instruments embody this principle, and the extreme susceptibility of membranes to sympathetic vibrations has caused them to be used in this manner, although the use is limited to instruments of lesser importance.

Mythology is ancient man's effort to explain natural phenomena, and in all countries the gods have been regarded as the inventors of music and the instruments of music. There exist beautiful stories hard to discard for the theories of evolution. Underneath the fancy, however, there lies a conjecture worthy of respect. The myths point to nature as the first music teacher. Were not the sounds of nature ever present for man's vocal imitation? The wind in the trees has a voice of its own, as do the birds and the animals.

There is rhythm in all things. The wild man is driven by his emotions to that rhythmical swaying of his body which is his dance. The mother sorrowing over the dead child sways and bends in rhythm until she is exhausted. The joyful wedding-guests dance or watch other swaying forms. When man fights man, the warriors stimulate their courage with the dance. It is rarely a noiseless dance, but is accompanied primarily by hand clapping, which survives today with the shuffling dance of the southern negro. The hand clapping may be combined with the beating of drums. The hollow tree accidentally struck was perhaps the first inanimate thing to speak. The hearer was no doubt startled into such a feeling of awe by the mystery surrounding the production of the new sound, that he made a god of the tree, and as he discovered that other hollow and solid things spoke, his gods increased. From the hollow tree grew the drum, which means much to primitive men. It may be their god, or it may serve as a medium for communication with their god. It instils joy, sadness, or courage. It can give orders in battle and carry messages in peaceful times. The sounds produced by the drum possess strong attraction to the ears of the savage, and this led to its early transformation into an instrument of music, and in this latter capacity it appears in the present military bands and orchestras.

Herodotus writes that Athene, the goddess of knowledge, invented the flute, but threw it away because of the facial distortions its playing caused. In its stead she took the lyre, which Hermes, the winged messenger of the gods, had invented and had given to Apollo, the god of music. Apollo praised the wonderful sound, which neither gods nor men had heard before, as until then he had been contented with the amorous sighing of the flute. But long before Athene's flute or Apollo's lyre were heard, music had come into being with the cymbals of the Curetes, the attendants of Zeus.

The Greeks attributed the discovery of the open pipe to the uncouth Pan, the god of the shepherds, who loved the beautiful Syrinx, but whose rough wooing won him only disdain. Finally he pursued the nymph to the reedy bank of the stream, where in desperation she called upon the gods for help. In answer they transformed her into a reed that grew with the others on the bank. The baffled Pan ruefully viewed the swaying mass, and as the subtle music of the wind blowing over the broken stalks stole into his heart, he quickly grasped the suggestion and pulled a reed, and placing it to his lips, told of his love in dulcet tones, wooing as he had never wooed with words.

The antiquarian, on the other hand, explains that the bone pipe existed before the reed, fashioned in many cases from the bones of the slain enemy or the beast of prey. Even now the Lama priests use the bones of their departed brethren in the making of their temple music. The mound builders have left such musical relics. Indeed, we are told that there was a time when no reeds grew, and rocks were everywhere. It was then that the cave man lived, and outside his door there ever lay whitening bones, full of suggestions. When and why man was inclined to put an open pipe to his lips for the production of sound, baffles the theorist.

The Egyptians ascribed the honor of discovering the principle of plucked strings to Thoth, their Mercury, who in passing along the bank of the Nile after a rainy season, struck with his foot the skeleton of a tortoise which had been left on the bank by the receding waters. The dried muscles and tendons had been drawn taut by the wind and the sun, and the movement caused them to vibrate and produce the sound which attracted the god. He secured the skeleton, and it became the first lyre. The Greeks tell of a more simple beginning of stringed instruments. Apollo and Artemis were enjoying the hunt, when Apollo perceived the twanging of his sister's bow string, and the deadly weapon of the hunt was transformed into the foundation of the violin and of the piano. The Grecian story is more logical, as primitive man in many instances has been found converting his bow into an instrument whose string he plucks to produce musical tones. There are many possible explanations of the origin of musical instruments, and man's imagination has added much that is picturesque.

The Assyrians have left behind them representations of their instruments, and a few remains have been found in the excavations at Nineveh. No corresponding names having been discovered, those of the similar instruments of other countries have been assigned to these ancient relics.

On the other hand, the ancient Hebrews had but one instrument that is known to the modern world, the shophar. The Bible abounds in musical references and names of instruments, but throughout the pages there is no word of description. At times the names are in Hebrew, and at others in Chaldean, hence their etymologies are impossible to trace, and each translator has added a shade of meaning clear only to himself. This state of affairs has created such havoc that sackbut and other modern names figure in the Old Testament. Volumes have been written in the effort to make the subject clear, but without success, for there is nothing tangible upon which to base the deductions.

To some extent the careless naming of instruments has continued to the present time. As distinctive features were added in the process of evolution, the name, perhaps descriptive of the older instrument, was not immediately discarded, and the transition from the old to the new was so gradual as to render distinction difficult. Even for the enlightened there are pitfalls, and the use of names is dangerous for the slipshod novelist. The musically wise have at times culled the blunders thereby occurring, and have cast them before the public with facetious comments. Some are dank and mouldy and need not be disturbed, but the general writer is ever attracted by the alluring names. Shakespeare trod upon the treacherous ground without serious mishap, but he can be classed alone. Tennyson has been harshly upbraided for his flute, violin and bassoon combination which furnished the music for the ball. Orchestration for this limited group would be indeed difficult, and the somber growls of the bassoon would rather overpower than blend with the delicate voices of the violin and the flute, A year has not passed since a popular musical monthly, in answers to historical questions, stated that Handel favored the clavichord or spinet. It is true that he enjoyed the clavichord, but the names are by no means synonymous, and refer to entirely different instruments. In that oft-repeated story of the small keyboard instrument, surreptitiously carried to the garret and practised upon by the youthful Handel, the entire number of stringed instruments have been made to figure, although in reality a small clavichord was used. The case of mistaken identity has been assisted by the picture which looks down from the wall of many music rooms, and in which the future master of the oratorios is shown surrounded by nightcapped elders who have been awakened by his music, and have surprised him in his enjoyment of forbidden pleasures. He is seated at an instrument, in size resembling a small piano, which causes the beholder to reflect wonderingly on the means of its secret conveyance to the garret.

The Egyptians are regarded as the most ancient of the civilized nations who have left to the world any knowledge of their music and its instruments. For many years after the discovery of traces of this ancient civilization, the Egyptians were considered a non-musical people. This supposition prevailed until a recent date, but has been disproved by the revelations of the last century. The Assyrians, of whom even less is known than of the Egyptians, show in their bas-reliefs that they also had instruments of considerable development. Students of ancient India assert that music, and in fact all of the arts, long ago existed there, and had assumed a highly developed state. Knowledge of music, as knowledge of all else, is claimed by China from time unknown. Greece acknowledged the more ancient musical skill of Egypt and borrowed ideas and instruments from the older land. The Greeks in turn instructed the Romans. From Egypt, Assyria, India and China, the knowledge naturally spread throughout Asia, and was brought by the Saracens to Turkey, and by the Moors to

Spain, and thence to the rest of Europe. The steps by which the progress continued are defaced by time, but there are chance glimmerings which reveal the general trend of the way.

The maker of musical instruments must know many intricate laws of acoustics in order to construct instruments capable of producing musical tones as designed. The maker may not know the laws as the physicist knows them, and it is doubtful if he could write a treatise concerning what he does know and why it is true. The knowledge has grown with experience, and has been handed down through the generations, until during the last few centuries the science of acoustics has added new knowledge and made clear the old.

It has been explained that musical tones are groups of sound vibrations, and that these groups differ in pitch, loudness and timbre. In producing instrumental music, the performer can determine the loudness to a degree, but the instrument-maker must determine the pitch and timbre. The longer the vibrating string or column of air, the deeper will be the pitch, and to accommodate the longer string or column, the instrument must be proportionately large. The vibrations of the strings of the violin and the piano do not differ in a degree sufficient to account for the great difference in the tone of the two instruments. Instead, the cause is the dissimilar surroundings and manner of causing vibrations. The instrument-maker considers the vibrations much as the modeler does his clay, fashioning the groups so that they may have the proper timbre. He selects and arranges that which produces the vibrations, in such a manner that the fundamental may be accompanied by the correct number of partials to form a given tone, and adds still more character to the tone by the means employed in creating the vibrations.

The instruments used in the production of musical sounds, when considered with regard to that which produces the sound vibrations, fall into four general divisions: Sonorous substances, vibrating membranes, wind instruments, and stringed instruments. Solid and hollow bodies, embracing the first two divisions, are caused to produce sound vibrations by blows, but the last two divisions are subdivided into several classes as to the method of creating the vibrations.

The vibrating column of air in wind instruments is set into motion by the vibrations of thin strips of material or air, or of membranes caused by currents of air directed by the lips of a performer, or by mechanical means. The elastic strips of material are called reeds, and are used either singly or in pairs. A single-beating reed is one which beats against the side of a pipe in dividing the current of air into the puffs which create vibrations in the air column, and double reeds beat against each other in dividing the air current. Another variety of reed is called the free reed, and is fastened at one end in such a manner that in its vibrations it does not come in contact with any other material, but is entirely free in its movement.

In wind instruments, such as the flute, the material reed is replaced with the column of air directed from without by the lips of the performer, or by mechanical means. It vibrates and performs a function identical with that of the reeds. In still others of this division the lips of the performer vibrate within a cup-shaped mouthpiece, and create such disturbances in the column of air within the tube as will produce sound vibrations.

In the stringed instruments the vibrations are produced by plucking the strings with the fingers, or with pieces of material, by striking them with hammers, or by rubbing them with a bow or a rosined wheel. As these characteristics have been improved and have been applied in various combinations, the development of musical instruments has progressed. In the following pages an endeavor has been made to more fully explain the methods of producing sound vibrations and the development of the instruments.

The term sonorous substances refers to all instruments which have hollow or solid bodies. The theory of producing sound vibrations in instruments of this division is of greatest simplicity, for no method of determining pitch by the stroke has been discovered. The larger the body, the deeper and louder will be the tone, for there will be more vibrating surface, and sonorous bodies of varying sizes can be arranged to give a series of musical tones.

The theory regarding the suggestion given by the hollow tree is made more probable by the present use of hollow wood among the African and Asiatic peoples, and among the Indians of the Western Hemisphere. The Chinese yu, or wooden tiger, with its serrated back, and the Japanese mokugyo, or wooden fish, are fanciful forms which it has assumed. The Sandwich Islanders have a bowl which they strike with their feet, and there is a story of a South American god who gave to the people seeds that produced a gourd; another god gave a variety of small stones which were put within the gourd, and the rattle was placed upon a standard, where it predicted all manner of things for the people.

The dull voice of the wood has given place, in general use, to the sharper voice of metal, as it appears in the bell and the gong. The propensity of metal to produce many of the higher partials gives its tones that brilliancy which is impossible in wood, whose lack of elasticity smothers many of the partial vibrations. Very hard, dry wood has a sharper voice than has soft, green wood. Although metal has at all times held a decided prominence as the substance from which very sonorous instruments are made, pottery and glass have appeared in unusual specimens, and a few bells and gongs of wood or bamboo have lent their meager voices to the Oriental orchestra.

The bell was an early production of the eastern nations. The Chinese claim to have possessed bells even before a knowledge of how to hang them. This important secret was unfolded for them by a monkey with a forked tail, which enabled him to acquire a habit of hanging, during rainy seasons, upon a limb of a tree with a fork of his tail in each nostril, thus completing a circle.

Specimens of bells have been found in Egyptian mummy cases, and in excavations at Nineveh, crude in outline, lacking the curves necessary to a perfect tone, and of inferior metal composition. Long ago China was wise in the science of bell casting, and there are in existence perfect bells that were made many centuries before the Christian era. Their next knowledge of the properties of sonorous substances is shown in the exact tuning of the metal and stone chimes that figure prominently in their temple services. These chimes have an interest and significance all their own. The time and care expended by William Till, of England, in arranging the stone harmonica, as exhibited in the Metropolitan Museum, and by M. Baudre, of Paris, who spent from 1852 to 1876 in searching out flints from which to arrange a musical scale, suggest the extent of the necessary musical knowledge of old China.

The bell has served in many capacities. The Hebrew priest wore many small ones upon his robe while in the synagogue, for is he not admonished in Exodus xxviii. 35, "His sound shall be heard when he goeth in unto the Holy place before the Lord, and when he cometh out, that he die not." The Roman sentry wore a set of bells while occupied with his duties, that the sound might inform the centurion as to his faithfulness. The dainty Japanese dancing-girl at all times wears a string of bells about her ankles. It is a token of her vocation which she must never discard. This practise has suggested the proverb "You have tied on the bells," which signifies "the die is cast." The costume bell is an interesting conceit. Commonly the figure forming it represented some historical character, perhaps Voltaire, Louis XVI., or Napoleon, and figures of these great folk have thus often served in calling my lady's maid.

There has been an abundance of superstition surrounding bells. In Europe a new church bell was not used until it had been consecrated with the entire baptismal ceremony. It was the tradition that the bell would never sound until it was made holy. Even now this practise continues in a few localities. Before the fact was known that the motion of a bell through air charged with electricity tended to attract the electricity, the superstition existed that the ringing of a church bell would avert disaster during a thunder-storm.

Bells of the early part of the Christian era were made of riveted plates; there are a number of these still in existence, but their value was small, as can easily be appreciated. With the loosening of the rivets caused by ringing, the clear tone of the bell was lost. The plates forming the bell were beaten into proper thickness and shape, and the process could not bring about as perfect results as does casting, and riveted bells fell into disuse. As time progressed, the knowledge of bell founding has increased, and peals and chimes, in which appear bells that have been cast of such size and thickness that they may produce the tones of the musical scale, have existed for many centuries. A peculiarity of bells is that they emit two distinct sounds simultaneously. The tones differ in pitch, which accounts for the rising and falling of sound when a bell is vibrating. Small bells have this quality to a greater extent than large ones, and even those used in carillons are dissonant.

Cymbals also have a long history. It is believed that they originated among the Turks and Arabs. Those of Turkish make produce the finest tones, and the composition of the metal is retained as a secret. A slight resemblance may be discerned between the clappers figuring in the bas-reliefs of the Assyrians and the Egyptians, and these clashing time-beaters.

Another member of the orchestra is the triangle, which is a bar of steel bent into triangular form, and beaten with a rod of the same metal. The triangle, like the majority of sonorous instruments, lends its clear, sharp speech to mark time.

Among the instruments of this division must be mentioned the sistrum, which is first found in the ancient worship of Isis in Egypt. Here it was called seshesh. The sistrum consists of a metal hoop with a handle; through the hoop are passed several rods of metal, and little bells are suspended from the rods. Just before the Christian era the worship of Isis, which had grown into a barbaric revel, was carried to Rome, where its impure practices commended it.

The marimba of Africa, with its bars of wood laid across other pieces of wood, or suspended over gourd resonators, is primitive man's idea of the modern xylophone. The xylophone figures in the writings of Virdung (1511), and attains an unmerited prominence in an illustrated Anglo-Saxon psalter of the Eleventh Century, where it appears hanging with the harps upon the Babylonian willows. This tuning of bars of wood appears in many countries, one instance being the Japanese mokkine. The tekkin, also of Japan, bears a great similarity to the glockenspiel, in which bars of metal are substituted for those of wood.

Bars of metal are struck, and metallic strips are plucked or bowed, to create musical vibrations. The nanze of the African is a representative of the plucked type. The instinct for the crude constructing of this instrument appears to be inherent in the African; wherever he may be, if by any possibility he can secure the necessary materials, he will combine them. Very similar, but of wholly individual origin, is the European nail violin, an invention of the Eighteenth Century. It belongs to the bowed category, and is the development of an idea suggested by the passing of the violin bow against a nail. The jew's-harp, with its metal reed, also belongs to this division.

Glass has been employed as a music-producing substance. That the glass harmonica originated at the dinner table in wine glasses varyingly filled, which were found to produce the tones of the scale, is an explanation that is generally accepted. The instrument has been developed by Pockrich, Franklin and others, until the keyed harmonica is the result. This unusual agent in the production of music has a primitive relative. The natives of New Ireland in the Bismarck Archipelago have an instrument called kulepa-ganez, in which highly polished wood is employed instead of glass, and a scale of four notes is obtainable from four pieces of wood, which are rubbed in much the same manner as are the glasses of the harmonica.

The fundamentals of sonorous substances are accompanied by inharmonious instead of harmonious partials which cause the discordant character of the tones produced. Their pitch and character cannot be exactly calculated, for in sonorous substances, unlike strings and columns of air, experiment does not carry out theory. Vibrating membranes are similar in this respect. With one exception, the pitch of musical tones produced by them can not be determined. The exception is in the orchestral kettle drum, in which the tension of the skin head can be changed by means of screws in the edge. The membranes in drum form may be arranged in three classes: 1. There may be, as in the drum of the Egyptians and in the present tambourine, a single skin stretched over a frame open at the end. 2. The single skin may be stretched upon the top of a frame, or shell closed at the bottom, as in the hand drums of the east, or in the kettle drums of the orchestra. 3. There may be two heads of skin covering each end of a cylinder, the side drum being a modern example.

The primitive drum is often a ghastly thing, with its shell a skull, frequently human, with the crown cut off and a membrane stretched over the opening. In many instances skulls form a decoration, the African savages having processional drums of great proportions, embellished with perhaps twenty skulls. The method of tightening skin drumheads with cords, as is done in the bass and side drums of the orchestra, is of primitive origin. Africans and similar races have made use of the idea. The same endless cord is employed, but instead of the leather braces used in increasing their tension, another cord is interlaced through the first.

The drums of the Assyrians, as they are depicted in the bas-reliefs, were miniature as compared with the large ones of the Chinese. The nomadic habits of the Assyrians are held accountable for this peculiarity, which is manifest in all their instruments when considered with those of the Egyptians. This theory may be accepted in regard to the instruments of other Asiatic nations. Among their instruments are found numberless hand drums. Strapped to the body of the performer such an instrument is beaten with the fingers and hands. They carry in their outlines the suggestion of converted water jars or gourds. They frequently occur in pairs, and are known as daraboukkeh. Placed upon the necks of camels or horses, they may lead the army into battle, inspiring the warriors and sounding forth orders, much as do the bugles of the West. The drums used in the present cavalry are of this description. They are miniature kettle drums, each strapped to a horse's side.

In India occurs a peculiar drum, which is placed upon the forehead and beaten with the hands. The tambourine, which might be denominated a half drum, is related to the Asiatic hand drum in that it is struck with the fingers. Its noise-making proclivities are aided by the metal discs in the sides, which figure frequently in eastern time markers. The tambourine was known to the Egyptians, and is favored in the Orient.

A unique form in which the vibrating membranes appear is in the onion and zobo flutes. The paper-covered comb is a primary example of this type, and the onion flute, or flute eunuque, is the oldest European specimen. The name is derived from the piece of onion skin which originally covered one end of the bore; and has since been replaced with a membrane. The performer hummed into a hole in the side of the pipe, causing the membrane to vibrate. The zobo and the French mirliton are later forms. India possesses some throat trumpets called nyastaranga, having within the tube a piece of membrane that is caused to vibrate by placing the tube against the vocal chords while the performer hums an air; the sound is thus increased, illustrating the transmission of inaudible vibrations to a very elastic substance, capable of increasing their strength, and reproducing them as audible vibrations.

The Spanish pan bomba embodies another peculiar method. A jar is covered with a membrane, through which pass one or more sticks that are rubbed between the palms of the hands, causing the membrane to produce sound vibrations.

Theory is more correct regarding columns of air, and the makers of instruments have given the air column various forms of resonators, and numerous methods of causing it to vibrate have been employed, until the wind instruments possess voices of various qualities.

The fundamental principle of the flute is the splitting of an air column to produce sound vibrations. The current of air proceeding from the player's lips, or directed by mechanical means, after splitting upon the sharp edge of the tube, vibrates, and in turn sets in vibration the column of air within the tube. The material from which the tube is made has no effect whatever upon the tone produced. The longer the tube, the lower will be the pitch, for the vibrations are longer and consequently fewer. The pitch is made higher by overblowing, that is, increasing the force with which the air is directed against the mouthpiece. The more forcefully that is done the more rapidly will disturbances occur in the column of air, producing a higher tone. The player must rely upon his ear in gauging the force necessary for producing the partials, as the tones due to overblowing are called.

Intermediate tones, or those which cannot be produced by overblowing, are made possible by holes in the side of the pipe. These holes cannot be as large as the opening in the end of the tube. If this were the case and they were uncovered, the length of the tube would be reduced to the length between the top and the highest uncovered hole. The pitch of a flute will be higher as the distance from the mouthpiece to the side hole that is uncovered is lessened, and the larger the hole is, the higher will be the pitch. Hence, if the position of a hole be altered, the pitch will remain the same if the size be altered likewise. Prior to the discovery that the pitch of tones could be governed by holes in the sides of a tube, a series of pipes of different lengths were fastened together and blown into successively, after the manner of pan pipes. The reed or bone pipe in its most simple form was cylindrical of bore, and was open at both ends.

The flute of the Malay is sounded by a current of air from the nose. This unlovely practice has for its recommendation the fact that the current of air directed from the nose is at the natural angle for the production of successful results in flute playing.

The method of producing sound vibrations by directing the column of air against the edge of an end of a pipe was unnecessarily difficult, and by a mechanical contrivance termed a fipple flute, the lips of the performer were imitated. A plug was inserted in the upper end of the pipe, and contained a single slit, so placed as to direct the breath in a flat form against the thin edge of an opening in the side of the instrument; this mouthpiece could be directly inserted in the performer's mouth, or was covered with a hollow cap, sometimes containing a sponge for gathering the moisture from the breath. It was used with a pipe of inverted conical bore, and was found in the flute douce, the flute à bec, or recorder, and the flageolet, during a period extending from about the Fifteenth Century to the latter part of the Eighteenth Century. Another defect in the older instruments was the difficulty in reaching all of the finger-holes. This was due to the length of the pipe and the insufficient number of metal coverings for the side holes. These coverings, or keys, were capable of being raised and lowered by means of levers extending within the reach of the fingers.

The discovery of the transverse principle was claimed by the Greeks for a youthful flautist who was striving for a prize at a contest, when the end of his pipe became stopped. Fired with ambition, he turned his instrument, and finished the selection by holding the flute transversely and blowing through a side hole. The judges were so delighted with his ingenuity that they awarded him the prize. However, this method has been in use in the East since before history. Doubtless the Saracens carried the knowledge to the West, and it has been found depicted in a painting on the wall of a cathedral in Kieff, southern Russia. The painting is supposed to date from the Eleventh Century. The transverse principle came into prominence in Germany during the latter part of the Seventeenth Century. The fife and the piccolo are representatives of this family, at the head of which stands what is known as the German flute. In its early existence this was furnished with a conical bore, and the improvement resulting from the use of the transverse principle could not be appreciated until the cylindrical bore was adopted, the imperfect recorders rivaling the flute in popularity up to the time the change was made. The instrument possessed but few keys, until in 1832 Theobald Boehm perfected the instrument, and it assumed the form in which it appears in the present orchestra. With the change from the conical to the cylindrical bore the tone has become more mellow, and there has been added a mechanical device of rings and levers, by which the performer can more readily operate the keys. The Boehm flute, of all the wind instruments in the orchestra, has the greatest versatility and the longest range.

The flute has figured in the history of all times. The Egyptians were very proficient in the art of playing it, and at Alexandria there existed a school which the Greek flautists attended. The flute was used among the ancients more as a solo instrument than was the harp or lyre, which served in accompanying the voice. Players made use of a bandage which held the instrument more firmly in the mouth, and a veil was worn to hide the distortions of the face caused by blowing. Ptolemy Auletes, the father of Cleopatra, gained his name because of his liking for the flute and for flute playing. He even adopted the bandage and veil of the lowly professional flautist. Cleopatra took a similar delight in the music of flutes, and as she floated on the waters of the Nile, the oars of her galley kept time to their sensuous tones. The instrument, indeed, grew to be associated with licentious things, until Plato admonished pure persons against its use. This prejudice existed until several centuries after the beginning of the Christian era. St. Clement of Alexandria, about the year 100 A. D., wrote, "We will adopt one instrument only, the Word of Peace, by which we adore God, not the ancient psaltery, drums, trumpets, and flutes;" and St. Jerome (340-420) declared that a Christian maiden should not know what a flute or a lyre was, much less its use. At a more recent date the Puritans considered the music of recorders antagonistic to Christianity, and its sound would cause them to fall on their knees in prayer. The Greeks brought the flute into great prominence; their statesmen and princes were instructed in its use as a part of their necessary education, and it figured in the Pythian and Olympian games.

The Japanese refer to their flute as the bird from heaven. It is almost a sacred object to them, and they tenderly patch the instruments that have been in use for centuries. These are of workmanship and material far superior to the modern ones, for now common carpenters, both in Japan and India, attempt their construction, and unsuitable wood is bored and hollowed without musical design. The Chinese, prompted by their desire for exactness in pitch, have endeavored to overcome the tendency of wood to expand and contract from atmospheric changes, by making their flutes of marble.

The term wood-wind has been used to differentiate certain wind instruments in the orchestra from those popularly known as the brasses, and is due to the fact that the instruments so named were at one time made of wood, differing only in the kind of reeds which set the column of air in vibration. In the clarinet and kindred instruments a single-beating reed is set in motion by the current of air from the lips of the player. This reed is a thin strip of elastic material, which is placed at the opening of a tube, almost closing the aperture. When a current of air is directed toward it, the reed pulsates, periodically closing the aperture, and the motion causes the column of air within the tube to vibrate. The principle has been known and applied generally since the earliest time.

The tones in the instruments containing either single or double-beating reeds are regulated by the length of the tube, as in the flute, and by the speed at which the reed vibrates. Furthermore, the reeds vary in size with the size and pitch of the instruments. In the deep-voiced bassoon, the double reeds are much larger than those in the oboe.

Among European peasantry, there exists a knowledge of the art of constructing beating reed pipes of great simplicity. As he cares for his flocks, the shepherd makes for himself a reed pipe, as shepherds have done for ages before him. Specimens made of plaited straw, and fitted with a reed of straw stalk, are found in use at rural festivities, quite as they have figured for centuries in picture, romance and song. It is a theory that many of the Egyptian and Grecian pipes were furnished with reed mouthpieces. The Greek word aulos, translated as flute, is considered to also refer to reed instruments. As an argument for the more comprehensive translation of the word, use is made of the story of the beautiful and fastidious Greek, Alcibiades, who was so filled with disgust when he chanced to catch a reflection of the distortions of his countenance while playing his beloved aulos, that he threw away the instrument, and thereafter played upon the lyre instead. His injured vanity was rather disastrous to the popularity of the flute, for Alcibiades was a fashion leader among the Greeks. In mythology a similar story is told of Athene or Minerva, who saw her reflection in a pool, and was caused to cast away her flute. The effort necessary in playing a flute does not create especially unpleasant contortions of the face, although such is the case in playing reed instruments, and the researcher grasps this as one proof of the correctness of the new theory.

The pair of reed pipes found in Egypt with the Lady Maket in her mummy case, has been given the name mam, and although the ones in question were without a mouthpiece, the mam is considered as the immediate ancestor of the Egyptian zummarah and the Arabian arghoul, double pipes played with a single-beating reed mouthpiece. An equally primitive form of the single-beating reed pipe is the European pibgorn or hornpipe. The Metropolitan Museum of Art has a copy of an early specimen, which is made of the shin bone of a deer, and has a piece of ox-horn at either end. Within the horn at the upper end is a beating reed of straw stalk.

The derivation of the name of the chalumeau, an instrument existing during and succeeding the Middle Ages, can be traced from the Latin calamus, meaning a reed. The instrument had a long life, and found a place in the orchestra for many years. Gluck, in the Eighteenth Century, was the last composer to employ it. In the National Museum at Munich, and copied for the Metropolitan Museum of Art, is the instrument considered to be the first attempt of Johann Christopher Denner to apply keys to the chalumeau in the evolution of the clarinet. The instrument bears his name as maker, and is dated in the Seventeenth Century.

The clarinet itself has undergone development, one stage being the attempt of Papaline, about 1813, to reduce the length of the bass clarinet by giving it a serpentine bore. The length of his instrument was a little over two feet, about a third of that of the ordinary bass instrument. Its curved bore made it capable of giving the low C. The basset horn, the tenor of the clarinet family, has been a prominent member of the single-beating reed class, but is declining in use, although Mozart's and Mendelssohn's appreciation of its beautiful tone is shown by its frequent appearance in their scores.

Sax, with extreme ingenuity, produced the saxophone in 1840. Although classed with the clarinet, the fingering is that of the oboe, and the tube is of brass and conical, the last trait being individual. The instrument, useful in military music, is not looked upon with favor by composers for the orchestra.

The ancient Egyptians left no trace of a knowledge of the double-beating reed, but the Chinese claim its use for thousands of years. It is composed of strips of elastic material fastened to a brass tube or staple attached to a tube, a prominent modern exponent of this principle being the oboe. These strips are fastened together at one end, but stand apart at the other, and the breath from the performer's lips tends to cause them to vibrate in such a manner that the free ends beat together and communicate their vibrations to the column of air within the tube.

Unlike the single reed, the double reed is found more often in use with a tube of conical bore than with one of cylindrical. The cylindrical bore, however, appears in the Chinese kwan tzu and in the Japanese hitschi-riki. The aulos of the Greeks and the tibia of the Romans, are of this description, as were the krumhorns of the Sixteenth and Seventeenth Centuries. The cervelas or sausage bassoon gained its name from the manner in which its cylindrical tube was coiled in nine or more short, parallel lengths, with an outer covering.

The zourna and zamr, found in Persia, Turkey, modern Egypt and northern Africa, are to be considered as the earliest specimens of the conical tube fitted with a double-beating reed. The pommer family, including the shawms and bombards, are the mediæval transitional instruments. The pommer, with its long, straight tube, bringing the lower finger-holes out of the player's reach, was somewhat improved about the end of the Sixteenth Century by having the tube bent upon itself several times. This new arrangement, which bore a slight resemblance to a bundle of fagots or sticks, promptly gained the name of fagotto. This has clung to it in the German and in the Italian, even though the bassoon, or bass fagotto, is the only instrument with bent tube now in use. The oboe, whose French name, hautbois, means high wooden pipe, is the improved treble shawm, and is prominent in the orchestra, as is its larger brother, the cor Anglais, a development of the alto pommer, and the oboe increased by half, which causes its pitch to be a fifth lower. The bassoon is in reality another member of the oboe family, being treated in orchestral selections as its bass and contrabass.

As the metal saxophone finds a place among the wood-winds with single-beating reeds, the sarrusophone, with its metal tube, has a place among the wood-winds with double-beating reeds. This was invented in 1856 by M. Sarrus, a bandmaster in the French army, and has the conical bore and the mouthpiece of the oboe family, although — another parallel with the saxophone — it is not accepted to any extent by orchestral composers, having for its most important duty the carrying of the part of the stringed basses in military bands.

The clarinet and oboe have not been altered in any marked degree during the past fifty years, as any mechanical change has a tendency to make the tone inferior. Although the varieties have not changed, what is referred to as the wood-winds of the orchestra have been improved in the degree of quality, until those of today are hardly recognizable as followers of those two hundred years ago.

The free reed does not appear in the orchestra except when the organ is used. It has been in general use but a little more than a century. Before the latter part of the Eighteenth Century its use was exclusively Asiatic. Instruments in which a group of pipes of different lengths fitted with free reeds are furnished with a common mouthpiece, are found in China, Japan, Burmah, Siam and Borneo. In fact, it is said that the Chinese cheng, one of this group, afforded the suggestion which the organ-builder Kratzenstein, of St. Petersburg, in the Eighteenth Century carried out in the reed organ.

A free reed is a thin metallic tongue fastened in a frame by one end in such a manner that, when caused to vibrate, the free end will neither come in contact with the frame, nor with the fixed end of the reed. A peculiarity of this reed is that it can produce sound vibrations without being fitted within a tube or resonator.

The principle is found applied in the mouth harmonica, the concertina and the accordion. With the application of the keyboard, the harmonium, the melodeon and the reed organ came into existence. These instruments have attained the greatest prominence of any in which the free reed is used, although a few of the pipes of the pipe organ are fitted with them. Indeed, this reed has not achieved great importance musically, and doubtless never will. With the few exceptions mentioned the instruments in which this principle has been employed may be classed as toys.

Ribbon reeds, which are found in the horns of the Alaskan Indians, and in children's toys, may be mentioned as of small importance. Although fixed in a frame at either end, this reed possesses sufficient elasticity to allow vibrations. The principle is known to every boy who lives where grass grows, and is made use of when he plucks a blade of grass and blows upon it as he holds it between his thumbs.

Next in importance to the wood-winds in the orchestra, and forming an indispensable element, are the cup mouthpiece instruments. Their tones are extremely martial, and unless carefully restricted, will overpower the other more delicate voices. Their evolution from the conch-shell and animal horn of primitive man has been established. Although they have their place in the orchestra, their peculiarities cause them to figure with greater prominence in the military band, their presence leading to its popular name of brass band. The material from which these instruments may be made is by no means limited to brass. Wood, ivory, porcelain, and various metals have been used successfully. At the Metropolitan Museum of Art are displayed a family of sax horns made exclusively from wood, and their speaking voice differs but slightly from that of the brass instruments. The tone of members of this division is affected by difference in bore. In the cornets and horns the bore is conical, in the cornet wide as compared with its length, and in the horns narrow. The consequence is, that the voice of the cornet has a tendency to coarseness, while in the horn the quality is finer. The trumpet and trombone have tubes that are cylindrical, except for the short conical bell, which peculiarity adds brilliancy to their tone. The individual timbre or quality is governed by the size and shape of the mouthpiece; that of the trumpet is hemispherical and shallow, that of the cornet is deeper, and that of the horn is a tapering cone. The size of the mouthpiece also affects the limits of the cone. The size of the mouthpiece also affects the limits of the compass, which can be increased if the mouthpiece is large enough for the player to change the position of his lips. In the tuba, the valves tend to detract from the correctness of pitch, but the lips are held loosely against the mouthpiece, making it easy to change, and remedy any defect that might otherwise be perceptible.

The simple horn used by the savage in signaling can easily be imagined at the lips of the rugged hunters of an early period. It has as a type in modern use the shophar of the Jewish synagogue. This is the horn of a ram straightened during the application of extreme heat; it is capable of but a few tones, which have been arranged in certain series that are called for in the ritual. To remedy its imperfect natural scale, the simple horn has been fitted with side holes, slides, and valves. The side holes have not proved successful, but the slides and valves are still in use. The principle of the slide is one that has been employed since the time of the ancient Romans, and its discovery is attributed to Tyrtæus, 685 B. C. The slide trombone, its modern embodiment, is merely a sackbut improved and renamed. The sackbut flourished in mediæval times, and the name can be traced to a Spanish foundation, aptly referring to a pump. (See sackbut.) The trombone is bent into three parallel lengths. One length is doubled in such a manner that the outer section may slide over the inner, and give additional length when the lower tones are desired. The action is free, and except in the lowest octave, very minute degrees of change in pitch can be regulated by a musician with a true ear.

The flutes of Egypt and Assyria attest the early use of side holes in gaining harmonics, and the natural tendency was to apply them to the cup mouthpiece instruments. The ancient zinken were extensively used during the Fourteenth and Fifteenth Centuries; these were generally straight horns having a conical bore, and fitted with finger-holes. The extension of the limits of musical interpretation led to the addition of holes, until the number was too great to allow the player to quickly change his fingers from the upper ones to those lower on the instrument. Side holes that cannot be reached, and notes which cannot be produced, are worthless. Edme Guillaume, a canon of Auxerre in France, near the end of the Sixteenth Century introduced the serpent as a temporary remedy. Two sections of wood were carved into serpentine outline, the bore remaining conical, regardless of the outer curves. The sections were glued together, and were often covered with leather, which better held them in place, and the curves brought the lower finger-holes within reach of the performer. The size of some of the holes was too great for one finger to cover entirely, and keys were introduced for covering a few of them, the keys having long handles, which brought the holes more completely under the control of the performer.

In 1820, Streitwolf, of Göttingen, invented a bass horn in which the serpentine outline had given way to one that was conical, and the tube of wood or brass was bent upon itself, and was furnished with from nine to eleven finger-holes fitted with keys. With the Nineteenth Century came the ophicleide, which enjoyed orchestral favor for about fifty years, but is now entirely out of use. It was a brass instrument of broad conical bore, with its tube bent upon itself, and furnished with keys similar in number to those of the bass horn. Owing to the unpleasant qualities of its voice, which did not blend well with those of the other members of the orchestra, it was gradually superseded by the tubas. Even before Streitwolf, keys had been applied to the bugle by Joseph Halliday, in 1810. This keyed, or Kent bugle, as it was called in honor of the Duke of Kent, has given way before the instrument furnished with valves.

In the hand horn is found a principle that is surprising in its simplicity. It was discovered by accident by Hampel, of Dresden. Until the Eighteenth Century the horn had been excluded from the orchestra, and its adoption there was loudly decried. The change from a blatant instrument of the chase to a fitting member of that soft-toned organization was indeed great. It was necessary to soften the tone, and the mute or pad, which had been in use in softening the tone of the oboe, suggested itself for use with the horn, and Hampel, in using one of felt, found that his tones were flattened or lowered a semitone; he substituted his hand, which could be moved more easily, and supplied the intermediate tones by placing the hand across and within the bell of the instrument. The composers of the beginning of the Eighteenth Century wrote for the hand horn, and many players use this method even now when interpreting these works.

Valves, inventions of the Nineteenth Century, are additional lengths of tubing, which can be connected with the original tube when it is to be extended for the production of tones of lower pitch. In reality, they have three functions; they serve in producing the notes necessary for a complete scale, they are used in transposing the key, and they rectify any falsity in the notes or any imperfection in the timbre. They appear in groups of three in nearly all the cup mouthpiece instruments; the first lowers the pitch a tone, the second a semitone, and the third a tone and one-half. By their use, in a variety of combinations, all the tones necessary for the completion of the chromatic scale may be obtained. Some of the barytone, bass, and contrabass instruments have valves enough to lower the pitch two and one-half tones. The cornet, which originally was furnished with but two valves, now has six in exceptional instances.

The piston valve is popular in France, England and the United States. It is more simple than other varieties, and therefore is more successful. The path to the extra tubing is opened by depressing a cylindrical piston, which works within an outer case; the piston rod is pierced with windways or holes which allow the performer to govern the amount of air to be admitted for use in the production of tones. This was invented in 1815 by a German named Blumel, and Stolzel, Shaw and the Sax family have aided in its development. A valve having a short stroke is called a pump-valve, and dates from 1830; the double-piston valve, invented by Shaw in 1824, enjoys minor prominence; a valve with rectangular parts is termed a box valve, and there are early specimens of instruments fitted in this manner, although Hall, of Boston, has been falsely credited with originating it in 1875.

Austria, Italy and Germany favor the rotary valve introduced by Blumel in 1827. A four-way stop-cock turns in a cylindrical case; two of the four ways connect with the main channel, and as it rotates through a quarter circle, the other two openings admit air to the extra tubing. The disc-valve was of such complicated mechanism that it could not long remain in practical use. The extra tubing was attached to a metal disc, which, by revolving a quarter turn upon another disc, was connected with the original tube; the difficulty in keeping the disc air tight was one of the reasons for its disuse.

In some instances there is found on the slide trombone a small valve to be used in producing a half-tone trill. Crooks are used in changing the key of many of the cup mouthpieces. They are movable pieces of tubing, which, when inserted in the original tube, lower the pitch. The cornet, which naturally plays in the key of B flat, is furnished with crooks capable of lowering the key to A, A flat, or G.

The stringed instruments are considered the foundation of the orchestra. Not only is their importance apparent in that capacity, but they find much favor for use in the home, as they are exceptionally adapted to accompany the voice.

Plucking is the most simple method of causing strings to produce sound vibrations. They may be plucked with the fingers as in the harp, with a plectrum as in the mandolin, or with the tsume as in the Japanese koto. The plectrum may be a stick of bamboo or a piece of wood, metal, ivory, or quill, and the tsume are pointed bits of metal or ivory, which slip over the fingers in the manner of a thimble. A like contrivance has been more recently applied to the American banjo, and the ring employed in playing the zither is similar in principle.

The theory of the conversion of the hunting bow into a musical instrument has been discussed. The naturally weak tone of this single-stringed instrument has been increased by various methods. One savage is found twanging the string with his fingers, or with an arrow, and holding the end of the bow between his teeth; another has attached to one end of his bow a gourd or shell acting as a resonator. The resonators, or sound boxes, of modern plucked instruments divide them into three classes. 1. The strings of the harp rise vertically from the sound box, and are entirely open; that is, they are backed by no resonator. 2. In the psaltery family, the sound box is indeed a box; it has length, breadth and depth, and may have three or more corners. The strings pass along the upper surface, and are backed with a resonator throughout their entire length. 3. The strings of the norfe and lute families pass over a hollow sound box, and thence along a neck appearing in a diversity of lengths, at the upper end of which are inserted pegs, around which the strings are fastened. The part of the neck through which they pass is called the peg box, and by turning the pegs the strings can be shortened or lengthened and the pitch regulated, which function gives them the name of tuning pegs. As the holes wear too large they are filled, and new ones bored.

The process of development from the instrument used by the first player on strings, into the harp and the lute as they are found in the hands of the ancient Egyptians and Assyrians, can only be conjectured, but judging from the degree of perfection that has since been attained, it was long and devious. Gradually primitive man learned that strings of different lengths gave different tones; that one string, whose vibrating length could be shortened at various intervals, gave a rising series of tones, obviating the necessity of so many strings; they also learned many facts concerning the properties of sound boards.

The harp is found in a surprising state of perfection among the ancients. Its most evident fault was the absence of a front pillar or support, as owing to this deficiency the strings could not be stretched to any great degree of tension, and the tone of the instrument undoubtedly weakened. The triangular outline of the present orchestral harp has prevailed throughout all ages and nations. A less favored form is the boat shape as seen in the soung of Burma. This type has had representatives during all periods, but it is graceful and picturesque at the expense of practicability. The buni or harp of ancient Egypt, with its weak voice, bears but little resemblance to the clear-toned harp of the orchestra of today. Paintings dating from the Thirteenth Century B. C. have been discovered at the entrance to a tomb at Thebes, which depict two priests, one at each side of the portal, playing upon harps. These instruments are taller than the players, and rest upon the upward curving sound boxes, and are highly carved and decorated, the players handling their strings after a method similar to that now employed. Seventy-five years ago, when Egypt was cloaked in far greater mystery than now, and these paintings had still successfully defied the archæologist, the origin of the harp was ascribed to the Arpi, a people of Italy, among whom it was very popular; this supposition has now been set aside, but the theory that the name now in use came from these people is of easy acceptance.

The harp was ever prominent in Scotland, Ireland and Wales, and the Celts claim its invention. How it came to find its secure place in the hearts and lives of these people is not to be explained, but the fact remains that it has ever been associated with their history. The Scotch harpers enjoyed a prominence almost as great as did the pipers. In Ireland the harp was found in the hands of the monarchs, the warriors and the bards, and according to the ancient Welsh triad:

> Three men are of the same regard:
> A king, a harper and a bard.

An instrument said to have belonged to Brian Boru, a poet king who reigned about 1000 A. D., is in the museum of Trinity College, and a faithful copy has been made for the Metropolitan Museum of Art. Later researchers attribute this instrument to the King of Thomond, who lived over two hundred years later. There is such a wealth of story founded on Brian's valor and his music, that it seems well-nigh contemptible to rule out this charming bit of evidence. The romantic Irish held their harpers in high esteem; it was the music of the harps that led them into battle, and in time of conflict a truly inspired harper was considered of more value than was a warrior, and there are in existence wonderful tales of the bravery inspired by their music. The harp has also been a favorite among their multitude of fairies, who richly endowed certain of the musicians.

The lyre is allied to the harp; its strings are similarly open, but are more limited in number. The kissar, in which the African savage delights, bears a most striking resemblance in outline to the elegant lyre of the Greeks. In modern times innovations are so readily accepted that the following extract from the writings of Athenæus regarding attempted changes in the lyre is hard to understand: "Whereas, Timotheus, the musician, coming to our city, has deformed the majesty of our ancient music, and despising the lyre of seven strings, has by the introduction of a multiplicity of notes corrupted the ears of our youth, and by the number of his strings, and the strangeness of his melody, has given to our music an effeminate and artificial dress, instead of the plain and orderly one in which it has hitherto appeared. . . . The Kings and the Ephori have therefore resolved to pass censure upon Timotheus for these things, and further to oblige him to cut off all the superfluous strings of his eleven, and to banish him from our dominion, that men may be warned for the future not to introduce into Sparta any unbecoming customs."— (Athenæus lib. iv.)

The members of the lute family are direct descendants of the hunting bow with the gourd resonator. This type has appeared more frequently than any other with plucked strings. In the Orient it has many forms. The rounded outline of the pear-shaped sound box of the lute is merely the outcome of artistic invention. A small cylindrical body placed at the end of a long neck, and a box-like frame covered with skin, are the successors of the gourd. The bodies of other instruments belonging to this family are oval, with flat backs, as in the English zither, and later in the guitar, in the yueh-ch'in of China, and in the guenbri of Arabia and Syria. The banjo is apparently of this family, but in reality it is an individual type, being a product of comparatively modern invention, and not the result of development.

The lute as a lute is very old. In Europe it has a history of extreme length, and composers wrote for it at almost as early a date as they did for the pipe organ. It was popular for several centuries as a household instrument, but a change in its capacities was necessitated as music progressed and composers became more ambitious, leading to an increase in the range of practicable notes. When, in the Sixteenth Century, a group of Italians stumbled into the invention of the opera, it was found that in the musical forms thus created, the voices could not be supported properly by the lute's meager music. Longer bass strings were needed, and the neck was elongated, while a second peg box was added farther up the neck, making possible louder tones. From this enlarged lute three distinct instruments were developed, the archlute, the theorbo, and the chitarrone. The lute in its new form appeared in sizes suitable for the accompaniment of the different voices, and as these became permanent, or were introduced into new lands, they received new names. The mandora was very large, having a length of three feet or more, the pandore smaller by about one-third, and the pandurina the smallest of the three. In Spanish-American countries, particularly Mexico, many of these forms are retained in popular favor. The lute in its more perfected forms possessed a large number of strings, tuned by a complicated method, and the playing was extremely difficult. The tuning could be properly accomplished only by those who had much experience. The oval body with a flat back has descended from the Oriental instruments through the English cither to the guitar, and a triangular outline appears in a number of instances, among them the Bulgarian tanbourica and the Russian balalaika.

The psaltery is another long-lived instrument. A modern form is the German zither, which is provided with frets, and is as highly developed as is possible for this type. More strings and other additions have only served to produce an instrument too large for ease in playing. The kantele of Finland is a psaltery raised to the prominence of a national instrument. The sound box in a vertical position appears in the spitzharfe, designed for duet use.

The voice of the lute family did not fulfil the ideals of the chamber musicians and their hearers. The churchly pipe organ, with its resounding voice, had appeared in smaller forms as chamber, positive, and portative organs. These instruments, however, were incapable of producing the lighter, sprightly music of the lute. As musical progress made itself felt, and the ears of the world required for their edification lustier music, an ingenious mind attached a keyboard to the psaltery, and arranged a mechanism by which the key lever sent a plectrum of metal, leather, or quill, against the string. The mechanism rendered possible strings of such increased weight and number as could not have been played with the fingers or with a plectrum. This invention appears in many paintings previous to the Fifteenth Century, and every collection of musical instruments contains a numerous assemblage of spinets or virginals, as they were interchangeably called. The instrument was called a clavicytherium when the strings and sounding board were vertical, having the keyboard at the bottom, and when it was placed on a standard for playing.

With the addition of more strings, and the use of a more complicated mechanism, the harpsichord appears. However, even with these additions, the tone was inadequate. The harpsichord did not have powers of expression, and after a short struggle with the pianoforte in the first century after Christofori introduced his instrument to the world, it went out of existence, except as a curiosity.

The dulcimer may be described as a psaltery whose strings are set in vibration by being struck with hammers. The principle of the dulcimer has been applied to many instruments in the East and West, these instruments having attained an especially great popularity in the Orient. The sound box generally has four or more angles, but the khudra katyayana-vina of India has a circular body, with a short neck. This circular tendency is evident in the majority of Hindu instruments, and may perhaps be accounted for by the primary use of gourds as resonators in all stringed instruments. The dulcimer of the West has become associated with the people of Hungary, and is prominent in the Hungarian orchestras, the tone of the instrument being clear and bright. Pentaleon Hebenstreit, in 1705, made a number of ingenious changes in the instrument of his native land; he added strings, and covered the hammers with such materials that the tone they produced was capable of many modulations. He carried it to the court of Louis XIV., and created such a furore that the king named it pantaleon. The dulcimer and its improved form are looked upon as the prototypes of the piano.

Before the days of the pianoforte, there existed the clavichord and the cembal d'amore. The ancestry of the clavichord can be traced to the monochord of Pythagoras, the Greek mathematician who lived nearly six hundred years before Christ. By means of movable bridges, Pythagoras divided the strings of his monochord into lengths capable of giving the intervals of the Greek diatonic scale. The monochord came down through the ages, and for centuries served in Europe to give the pitch to the voices of the church singers.

During the Fourteenth Century there came into existence an instrument which later acquired the name of clavichord. For a period the contradictory name of monochord was assigned to it, although it was more correctly a collection of monochords placed within a case, to which was attached a keyboard. The exact date of the invention is not to be learned, and the double use of the name of the older instrument has produced a tangle that cannot be unraveled. The bridges of the monochord appeared in the clavichord as wedge-shaped pieces of brass called tangents; they were sent by key levers against the strings from below, and served two purposes, in that they divided the strings into vibrating lengths, and set them in vibration. Like the spinet and the harpsichord, the clavichord lacked strength of voice, but unlike the plucked instruments, it possessed powers of expression to a degree attained by no preceding or ensuing kindred instrument. Its possibilities in this direction brought forth the highest laudations from composers and artists during the centuries in which it flourished. It was the favorite of Handel, and the constant companion of Bach in his study, where he used it while composing.

The harpsichord, with its slightly stronger voice, for a time attained a prominence over the clavichord, but its lack of expression allowed it only a comparatively short period of popularity. The action of the clavichord was so susceptible to the touch that, after the key lever had been lowered, a slight increase or decrease in the power of depression was followed by a similar change in the tone. In the beginning of the Eighteenth Century Gottfried Silbermann revived the principle of the clavichord in the cembal d'amore, which was in reality a clavichord doubled as to size and as to vibrating length of the strings.

The search for an action capable of producing either soft or loud music continued until about 1710, when Christofori profited by the experience of his predecessors, and produced what he named "gravicembalo col piano e forte," in other words, a keyboard instrument capable of soft and loud effects. The action was weak and mechanically crude, but the theory was correct, and Christofori's action has been the groundwork of all later makers. Scipione Maffei, in the "Giornale dei Litterati d' Italia" (1711), announces the invention. It had been considered impossible to attain the two effects successfully, and Maffei says: "Signor Bartholemeo Christofoli, of Padua, harpsichord player of the Most Serene Prince of Tuscany, has already made three harpsichords in which the production of more or less sound depends upon the force the player uses in striking upon the keys. Instead of jacks that produce sounds by quills, there is a little row of hammers that strike the string from below, the tops of which are covered with leather. Every hammer has the end inserted in a circular butt, that renders it movable. These butts are partially embedded and strung together in a receiver. Near the butt and under the stem of the hammer there is a projecting part, or support, that, receiving the blow from beneath, raises the hammer and causes it to strike the string with whatever degree of force is given by the hand of the performer, hence the sound produced can be greater or less, at the pleasure of the player."

Christofori's claim to the invention has been established beyond all doubt, although attempts to usurp the honor were made by the Frenchman Marius and the German Schröter. However, neither produced his invention until several years after Christofori had introduced his. In the Metropolitan Museum of Art there is one of the two existing Christofori pianofortes. It was purchased in 1895 from a Florentine family who had acquired it about 1820 at a public auction of ostensibly worthless articles from the Ducal Palace in Siena. It was retained by the family because of private associations until, in 1872, the discovery of its historical value was made. In the shape of its case it resembles a small grand piano, but it is without the pedals, which first appeared in the pianoforte made by Zumpe in 1783.

Next to the pianoforte, the violin finds favor as an instrument of music in the home. It suffers greatly in the hands of inexperienced players, who doubtless even by study could never learn its secrets. In the East it is played by the common people to a great extent, and someone has said that civilization has followed the fiddle, referring to its extensive use in furnishing music for frontier dances. The savage who rubbed his bowstring with a piece of rough bark, in order to produce sound vibrations, was the parent of the violin. The material used in producing vibrations in strings has been changed from time to time. A successor of the rough bark was the stick, with a serrated edge. This is the most primitive form of bow which presents itself for examination by the student of today. Despite its extreme crudity, it is still found in rural France in use with the bumbass.

The time and place of the introduction of horsehair cannot authentically be stated. The Hindus assert that King Ravanon, of Ceylon, 5000 years ago invented the ravanastron by discarding the notched stick and substituting in its stead a stick having horsehair stretched from end to end. The bow of the present ravanastron is formed from a piece of bamboo, pierced by a hole near one end. A mesh of hair is passed through, and secured with a knot, while another

BURMESE GONG.

Property of The Metropolitan Museum of Art.

The height of the stand is twenty-one inches, and the diameter of the gong eleven inches. The elaborately carved figures which support the cross-piece, and the embossing of the gong, are typical of the decorations of Burmese instruments.

knot is placed in the opposite end of the mesh, which is drawn to the other extremity of the bamboo, and the knot fastened in a cleft. The strain of the hair gives the bamboo a natural outward curve. The first horsehair bow was doubtless of this description. As years passed the curve gradually grew less, until the bowstick during the Twelfth Century became nearly straight. Later it acquired the inward curve, which still exists. This curve renders possible a decided tension of the hair. At intervals attempts were made to improve the method of tightening the hair. About the Fourteenth Century two fingers were inserted between the hair and the stick. The Seventeenth Century bow was provided with ratchet points over which the hair could be hooked, and during the next century Corelli introduced the use of a screw to replace the ratchet points.

Tartini, 1740, made the bow longer and more elastic than previously, but Francois Tourte, a Frenchman (1747-1835), brought the bow to its present state of perfection — white horsehairs stretched over a stick of Brazilian lance-wood or snake-wood curved inwardly. It was Tourte who decided the extent of the curve and the length of the bow, and contrived the method of pinching the horsehairs by a piece of wood in order to present a flat surface to the strings, in this way greatly increasing the volume of sound and the power of expression. The violin bow should be a little over twenty-nine inches in length, and the hairs should be twenty-six inches long. Formerly from eighty to one hundred hairs were considered necessary in constructing a perfect bow, but now the number varies from one hundred and seventy-five to two hundred and fifty.

It is not hard to imagine the bowed ravanastron passing through Persia to Arabia, and thence to northern Africa. Here it fell into the hands of the Saracens, who, when they went to Spain, carried with them the rebab or rebec. However, the use of the bow is claimed with the rote, one of which instruments was found over the bones of a German knight of the Seventh Century. In outline the rote resembles the English crwth, another ancient instrument with which the bow is associated. Both bear evidence of descent from the lyre. Their strings are similarly open, and the sound boxes are similar in shape, but when the bow began to figure in their history is quite unknown.

Ancient manuscripts contain references to the rebec and the rote, and associate them with the gay minstrels dating from the Twelfth Century. In the hand of the minstrels the instrument developed, and it is found later transformed into a rude fiddle, whose strings were plucked, bowed, or even rubbed with a rosined wheel. The body of the early fiddle was pear-shaped, and at first possessed a rounded back, which later became flat. It appears in old paintings and engravings, and is an ungainly instrument, often held in a horizontal position with the neck upright.

The viols, with their many defects, appear as the next epoch in the progress. Their flat backs made necessary cumbersome cross pieces, which helped to withstand the strain of the strings, but rendered a clear tone impossible. The sides had very shallow inward curves, which would not allow the bow full play, but made ever present the danger of rubbing more than one string at a time, as the bow could not be held at an angle sufficient to prevent this without coming in contact with the edge of the belly. The necks were fretted, and the swift glides now made by the fingers of the violinist over the polished surface of the violin neck, were impossible. Furthermore, the number of frets never exceeded seven, as the knowledge of the art of shifting belongs to the method of the modern instruments.

The viols appeared in sets of four, and it was a poorly furnished household which was not provided with a chest of them, as the group was called from the receptacle in which they were kept while not in use. It contained an instrument corresponding in pitch to each of the voices, soprano, alto, tenor and bass. At a gathering of friends the chest was opened, and long winter evenings were whiled away with vocal music, each voice being supported by a corresponding viol, and if a voice chanced to be missing, the viol of that pitch carried its part of the harmony alone. Serious men of business and of the church, philosophers, scientists and educators, were proficient in the art, and found time to assist in the music performed by the little orchestra of family and friends.

An innovation of the Sixteenth Century which lasted until the Nineteenth Century, were the sympathetic strings found upon the violas d'amore. Under the gut strings, near the belly of the viols, and fastened by a tuning plate of its own, were stretched a number of thin wire strings tuned in unison with those of gut, and when the bow caused the heavier strings to vibrate, those of wire vibrated in sympathy, and added a peculiar softness to the tone, from which was derived the idea of the name. Viols of all sizes were furnished with the sympathetic strings, but the instruments were not practicable except for solo work, which is the reason for their short life.

The Sixteenth Century saw the coming of the violin. The story of Stradivarius and his masterpieces, that have never been excelled, resembles a fairy tale That to one man alone should be given the power to construct a perfect article is indeed marvelous. Gaspar da Sala, the Amatis, the Guarnieri, gradually improved the violin, and paved the way for the great workman.

Of all instruments, those of the violin tribe are the most difficult to master, owing to the widely different functions of the hands of the performer. Each hand must be equally skilful, and the violinist must give himself entirely to his performance. The right hand is occupied with the bow, while the fingers of the left hand determine the pitch of the tones by varying the length of the vibrating segments of the strings, pressing them against the finger board. Those members of the family now in use in the orchestra are the first and second violins, the viola, the violoncello, or cello, as it is popularly known, and the contra or double bass.

The English kit and the French pochette, miniature instruments used by dancing masters of the Eighteenth Century, were so small that they could be carried in coat pockets, and could be played by the teacher as he demonstrated the steps. The zither with plucked strings has been changed into the streich-zither, or philomele, by the use of a bow. The body resembles that of a violin, but the neck is fretted, the construction is crude, and the tone is but a sorry imitation of that of the violin.

The tromba marina has not been mentioned in this evolution, for it can hardly be considered as an ancestor of the violin; it is rather to be looked upon as a descendant of the monochord of Pythagoras, to which the bow had been adapted. This monochord was diversely used by gentle nuns to accompany their hymns to the Virgin, and for many centuries in giving signals upon vessels.

The hurdy-gurdy, with its rosined wheel, provided later with a keyboard, was first used by the minstrels, and last by the Nineteenth Century street mendicants. Many of the handsome lutes were sacrificed in constructing the hurdy-gurdies, or vielles, as the French called them. The pear-shaped bodies were thought to impart especially pleasing qualities to the voices, owing to their powers of resonance. These instruments grew into an international prominence, and the traveler found them upon the street corners of Europe, England and America, and as a consequence the name has been incorrectly passed down to the street pianos of today. They are not of much importance musically, but possess romantic associations. Pepys, in his diary under the date of October 5, 1664, tells of an English invention belonging to the hurdy-gurdy family, which he had inspected on that day. As the scene of preparation is brought into view, the anecdote contains what is almost pathos, and in the minds of the readers there remains no doubt as to the career of the "Viall." "To the Musique-Meeting at the Post-office, where I was once before. And thither anon came all the Gresham College, and a great deal of noble

Company; and the new instrument was brought, called the Arched Viall, where, being tuned with lute strings, and played on with keys like an organ, a piece of parchment is always kept moving; and the strings, which, by the keys, are pressed down upon it, are grated in imitation of a bow, by the parchment; and so it is intended to resemble several vialls played on with one bow, but so basely and so harshly that it will never do. But after three hours' stay it could not be fixed in tune; and so they were fain to go to some other musique of instruments."

Although used synonymously by many writers, the words instrumentation and orchestration have a distinct meaning. The first is the science of individual instruments, and the last is the art of combining instruments harmoniously. Instrumentation regards the instruments acoustically and mechanically, but orchestration deals with the art of writing for the orchestra.

The many instruments which compose the orchestra, with their varieties of compass and tone, offer to the writer of music opportunities as numerous as do the different pigments which fill the color-box of the artist. Indeed, it is permissible to refer to the individual qualities of tone as their color. The German word corresponding to timbre is klangfarbe, a combination of words meaning tone and color. Thus there is to be found a striking analogy between the art of orchestration and the art of painting.

Before attempting orchestration, the composer should have a knowledge of instrumentation, and a thorough knowledge of all forms of correct writing of music. He should make a thorough study of theory and harmony, in order that he may not be tempted to trust to orchestration as a means to hide defects in form, just as an artist must master line drawing before he attempts the use of color.

The term orchestra is very elastic, and may refer to a complete group of instruments numbering eighty or more, or to a group limited to eight or ten. The Boston Symphony Orchestra, one of the standard organizations of the country, may be considered as a typical first-class orchestra, although at musical festivals five hundred performers are sometimes gathered together. The Symphony Orchestra contains sixteen first violins, fourteen second violins, ten violas, ten violoncellos, a harp, eight double basses, three flutes, two oboes, one English horn, three clarinets, three bassoons, four horns, three trumpets, three trombones, one tuba, three kettle drums, a triangle and a bass drum. As a general rule, the first violins slightly exceed the number of second violins; the violas are somewhat fewer than the second violins, and the cellos and double basses are about half the number of the first violins. Above all else, the instruments must balance well.

The art of writing for the smaller group differs greatly from that of writing for the larger, but is no less an art, for the perfection of the composition depends more upon the manner in which the available instruments have been treated than upon their number. Large or small, the orchestra contains much the same elements. There are always the string band, the wood-winds, the brasses and the percussion group. The individuals of each group may be combined with each other, or with individuals from other groups.

The string band is composed of the first and second violins, the violas, the violoncellos, and the double basses. This group is the foundation of the orchestra, and must receive especially careful attention. Their importance is due to the fact that they have greater possibilities of expression, and can be played for longer intervals without fatigue than can any of the other groups. The first violins are treated as sopranos, the second violins as altos, the violas as tenors, the violoncellos as barytones, and the double basses as basses. They are not restricted to these uses entirely, for the compass of the violas or of the violoncellos renders either capable of crossing and sounding even above the violins. The violins are the most wonderful instruments in the orchestra, as they can produce a tone unbearably shrill or beautifully soft and low. It can change from a wooing whisper to a fierce roar, and can be used in melodic passages of any quality. The violas and violoncellos possess many similar qualities. The voice of the viola in certain passages has a refined, veiled beauty, exclusively its own. The violoncellos may be taken from their duty of supplying the bass of the orchestra, supported as they usually are (an octave lower) by the double basses, and made to figure in melodic passages, giving a tone of romantic richness impossible for the violins or violas. Only since the beginning of the Nineteenth Century has the double bass been allowed any function but that of doubling of the violoncellos. Beethoven discovered many new possibilities for it, and it now may carry an individual part. Although its voice is the lowest in the orchestra, the tones of the violoncello are much firmer, giving the effect of being louder.

In the stringed instruments, the fourth and second strings cannot be played together without the third sounding, making many chords impossible. When writing music for these instruments, the convenience of the fingers of the player's left hand must be considered, their proper order being, as a rule, the first finger to the fourth string, the second to the third, and so on. The fewer notes required of each instrument, the better will they be played, and often a chord is divided between two instruments when the whole could not be played easily by one.

The judicious use of the double bass is one of the niceties of orchestration, for there are times when it can be left out most effectively, and yet is indispensable in other connections. However, with the best of treatment for the violins or for the basses, there will be no solidity to a composition if the middle voices are not treated skilfully. If the viola cannot undertake the middle part alone, temporary assistance must be demanded of the other members of the stringed quintette. Although capable of great force and beauty when used alone, the strings can accompany equally as well; they can be subdued until their sound is no more than a flutter, which is felt rather than heard in every fiber of the appreciative listener.

The wood-winds include the piccolos, the flutes, the oboes, the clarinets, the English horns, the bassoons and the contra bassoons. The piccolo, which is in reality a small flute, can give the highest notes of the entire orchestra. It is not pleasant when heard alone, but used with the flute can produce good tones that are several semi-tones higher than those of the first violin. It is often used with the first violins, sounding an octave higher.

The flute used in the orchestra is the concert flute in C, and is a most important and effective instrument. It adds brilliancy to the violin tones when used with them to fill out in loud passages, and produces a sweet and tranquil effect when written an octave above the first violins. Pathetic melodies are effective when the flute accompanies the oboe an octave higher, and the two instruments are capable of producing a bird-like "twitter" when thus combined. The clarinet and flute, the latter an octave higher, may be combined to advantage, but with less romance than the oboe and flute. The latter pair is found in operatic scores, an octave above the voice, assisting the singer. Chords for the wind instruments alone are made especially effective by writing notes for two flutes close together. Two flutes in thirds or sixths may be made to figure in stormy passages.

The most refined of the wood-winds is the oboe, with its delicate mechanism and its double-beating reed mouthpiece. It has a tone that is very penetrating, and yet may be soft and tender. The lower notes tend to be extremely piercing when united with those of other instruments, and unless handled carefully will usurp to a disagreeable extent the principal place in the harmony. The tone quality of the oboe makes it especially qualified to express romantic passages, and two sounded together are successful in pastoral effects. Two written in thirds and lightly accompanied are heard to advantage. The oboe blends beautifully with the French horn.

The most beautiful of the wind instruments is the clarinet, and it is also the most useful. It can assist the first or second violins, the viola, or the violoncello, and in the military band does the work of the violins. It can convey melodic phrases and accompaniments with equal grace, and blends well with the bassoons and horns. In writing for a full orchestra, the powers of the clarinet are reserved for the most aspiring effects, and it serves very largely as a melodic instrument. The clarinet also blends well with the soprano voice, and furnishes an obbligato in much operatic and sacred music.

The bassoon, which is the bass of the oboe, occupies a position among the wood-winds similar to that of the cello among the strings. Its tones are heard most advantageously when combined with the clarinets and horns. When two are used with the strings, they give a soft warmth to the lower harmonies that is impossible with any other instrument. They appear well in solos to produce the mournful effect necessary in funeral marches, and can furnish a bass when the wood-winds sound without the strings for a time. The contra bassoon sounds an octave lower than the ordinary bassoon, and though exceedingly effective in suitable places, it is less frequently used than the higher instrument. It requires much breath for blowing.

The English horn, the alto of the oboe family, is essentially an instrument for solo or obbligato work. Its voice is very beautiful, and it can give occasional phrases indicating great pathos and gentleness.

The brass instruments comprise the horns, the trumpets or cornets, the trombones and the tubas. The French horn, as it is more properly called, when used in pairs, is a peculiarly genial instrument, adding a certain warmth to any gathering in which they may figure. The horn in an upper melody supported by the strings is very effective. A too popular method of using the horn is to have it emphasize the latter notes in a bar in the accompaniment to waltzes and other dances. The beauty of the tone is entirely taken away by this jerky utterance.

The trumpet is difficult to play, and it fails to occupy a place among the melodic instruments because of its limited scale. It has been succeeded by the orchestral valve trumpet, and the more easily played cornet, although the tone of the latter is greatly inferior.

The best qualities of the cornet are evident in low passages, for its voice grows blatant as the music increases in loudness. The cornets combined with the horns, and assisted in the bass by the trombone, produce brilliant effects, which are especially bright when part of the cornets and part of the horns cross. In waltz music of the better class the cornets and the trombones may effectively emphasize the first note of each bar with a full chord.

The trombone possesses great power, is capable of a remarkable variety of effects, and appears to best advantage in groups, for singly its usual function must be to supplement the other basses. In a full orchestra, a magnificent quintet is formed of the trombones in the three lower parts and the trumpets or cornets in the two higher. Trombones are capable of grand passages, and may figure in martial or heroic melody. A player has the power to give a furious blast on his instrument or to produce a tone similar in quiet dignity to that of the violoncello.

The bass of the brass band are the tubas, which take the place of the cellos and double basses in military bands. Unless their voices are carefully subdued they are noisy, but used properly, they add to the complete orchestral structure.

The instruments of percussion are useful in imparting accent and emphasis to an orchestral production. Theirs is a very important function, and is fulfilled with greatest beauty by the kettle drums. These are the only ones of the percussion group which are each capable of producing several tones of definite pitch. The bass drum and side drum are also prominent, although the side drum finds a place in orchestral work only when combined with the other instruments; used alone it is very crude. The cymbals are sounded with the bass drum, and are capable of assisting in very fine effects. The sharper voice of the triangle may also appear to advantage, and judgment is the only possible guide to the use of any of this group. The drums can produce rather grand effects, for instance, their beats in Handel's "Dead March" from Saul seem almost like sobs when heard at such a distance that the other instruments are rather subdued.

After the individuals of the different groups have been thoroughly understood and judiciously handled, the groups must be mingled in such a manner as to retain the beautiful effects of the individual combinations, and to produce new beauties. Any conceivable combination may be called for, but it is absolutely worthless if it creates confusion when played, and if there is no reasonable necessity for it. Eccentricity must be debarred from the manner in which the voices of the instruments are arranged, and there are innumerable elements of beauty at the disposal of the composer to be united in creating charming effects. If the elements of the groups are treated correctly, the exact effect which the composer desires may be produced. Modern composers are much more venturesome in their combinations than were the composers of the time of Bach, who adhered strictly to certain established rules. However, one of the delicate compositions of Bach may be produced with as beautiful an effect as the more sonorous and daring compositions of the new school. Wagner outraged the old standard, but behind his extreme ideas was a power and reason which has caused his music to attain its prominence. Many who have attempted to follow his example have failed, because they wrote more to produce startling effects than to embody a special feeling or reason.

When loud passages are required, as in march music, the handling of the group will of course differ greatly from that employed for more quiet or delicate passages, for the instruments need not be considered as cautiously. The brasses are sometimes entirely eliminated when delicate effects are desired. The brass group, unconsciously regarded as strident, may be subdued to express the most refined feelings, while the strings may shriek in frenzy. The entire orchestra should be so perfectly balanced that when a full chord is played, it will sound like the utterance of a single great instrument played upon by the director. It is an organ, with each instrument a pipe and each group a stop, and the dormant power with which the performers may execute their passages is the swell.

Contrast is an essential quality, and is procured by employing instruments of different tone quality to play the principal parts at different times. Without it, the best music would grow monotonous. Another effective combination is made by causing two groups to answer each other; the strings and the wood-winds, the wood-winds and brasses, or the massed winds in opposition to the strings. The brasses and strings do not combine well, however.

As new instruments have been added to the orchestra, the art of orchestration has changed. The ophicleide, and before it the serpent, formerly occupied the place held by the tuba. The addition of valves to the horns and trumpets makes these instruments chromatic, and vastly more easy to handle. The guitar and mandolin are used for serenade effects. The cornet has falsely usurped the place of the trumpet in many organizations because of its less difficult method of playing, but its poorer voice will always debar it from the better orchestras.

MUSICAL INSTRUMENTS

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Accordion — Free Reeds. Europe. A predecessor of the concertina, and a successor of the mouth harmonica. It was invented by one Damian, of Vienna, in 1829. It is a rectangular case containing bellows in folds. The bellows are worked by the left hand, while the right is occupied with the keyboard at one end, which contains from five to fifty keys. The reeds are arranged in two sets, and sound alternately as the bellows are being opened or closed. The left hand has two or more keys for the bass harmony. These are played with the thumb and second finger. Selections in one key only can be played. The instrument varies in size, although it is always portable.

Æolian Harp — Europe. This is generally placed in the open sash of a window and the wind blowing upon the strings causes them to sound harmonic tones, according to its varying pressure. It sometimes possesses two sets of strings, in which case the angle of the frame is placed toward the wind and both sides sound. It has a sound board and bridges. King David, according to the Bible story, suspended his harp above his couch, and the north wind played upon it. There is also the chronicle of St. Dunstan of Canterbury, who was accused of sorcery because his harp was placed in such a position that the wind blowing against it caused the strings to sound.

ÆOLINA — See mouth harmonica.

ÆOLODICON — See æolodion.

ÆOLODION or ÆOLODICON — Free Reeds. Europe. This resembled and antedated the harmonium. The tone was at first produced by steel springs, but later the springs were constructed of wood, and more properly called reeds. They made the tone softer, and perhaps enabled it to take the place of an organ in churches. The brass tubes were arranged much as the present-day stops. It had a compass, when first invented, of six octaves. It is said to have been the idea of J. T. Eschenbach, of Hamburg, in 1800.

AGWEL — Vibrating Membranes. Africa. A bottle-shaped hand drum from Morocco.

AKAM — Plucked Strings. Africa. An instrument of the same description as the wambee, which is found among the Fan Tribe, Gaboon, French Congo. See wambee.

ALGOJA — Vertical Flute. India. A flageolet of bamboo, usually with five finger-holes, and frequently played in pairs.

ALPINE HORN — Cup Mouthpiece. Europe. A conical bore with a cupped mouthpiece and a bell. The horn is very long, and nearly straight; its least length is three feet, and the longest specimen in the collection at the Metropolitan Museum of Art measures seven feet four inches. It is composed of wood and bark, and is wrapped about with a reed. The herdsmen and mountaineers of Switzerland use it in giving signals and in making their rustic melodies. Its quality of tone is somewhat modified by the narrowness of the bore in comparison with the length.

ALTHORN — Cup Mouthpiece. Europe. Two forms of the tuba, the tenor in E flat or F, and the barytone in B flat, are given the name of Althorn. It is not properly an orchestral instrument, but replaces the French horn in military bands. Its upright bell making it more easy to play on horseback, recommends it, as also its less complicated method. Wagner and a few other composers call for the Althorn in orchestral scores.

AMMA-NO-FUYE — Vertical Flute. Japan. A double bamboo whistle.

ANANDA LAHARI — Plucked Strings. India. A cylinder of wood, one end of which is covered with skin. A single string fastened to the center of the membrane and passing through the open end is held taut by the left hand, and plucked by a bit of ivory or bone held in the right hand.

ANGRA OCWENA — See wambee.

ANTSIVA — Cup Mouthpiece. Africa A conch-shell trumpet from Madagascar.

APOLLO LYRA — Free Reed. Europe. An instrument of the early Nineteenth Century. The case was shaped like a lyre with an enlarged base, hence the name. One of these instruments, which are of minor importance, is in the Metropolitan Museum of Art in New York City. It has two sets of free reeds, which are acted upon by forty-six black and pearl touches, arranged in two rows. The lower row acts upon one set of reeds, and by means of a coupling mechanism the upper acts upon all the reeds. The left hand of the performer operates a sliding piston which pumps the bellows supplying the wind.

ARCHIMANDORA — Plucked Strings. Europe. This has a deep pear-shaped body, with a long neck. It is, indeed, a large Mandora, "archi" signifying that it is the largest of the family in question. It has never been as popular as the mandolin.

ARCHLUTE — Plucked Strings. Europe. A large pear-shaped body, in fact an ordinary lute furnished with an additional peg box, in order to give greater length to the bass strings. A specimen in the Metropolitan Museum of Art is four feet and seven inches in length. The number of pegs differed greatly, and the instrument was very difficult to tune, as several of the strings were doubled, the extra string being tuned an octave higher. Spruce was considered an admirable wood for use in the manufacture of the archlute, and it was often highly ornamented, much artistic effort being expended upon the roses in the belly, which numbered from one to three. The strings were of both wire and gut. The archlute was popular during the Sixteenth, Seventeenth and Eighteenth Centuries, and was used entirely for instrumental music. It carried the bass in conjunction with the violone in Corelli's sonatas, and it finds a place in Handel's "Giulio Cesare."

ARCHIVOLE DI LIRA — See lyre.

ARGHOOL — Single-Beating Reed. Egypt. A pipe with six finger-holes bound to a longer pipe without holes, which acts as a drone-pipe. It is occasionally played by boatmen on the Nile. Representations are found in the ancient sculptures, greatly resembling the diaulos of the Greeks.

ARPICORDO—Italian name for the harpsichord, which see.

AULOS — Vertical Flute. Greece. This was the most important wind instrument of the Greeks, and has been generally translated flute, but the name is doubtless more comprehensive, including reed instruments also. It was in numerous forms, and was often double, with one pipe longer than the other. This difference has been explained by the supposition that the two were tuned in different modes. Two formed a set of tibiæ impares, which was played by the same performer, the longer or bass pipe being held in the left hand.

AZUMA-KOTO — Plucked Strings. Japan. (Eastern Koto.) A koto having three sympathetic wire strings. It is bound along its length in wicker to preserve the idea of hunting bows tied together. See koto.

BALAFO — See marimba.

BALALAÏKA — Plucked Strings. Russia. A guitar with a long triangular-shaped body. The strings are of catgut, and there are three frets on the long neck. When played, it is held by the neck with the left hand, which hand also stops the strings, while the melody is plucked with the right. The body of the balalaïka remains poised without further support. A family consists of bass, tenor, and alto. It is the guitar of the Russian peasant, and is used by the Cossacks and gypsies.

BANDAR or BENDYR — Vibrating Membranes. Africa. An Algerian hand drum, having a circular frame, with skin stretched over at least one end.

BANDOLA, BANDORA — See pandore.

BANDURRIA — Plucked Strings. Spain. A Spanish guitar with a shallow oval body, and a neck furnished with twelve frets. Its strings of gut or wire are attached to a bridge, and the sound-hole is sometimes elaborate. Another distinguishing feature is the flat head.

BANJO — Plucked Strings. America. Said to have been invented by a negro plantation hand from a cheese-box, although this is not an established fact. The instrument is strictly American, and foreigners are little familiar with it. Prominent makers at first considered that it was unworthy to be called a musical instrument. It had a smooth neck, and the strings could merely be strummed with a metal thimble or the player's forefinger. It is now greatly improved as to quality and quantity of tone, has a fretted finger-board, and a carefully shaped neck. Its generally improved dimensions and outlines invite rapid and accurate execution. The banjo is a circular hoop, covered on the upper side by a tightly stretched parchment or skin, and has from five to nine strings. The left thumb plucks the melody string, which is the shortest, and lies next to the lowest bass.

BANYA, BONYA — Vibrating Membranes. India. A small wooden kettle drum with heads of skin, braced with strips of skin upon the sides.

BARREL ORGAN — Wind, with automatic mechanism. Europe. An organ in which a cylinder or barrel of wood or metal, studded with pins or pegs, when caused to revolve opens a series of valves connected with a bellows, thus admitting a current of air to a set of pipes, and producing a tune either in melody or harmony. The entire mechanism is contained in a case which may be either plain or very elaborate. In rural churches a barrel organ was sometimes used when a pipe organ was not available, and for these a case was frequently designed having rows of horn metal pipes. The usual instrument has several barrels to give variety.

In a pamphlet published by E. and H. Hodson, London, 1812, is contained a lengthy description of a machine or barrel organ of heroic dimensions which was invented and constructed by a Mr. Cumming for the Earl of Bute, its completion occurring in 1787. The organ possessed sixty-four barrels, capable of giving from four to twelve selections each, these selections being of both classical and popular nature. A number of the barrels were repeating barrels, i. e., upon their return the number would be played in an inverted order. The pamphlet is loud in its praise of the organ, and notes among its exceptional merits the method by which the barrels were kept in motion. Large buckets served as weights, and moved up and down alternately, one bucket being filled with water as it approached the highest point on its upward journey, when its increased weight caused it to descend, forcing upward the other bucket, which meanwhile had been relieved of its contents. This winding in no way interfered with the music, and obviated unpleasant intermissions during an evening's entertainment. Furthermore, the barrels could be placed in another room, all mundane matters being thus removed from the sight of the listeners. The organ came into public notice, and the Russian ambassador tried in vain to have a similar instrument constructed for the Russian empress.

The smaller barrel organs were and are used by street mendicants, and with the introduction of the harmonium and the American organ, they were displaced in the churches.

Baryton, Viola di Bordone — Bowed Strings. Europe. A viola da gamba fitted with sympathetic strings varying in number from seven to forty-four, and six or seven gut melody strings. These were tuned similarly to those of the viola da gamba, and passed over a bridge of unusual shape. The lowest sympathetic string was generally tuned in E. These strings were in a separate metal frame, and passed over an independent bridge. It may be said in passing that, although sympathetic strings are usually looked upon as an English adaptation, the baryton enjoyed great popularity in Germany, where it was frequently a household treasure.

The name viola di bordone may have been derived from "bourdon," meaning drone, and referring to the sympathetic strings. Another story has it that the instrument was the idea of an English prisoner under sentence of hanging, who, at the last moment for his invention, was granted "pardon," or, as changed by alien tongues, "bordone." This instrument was greatly liked by Prince Esterhazy, for whose pleasure Haydn wrote several pieces for baryton performance. According to Pohl, he composed no less than one hundred and seventy-five of these, and many lesser composers have written for it. J. J. Stadlmann, 1732, was a renowned maker of barytons. The instrument was a later form of the viola bastarda, after many changes had been introduced, one being the addition of one melody string, giving the baryton seven.

BASS CITHER — See bijuga cither.

BASS DRUM — Vibrating Membranes. Europe. This large drum was doubtless brought from Asia to Europe. In England at one time it appeared with a cylinder longer in proportion to the diameter; now the reverse is the prevailing condition. The two skin heads are each stretched over a smaller hoop, and held in place by a larger one. The tension is generally regulated by an endless cord passing around the drum in zigzag course from top to bottom, and tightened with leather braces which slip over the loops. Screws, or endless cord and pulleys, are also used in tightening. The bass drum is played with two rather large sticks, one smaller than the other. A roll is at times produced with a stick having a knob at each end, and held in the middle by the performer, who in striking alternates the knobs. No fixed notes are possible, and the principal function is to mark time in conjunction with the cymbals, which are used by the same person.

Bass Horn, Bassoon Russe — Cup Mouthpiece. Europe. During the latter part of the Eighteenth Century an attempt was made to improve the serpent, which resulted in an instrument called the bass horn. The conical tube was either of wood and brass, or of brass alone, and was doubled upon itself to allow the player to reach the finger-holes, which numbered six. Three or more extra holes were covered with keys. See serpent.

Bass Viol — See violoncello.

Basset Horn — Single-Beating Reed. Europe. An alto or tenor clarinet in F, which is becoming obsolete. It is being superseded by an alto clarinet in E flat, in use in the military bands. The basset horn, or cornet di bassetto, has a construction much the same as that of the ordinary clarinet, and the fingering is identical. The increased length requires, for the convenience of the player, that the tube be curved, this being done in different ways. The pitch can be lowered four semitones by means of keys that do not appear on other clarinets. The tone possesses dignity, and gives rather a somber effect in the lower register. The compass is from the second F below middle C to C^{3}, the instrument transposing a fifth. In appearance the basset horn differs from the other clarinets in having a small metal bell. Mozart favored it and an especially fine example of its use is in his great "Requiem;" also in his "La Clemenza di Tito," and in Beethoven's "Prometheus."

Bassoon — Double-Beating Reed. Europe. This is one improvement upon the ancient bombards accredited to Afranio, a canon of Ferrara in 1539. The English and French names refer to its position in the orchestra as the bass of the wood-winds. The German word fagott, and the Italian fagotto, are derived from a slight resemblance which it bears to a bundle of fagots. The tube is conical, and owing to its length, it doubles upon itself with a butt joint. It is provided with a brass crook or staple holding the double-beating reed, which is taken immediately into the mouth of the player.

The bassoon is in the key of G major, but extra keys carry it lower down to B flat, two octaves below middle C; A flat above middle C is the highest note, though modern instruments are able to sound a number of notes higher. Rapid passages are not effective in all keys, but in variety of employment it exceeds all of the other wind instruments, with the exception of the clarinet. For lower and medium notes, the bassoon is treated in the F clef, but the higher notes are found in the tenor clef.

Its use began, doubtless, with Cambert in "Pomone," in 1671. Handel used it infrequently, but an especially good example is in his "Saul." Bach avails himself of the bassoon very often, and sometimes in a prominent place, as in the great B minor mass. Haydn gave it a place in his military symphony, and in "Creation." However, in Mozart's time the bassoon appeared in earnest, and it was elevated to the place of a favorite with Beethoven, who employed it with great skill in his symphonies and other works, and who used also a double bassoon in the duet of Leonore and Rocco as they dig the grave of Florestan in "Fidelio."

Bassoon Quinte — Double-Beating Reed. Italy. A fifth higher than the ordinary bassoon, and a transposing instrument. See bassoon.

Bassoon Russe — See bass horn.

Batellus — See gotchnag.

Batsu or Hatsu — Sonorous Substances. Japan. Metal discs with broad flat edges, and a large boss in the center of each. See cymbals.

Baz — Vibrating Membranes. Turkey. This drum, used by the dervishes, has a bowl-shaped shell, usually of metal. The heads of skin are generally stretched over small projecting metal spikes.

Be — See n'gom.

Beggar's Lyre — The hurdy gurdy.

Bell — Sonorous Substances. These instruments consist of a metal cup or bowl and are caused to sound by the blow of a clapper or hammer which strikes either the inner or the outer surface. The bell may be fixed and the hammer alone movable, being propelled by some force from without, or the clapper may be fastened within the bell, so that when the bell is swung the clapper, because of its lighter weight, will be carried far enough out of its perpendicular position to strike the sides of the bell.

The origin of the bell is prehistoric and its noisy character has caused it to be used in many capacities. The Jewish high priest wears them upon his gown in order that he may be heard throughout the temple. The church bell in its tower dates from early Christianity. Sleigh-bells, cow-bells, and dinner bells, are forms in common and practical use today.

Bell metal is made of a mixture of copper and tin and the larger and heavier the bell and the denser the metal of which it is composed, the deeper will be the sound produced. C, an octave below middle C, can be given by a bell weighing twenty-two and a half tons, but for middle C, a bell weighing only three tons is needed. It is interesting to note that the cost of a bell like the first mentioned would be about $18,000, while the cost of the second bell would be $2,400. The largest bell in the world ever hung is that in the Kremlin at Moscow, weighing over 247 tons.

When in the theatre the effect of a church bell is desired, a heavy bronze bell is sometimes struck by a hammer, although within an inclosure the effect of a bell ringing in the open can be produced by striking steel bars.

Bendyr — See bandar.

Bent — Plucked Strings. Egypt. A small, light, Egyptian instrument, rather more like a lute than a lyre. One string or two are stretched over a board or a stick, and twanged with the fingers.

Bible Regal — Beating Reeds. Europe. A case in book form, containing a bellows at the back of the keyboard. The bellows inflated by lifting, supplied wind to the instrument. Immediately behind the keyboard was a set of pipes furnished with beating reeds. The keyboard was folded in the middle and could be placed within the bellows case, and in this form carried under the arm. One hand was needed to operate the bellows, but the grosses bible regal had pedals to supply the wind. The instrument was very popular in the home. Regal is Old German for organ. The bible regal belongs to the Seventeenth Century.

BIJUGA CITHER — Plucked Strings. Europe. Also called the bass cither. It derived the name bijuga from its double neck, that is, its two peg boxes, the farther one of which enabled the bass strings to be longer. Like the theorbo, the bass strings did not pass over the finger-board. It was especially popular in England in the Sixteenth and Seventeenth Centuries. See theorbo.

BIWA — Plucked Strings. Japan. An instrument having a pear-shaped body tapering to a neck furnished with pegs for fastening the strings. The entire length of the instrument is about thirty-five inches and the width of the body not quite a third of the length. The strings, three or four in number, are of silk and are plucked with a plectrum.

BIZUG — Vibrating Membranes. Syria. A tamboura with a long neck.

BOAT HARP — See pochette.

BOMBARDON — Cup Mouthpiece. Europe. The name is now given to the bass of the tubas in E flat, B^2 flat, B flat and C. The bombardon is circular, passing over the performer's head, with the bell directed upwards. It is the most prominent of the tubas. Those in E flat and B^2 flat are used in brass bands. See tuba.

BOMBARDON — Double-Beating Reed. Europe. Formerly the name was applied to an instrument of the pommer family. It was the largest member, and was capable of reaching F^3. It was in one length, without a bend except the usual pommer hook. Its high compass was more limited than that of the bassoon. See pommer.

BONES — Sonorous Substances. Europe. Four pieces of the ribs of horses or oxen held in the hand, and struck together for the purpose of marking time in accompaniment to the voice or another instrument. Bones are of ancient use in England, and are alluded to by Shakespeare in the fourth act of "A Midsummer Night's Dream," as forming one means of rustic music. In figures described by Inigo Jones for the court masques, a character is represented playing upon the knicky-knackers of bone or wood. The term "knicky-knackers" used by the country folk may have had its origin in the name "Nakerer," for in Strutt's Sports and Pastimes a payment is recorded as being made to Janino C. Nakerer, one of the minstrels of Edward II. The minstrels frequently indulged in burlesque music, and Janino may have performed upon the bones.

A rude instrument composed of several bones hung on a cord and played by rubbing with a stick was formerly used in Madeira to accompany the guitar. The name refers to castanets at times.

BONYA — See banya.

BOWED ZITHER or STREICH-ZITHER — Bowed Strings. Europe. As the name signifies, a form of zither played with a bow. The resonance box is heart-shaped and has a fretted finger-board across it. There are four strings, tuned like those of the violin. The instrument may be played as the zither proper. It is made in three sizes; treble, alto and bass. Because it lacks volume of tone, the streich-zither is quite unimportant. See zither.

BOX FIDDLE — See trapezoid fiddle.

BUCCINA — Cup Mouthpiece. Ancient Rome. This was one of the instruments used by the Roman army. It was doubtless used by the infantry as distinguished from the lituus used by the cavalry. The bore was cylindrical, gradually expanding into a bell. The tube was curved to nearly a circle with the bell resting upon the shoulder of the player. The instrument is found depicted in many bas-reliefs of the period and during the excavations at Pompeii, an instrument resembling the representations, was found. It is now exhibited at the National Museum at Naples although a copy is to be found at the Metropolitan Museum of Art. It was pitched at the second G above middle C. See lituus.

Budbudiki — Vibrating Membranes. India. A hand drum used by snake charmers, mendicants, etc., and resembling an hour-glass. A string having a small ball of leather or cork on the end is attached to the center and when the instrument is shaken, this alternately strikes each head. It is sometimes used in worship, when groups of five or six are shaken incessantly by relays of performers.

Bugaku-Biwa — Plucked Strings. Japan. A massive instrument with a pear-shaped body, formerly played on horseback. When the performer sits upon the floor, the lower edge rests upon it between his knees. Its four strings are plucked with a plectrum. The side of the instrument is called the sea-shore.

Bugle — Cup Mouthpiece. Europe. This in its original, simple form was the signaling instrument of the infantry. The tube is shorter and more conical than that of the trumpet. Brass or copper is used for its construction, and it has a small bell. Formerly the bugle was in most instances pitched in C, and had a crook for B flat, but now it is tuned in B flat and transposed, as the music is still written in C. The harmonics are produced either by keys or valves. The Kent bugle, so called in honor of the Duke of Kent, is merely the keyed bugle. Bugles have been made small enough to be carried in the pocket and yet useful in giving calls.

Bukkehorn or Prillarhorn — Cup Mouthpiece. Europe. An early attempt to apply side holes to a cup mouthpiece instrument. It is a native of Norway, and is generally made of horn. In Virdung's famous work (1511) there is an illustration of an instrument of this description, although it is here called a krumhorn.

Buni — Plucked Strings. Egypt. A harp in which the hollow sound-box of wood is covered with parchment, beneath which are stretched the strings attached to the central bar. The strings are tuned ordinarily by means of cords twisted around the bar and ornamented with tassels. It is played sometimes lying upon the ground and sometimes resting upon the shoulder.

BYAKUSHI — Soronous Substances. Japan. Nine long, tablet-shaped pieces of hard wood, strung together and used as clappers. The byakushi is occasionally made of bamboo.

CABINET ORGAN — Free Reeds. America. One of the names by which the reed organ is known.

CABINET ORGAN — Beating Reed. Europe. An instrument of the Sixteenth and Seventeenth Centuries. The name was applied to a premature device, within the case of which was a cabinet of drawers and a cupboard. One had a small removable spinet, which could be played either in its place or after removal.

CALASCIONE — Plucked Strings. Italy. This belonged properly to Italy. The body was that of the ordinary lute, but with a smaller neck. It was equipped with two or three gut strings, and was plucked sometimes with a plectrum, sometimes with the fingers. It greatly resembles the Egyptian nefir. Its use began to be discontinued in the Eighteenth Century. See lute.

CALLIOPE — Vertical Flute. American. This was invented by J. C. Stoddart, of Worcester, Mass., who received a patent for the same Oct. 9, 1855. This far from artistic instrument was suggested to the inventor by the steam whistles which herald the approach of a locomotive, or announce the dinner-hour in a factory. With unconscious irony, this remarkable device was given the name of the muse of epic poetry, famed for the sweetness of her voice. Stoddart conceived that these whistles could be so arranged that when the steam impinged against their thin edges the diatonic scale would be produced. Over the top of a steam chest was arranged, according to the number of whistles, valve chambers having double poppet valves. A small stem passed from each of the valves through the chamber to the outside, by means of which the valve could be opened upon a slight pressure. On each valve was placed a whistle that had its own separate tone, being of different diameter and depth of bell. The valves were lifted by means of pins placed in a revolving cylinder, and thus the tones were produced. The principle is similar to that of the music box, and the tones in the calliope may be of different lengths, as whole, half, quarter, eighth and dotted notes. This is due to the pins being of different shapes. A keyboard was a later addition. The first calliope was placed on board a small steamer on the Hudson River, with a view to attracting the public, and admirably fulfilled its mission.

CAMBREH — See halam.

CANE FLUTE — Vertical Flute. Europe. A walking-stick, the lower part being solid. Belongs to the Eighteenth and the early Nineteenth Centuries. The upper part is bored in a manner similar to whistle flutes.

CANE VIOLIN — Bowed. Europe. A narrow violin of small size made in imitation of a walking-stick, and furnished with an ornamented handle. When not in use, the small bow slips within the stick, and a cover conceals the whole. This novelty is made in Germany. See violin.

CARILLON — French term for the Glockenspiel, which see.

CASTANETS — Sonorous Substances. Moorish and Spanish. Spoon-shaped discs of wood made originally from the Spanish chestnut (castano). Two of them are hinged together by a cord, which passes over the thumb and first finger of the hand. The discs are struck together by the other fingers, and produce a hollow click. A pair is held in each hand. Castanets accompany the native Spanish and Moorish dances. They are employed in orchestras now for the accompaniment of any dance music, but are played by the performer upon another instrument, and are in consequence not held in the hand. A flat piece of wood to which is attached a pair of castanets is shaken when only a few measures require them. The drummer in military bands is sometimes called upon to use his sticks to strike a frame in which are fastened castanets.

CAVACO — Plucked Strings. Europe. This instrument is of the guitar family and has a small round or oval body, often formed of a gourd. Its home is Italy and Spain. The strings are of silk, wire or gut, and are attached to a small bridge from which they pass to the pegs at the end of the neck. The head is flat.

CAVONTO — Plucked Strings. Greece. A member of the mandolin family found in Greece, having a pear-shaped body, with a truncated base and a long neck. It is strung with wire strings.

CELESTA — Sonorous Substances. Europe. This instrument, the invention of a Frenchman, M. Auguste Mustel, of Paris, in 1886, was used by French composers and displaced the Glockenspiel or carillon in the orchestra. The celesta possesses a keyboard with a compass of five octaves. from the C below middle C. Bars of steel, to each end of which a brass block is soldered, are suspended over resonating boxes of wood, and are struck by hammers. The action is similar to that of the pianoforte. The resulting tone is clear and sweet. Leoncavallo and Puccini employ the celesta, and Tschaikowsky is one of the few foreign composers who have recognized it. It has a part in the "Danse de la Fee Dragée."

CEMBAL D' AMORE — Struck Strings. Europe. This instrument, invented by Gottfried Silbermann, of Freiburg, in the early Eighteenth Century was an attempt to improve upon the meager and expressionless voice of the harpsichord. The cembal d'amore did not belong to the harpsichord family, but was a revival of the principle of the clavichord, which had passed from general use. The tone of the new instrument, which was in reality a double clavichord, was not a complete success. However, it was another step towards the pianoforte. The strings doubled in length those of the clavichord, and passed over two bridges instead of one. The action was the same as that of the older instrument, but the tangents struck midway between the bridges, and both sections were allowed to vibrate. As the pressure was removed from the key lever, the tangent fell away from the string, which resumed a position upon a band of cloth which damped the vibrations. Here it remained in rest until used again. The case resembled that of the spinet, though the elongation was to the left of the performer. See clavichord.

CERVELAS — See wurst fagott.

CHABBABEH — Vertical Flute. Persia. The name applies to a vertical flute about a foot in length, and having six or more side holes.

CHA-CHIAO — See la-pa.

CHALUMEAU — Single-Beating Reed. Europe. This instrument was last called for in the orchestra by Gluck in the early Eighteenth Century. Its history is indistinct, as the ancient musical writers seldom mention it, doubtless from the fact that it was used exclusively by the peasantry. The name is easily confused with that of the schalmey, the antitype of the oboe, but the two instruments were greatly dissimilar. It had a cylindrical tube of wood or reed, in which the single-beating reed was placed. The number of finger-holes varied. When it was overblown, the fundamental scale was repeated a twelfth higher. Double chalumeaus, with a common mouthpiece placed in a block of wood, were used. The instrument was a forerunner of the clarinet.

CHANG-GON — Vibrating Membranes. Korea. This drum has a shell shaped like a dumb-bell, and covered with heads of skin, the projecting edges being laced together with heavy cord. One end is beaten with the fingers, the other with a stick. A good player can change the tone by beating first on the side, then on the middle, and finally midway between. In playing the wrists are used as well as the fingers.

CHAPEAU CHINOIS — See schellenbaum.

CHARP — Sonorous Substances. Siam. These cymbals are two brass discs with broad flat edges, and have a boss in the center. See cymbals.

CHEBEB or DJOUWAK — Vertical Flute. Algeria. Vertical flute of varying lengths and having finger-holes.

CHEKARA — See sarangi.

CHENG — Free Reed. China. A bowl-shaped reservoir fitted in one side with a crook mouthpiece. Seventeen bamboo pipes varying in lengths are inserted in the top, and arranged to simulate the tail of the phœnix. Each pipe has a free reed, and a hole which must be closed before a sound will be made. The cheng first suggested the reed organ.

CHI — Vertical Flute. Japan. A bamboo flute with seven holes. First made about 1000 B. C. It has never been much used, possibly because its plaintive tones too greatly resemble crying.

CH'IH — Transverse Flute. China. A transverse flute of bamboo measuring about fourteen inches in length. It was formerly blown at the middle. The number of holes varied between six and ten, with occasionally more. It has gradually become obsolete, its place being filled by the simpler instruments.

CHIKU-NO-KOTO — Plucked Strings. Japan. A koto of thirteen strings. It is played with a bamboo plectrum. See koto.

CH'IN — Plucked Strings. China. This is one of the most ancient of Chinese instruments, and embodies many poetical allusions. The name suggests restriction or prohibition, because its influence was supposed to check the evil passions, rectify the heart, and guide aright the actions of the body. The dimensions, form, number of strings, and whatever was connected with this interesting instrument found their principle in nature. It measured 366-100 of an inch in width, because a year contains a maximum of 366 days. The number of strings was five, because of the five elements. The upper part was made round to represent the firmament, the bottom flat to represent the ground. All these rules are not strictly adhered to in the present-day ch'in. The strings have come to be seven in number. They pass over a bridge near the wide end and thence through the board, and are tightened with nuts below. At the smaller end they are tightened with pegs. The ch'in is most difficult to play upon.

CHINCHICHI — Plucked Strings. Japan. A circular brass gong a few inches in diameter, and struck with a wooden beater. Used by mendicant priests in their chants.

CH'ING — See shun.

CHING — Sonorous Substances. Siam. Two brass discs with flat edges and conical centers. See cymbals.

CH'IN-SIAN — Vibrating Membranes. China. A tambourine with a circular frame of wood, and heads of snake skin. Metal discs are inserted in the sides.

CHIRULA — Vertical Flute. Europe. Another name for galoubet. See galoubet.

CHITARRA BATTENTE — Plucked strings. Italy. One of the guitar family, which has been used in Tuscany for several centuries. The body is rather deep, and has sides slightly incurved. The instrument has a length of nearly three feet. The strings are of metal, are tuned in pairs, and are struck with a short plectrum, generally of wood or bone.

CHITARRONE — Plucked Strings. Europe. This was a theorbo with an exceedingly long neck. The Chitarrone was fitted with wire instead of gut strings, and had two peg boxes, the upper carrying eight strings and the lower twelve. The instrument was used in the orchestra as early as 1607. Two were employed in Monteverde's opera "Orfeo."

CHITTIKA — See kurtar.

CHORUS — See tromba marina.

CHROTTA — See crwth.

CHOTNITCHIYEROG — See Russian Horn.

CHU — Sonorous Substances. China. The body resembles a square box, and is larger at the top than at the bottom. A hammer in the middle of the box is so contrived as to move to the right and left, striking the sides. In one side is a hole for the passage of the hand to manipulate the hammer.

CITHARA — See kithara.

CITHER or CITTERN — Plucked Strings. Europe. The former is the modern spelling, the latter that employed from the Sixteenth to the Eighteenth Centuries. It is shaped like the lute, the back, however, being flat instead of pear-shaped, and its strings of wire, which with the fact that the lute strings are plucked with the fingers and the cither strings with a plectrum, constitutes the principal difference between the two. It has any number of strings, from four pairs to perhaps fourteen. The name, English Guitar, was given to the cither during the Eighteenth Century, when that instrument was very popular in England.

CITTERN — See cither.

CLAPPERS — Sonorous Substances. Pieces of wood, bone or metal held between the fingers and struck together rhythmically. They have been found in Egyptian tombs and are pictured in Assyrian bas-reliefs.

CLARINET — Single-beating reed. Europe. A modification of the medieval shawm admitted into the orchestra about 1775. Since then it has been improved and has grown to great importance. It consists of a cylindrical tube ending in a flaring bell. It is fitted with a single-beating reed mouthpiece and is furnished with eighteen side holes, nine of which are covered by keys and nine by the fingers. The lowest tone which it is capable of producing is E, below Middle C, the compass extending to C, three octaves above it. The clarinet is considered the most expressive of the wood-winds, because it is capable of almost perfect gradations in the power of its tones. Its voice is rich and full, although the extremely high tones are too piercing for frequent use. Beethoven, Schubert, Weber, Mendelssohn, Rossini, Wagner and Tschaikowsky have employed it freely.

Clavichord — Struck Strings. Europe. Called "the comforter of the sufferer, and the sympathizing friend of cheerfulness," by Koch in his musical lexicon, the clavichord is to be considered the direct predecessor of the pianoforte. The strings were set in motion not by hammers but by tangents or wedges of brass about an inch in height and an eighth of an inch broad at the top. The case was oblong, resembling that of the early square pianofortes. The general direction of the strings followed the length of the case, but at the right of the performer they passed over a curved bridge which definitely determined their direction and transmitted their vibrations to the sounding board.

In the older clavichords one string, or set of strings, was made to serve in producing two or more tones and the tangents did a double duty by dividing the strings into unequal parts and by causing them to vibrate. A narrow cloth band was interlaced among the wires, allowing only the desired section of the strings to vibrate until the pressure was removed from the key, when the entire length was damped. When supplied with one string to several tones clavichords were called "gebunden" or fretted. When supplied with a string to each key the adjective "bundfree" (unfretted) was applied. The system of the tangents was not unlike that of the bridges on the monochord of Pythagoras. In fact, the name monochord is early found applied to an instrument in other respects resembling the clavichord and the generally accepted idea is that the latter was evolved from a grouping of several monochords in a case having a keyboard attached. When this took place is not to be definitely stated, but let us say not before the middle of the fourteenth century, as in 1323 Jean de Muris enumerates the musical instruments in use at the time, not mentioning the clavichord, but describing the monochord in its measuring or intervals.

Handel, Scarlatti, Haydn, Mozart, Beethoven and Bach looked with favor upon the clavichord. In the time of

Mozart two of them were often admitted into the orchestra, the director playing upon one. It was the most expressive keyboard instrument ever known. The action of the tangent upon the string was discernible to a perfect touch and the slightest deepening or lessening of the pressure upon the key after it had been depressed would produce a change in tone.

Writers of all periods of its use have been loud in their praises and the Germans especially clung to it when the louder-voiced instruments appeared. Even the pianoforte, which in its modern form seems the king of its kind, in the eighteenth century could not successfully bear a comparison with its ancestor. A critic of Leipsic in 1782 said that upon the pianoforte "the heart cannot express itself, no picture can be completely produced, as light and shade cannot be expressed; only a clearly defined sketch can be made. . . . The clavichord, however, stands highest of all. Although on account of its nature excluded from the concert hall, it is the companion of the recluse. Here I can reproduce the feelings of my heart and fully express them. In order to judge a virtuoso one must listen to him while at the clavichord, not at the pianoforte."

The oldest clavichord known to exist is at the Metropolitan Museum of Art and was made in 1537 by Alex. Trasontinus. It has a compass of thirty-six notes. The instruments were made until the nineteenth century and had more than double this compass.

Clavictherium or Clavicembalo Verticale — Plucked Strings. Europe. It was originally designed to be played upon a table, and was similar to a spinet. The case was three-cornered. Each key commanded a separate string, and in place of the tangents of the clavichord, there were used wooden bars (jacks), having at the upper end a small pointed piece of hard quill, by means of which the strings were set in vibration. In the course of time standards were provided, and the sound board was placed on end. There is a paucity of information concerning this instrument. It is also called the upright harpsichord or spinet, and is spoken of by Virdung (1511).

Clavicembalo Verticale — See clavictherium.

Clavier — See orphica.

Claviharp — Plucked Strings. Europe, Invented in 1815 by Christian Dietz, of Paris. The case was harp-shaped and upright. The strings were of wire. A keyboard operated a series of finger-like hooks, which plucked the strings, and produced an effect similar to that of the ordinary harp. Each hook after plucking resumed its position, owing to the leaden weight which was attached to it. One pedal operated an automatic muffling apparatus, another controlled a strip of cloth performing the duties of a damper, and another was connected with a swell shutter.

Colangee — Plucked Strings. Africa. An instrument coming from the Soudan, and similar to the wambee. See wambee.

Concertina — Free Reeds. England. Patented by Sir Charles Wheatstone, June 19th, 1829. It is hexagonal in shape, with a finger-board at each end between compressible bellows. The air is forced by the bellows against free metallic reeds. The notes placed on the lines of the musical staff are on the side of the instrument touched by the left hand, and those in spaces are played by the right hand. The C's are all marked in red, and the compass is about three and one-half octaves. The method of playing is very easy to learn. When in its glory, concerts were given, and William Cawdell, in 1865, issued a pamphlet extolling it and recommending it for general use. It could render classical music, and instruments of different pitches, such as treble, tenor, baryton and bass when played together were capable of producing rich and powerful effects. Signor Giulio Regondi, who appeared in London in 1865, created a furore with his concertina playing. Cawdell remarks that it would add greatly to the pleasure of traveling to be accompanied by one of them.

Conch-Shell Trumpet — Cup Mouthpiece. A primitive instrument made of a conch-shell through which the performer blew.

Contrabass, Double Bass — Bowed Strings. Europe. The contrabass derives its name from the manner in which it doubles the part of the violoncellos, the bass of the stringed quartet, and is capable of producing the lowest notes called for in the orchestral scores. It strings are tuned in fourths instead of in fifths, as are the strings of the other stringed instruments. Open they sound G on the lowest line of the bass clef, and D, A and E, below. In order that extra or leger lines need not be used constantly, the music is written an octave higher than it sounds.

This is the only one of the bowed family in which the individual features of the old viols are retained, the contrabass having the slanting shoulders and flat back of the older instruments. It has undergone but few changes since it was known as the violone, the largest viol. It is said that a small boy was sometimes placed within the body of the violone, where he sang a treble part of the harmony, the player, besides using the bow, singing the bass. The older instruments possessed more strings, the number varying from five to seven. Now a contrabass with three strings finds especial favor in England, where it is tuned in fourths, A, D and G, but in other countries the three strings are sometimes tuned in fifths, sounding an octave below the three upper strings of the cello.

Muted tones are never found in contrabass music, for a mute suitable for use on the instrument would be an impossibility, weighing about two pounds. The neck is long, increasing the distances between the notes, but a good performer can produce many effects. Although the instrument had been extensively used in completing the harmony, Beethoven somewhat scandalized his contemporaries by scoring new effects for it. Its versatility has been greatly increased, and Kussewitsky, a modern virtuoso, can vary his tone from a full and almost thundering bass, to sounds that are most delicate and flute like. Where the strings are plucked, they sustain the full rich tone for a long time.

The tremolo is telling and dramatic, and the contrabass can amusingly burlesque the other stringed instruments.

Contrabass Viol — See violone.

Contrabassoon — Double-Beating Reed. Europe. This member of the oboe family has a tube about sixteen feet in length, and sounds an octave below the bassoon. It is even able to reach B flat, next to the lowest note on the pianoforte. The instrument transposes an octave. Its voice is somewhat coarse and hard, but of fine effect under suitable conditions. Rapid passages are not practicable, and the parts assigned to it in scores are in many instances interpreted upon the sarrusophone, which is gradually finding its way into the orchestra. Beethoven employs the contrabassoon with telling effect in his ninth symphony and his mass in D, and Brahms makes most successful use of it in his symphony in C minor. Wagner employs the instrument notably in "Parsifal." See bassoon.

Cor Anglais — Double-Beating Reed. Europe. This instrument is regarded as the alto of the oboe family, although it is more properly a small bassoon. It stands in the key of F, a fifth below the oboe. It exactly resembles the oboe in its construction, scale and compass, and is the enlargement of that instrument by half. The name English horn is misleading, as the instrument is not a horn, nor did it originate in England. It is probably the corruption of a name referring to the curve or bend, which at one time occurred near the middle, although now the instrument is straight.

The tone possesses melancholy and somber qualities that cannot be found in any other instrument, and is less piercing and brilliant than that of the oboe. The cor anglais has a compass from E below middle C two octaves and one-fifth upward, and can give the intermediate semitones. The music is written in the G clef, a fifth higher than it sounds. Formerly the music appeared in the alto clef, and there was a difference of opinion among composers as to whether it was a transposing instrument. Bach treats the instrument as tenor, and denominates it taille de bassoon, taille meaning the tenor voice. In a less improved state the cor anglais was called the oboe da caccia, and it was referred to as such in the scores of the older composers. In the overture of Rossini's "Guillaume Tell" it imitates the alpine horn. Meyerbeer in "The Huguenots" and "Robert le Diable," Halévy in "La Juive," and Gluck in "Orfeo," make use of it. Wagner in his music dramas, and orchestral composers following, have made free and effective use of this instrument. Beethoven, Schubert, Weber and Mendelssohn are among the composers who have never recognized the cor anglais. See oboe.

COR DE CHASSE, HUCHET — Cup Mouthpiece. French name for postilion's or huntsman's horn. See hunting horn.

CORNO TORTO — See cornetto torto.

CORNEPYPE, CORNICYLL — See pibgorn.

CORNET — Cup Mouthpiece. Europe. The cornet, which has been adopted into many orchestras as a substitute for the trumpet, an instrument more difficult to play, has its more proper place in military bands, and in interpreting dance and popular music. It has a conical brass tube of wide bore, having a length of four and a half feet. The tube expands into a bell, and is fitted with three valves to extend the pitch. The cornet transposes downwards a tone. The instrument in B flat has a compass of two octaves and one-half, with E below middle C as the lowest note.

It is an instrument which can be played after a little study, and although it is rather versatile, the tone has few characteristic qualities, and tends toward coarseness rather than dignity. Its deep, cup-shaped mouthpiece affects the tone to a great extent, as also do the proportions of its tube and bell. The cornet cannot play double notes. In a few instances a cornet mouthpiece has been used with the tube of a trumpet in an effort to make use of the better qualities of both instruments. Rapid passages, trills, repeated notes, arpeggios, etc., can be given with ease, and the cornet is a good melody instrument.

Cornet a Bouquin — Cup Mouthpiece. Europe. The French name for zinken. See zinken.

Cornet-Trompe — Cup Mouthpiece. Europe. This name was given by Sax to a hand horn which he invented. It was so shaped as to fit the body of the player, and was designed for portability, the tubing being coiled about the middle, greatly reducing the size. See hand horn.

Cornetto Curvo — Cup Mouthpiece. Europe. Larger sized zinken with detachable mouthpiece. See zinken.

Cornetto Diritto — Cup Mouthpiece. Europe. A small sized zinken, straight, and with mouthpiece detachable. See zinken.

Cornetto Muto — Name signifying a soft toned cornet. It was a small sized zinken, consisting of a straight tube with a non-detachable mouthpiece.

Cornetto Torto, Corno Torto — Cup Mouthpiece. Europe. Larger sized zinken with "S" shaped tube. Predecessor of the serpent. See serpent.

Cornicyll — See pibgorn.

Corno di Bassetto — See basset horn.

Corno Torto — See cornetto torto.

Cornopean — Cup Mouthpiece. Europe. The name given to the earliest form of valved instruments, now called cornets.

Cornu — Cup Mouthpiece. Roman and Etruscan. The cornu was curved in a semicircle, and may be termed a bronze bugle. It is hardly distinguishable from the buccina, and without a doubt the names were interchangeable among the ancient writers. In the Metropolitan Museum of Art there is a copy of one of Etruscan origin which is displayed at the British Museum. Its pitch is D flat, about a minor third above that of the present infantry bugle. The cornu was held under the performer's arm, the broad end upwards over his shoulder.

Cor Omnitonique — Cup Mouthpiece. Europe. The name means diatonic orchestral horn. One of the many inventions of C. Sax, père, appearing in 1824. Instead of using crooks to change to the various keys, a graduated slide added or detached certain lengths of the tubing. A separate elbow of tubing bore a movable register, which the player could place upon a number representing the key in which he wished to play, and the correct length of tubing was immediately brought into connection with the mouthpiece.

CROMHORN — See krumhorn.

CROWD — See crwth.

CRUIT — Gallic term for violin or harp. Same as crwth or crowd, which see.

CRWTH, CROWD, CHROTTA — Bowed Strings. England. The oldest form of bowed instrument known in England. It was shaped a little like a lyre, having an extension in hoop form of the square sound box. In the center of the top of the hoop were the pegs. Through the center ran an unfretted finger-board, and over this were generally stretched four of the five or six strings, the others being just beside it and plucked by the right thumb. The sound holes were round. These instruments were very ancient, dating to four hundred years before Christ and were first mentioned about 609 A. D. by Venantius Fortunatus, Bishop of Poitiers. Crwth is the Welsh name, and crowd the English. The left foot of the bridge passes through one sound hole, and rests upon the back of the sound-board, fulfilling much the same duty as the sound-post on a violin. It is, in fact, an ancestor of the violin, and doubtless a descendant of the Irish cruit, which was plucked by the fingers, and which is claimed to have been mentioned by an Irish poet before the time of Christ.

CUCKOO — Vertical Flute. Europe. Two small pipes bound together and giving two notes resembling the call of the cuckoo.

CYMBALS — Sonorous Substances. Europe. Cylindrical plates of brass or bronze, thinner at the outer edge. They vary from the finger cymbals, an inch in diameter, to the large ones used in the orchestra and the band, measuring a foot or more in diameter. They originated in Arabia, and in Turkey, where the most successful are made, the composition of the metal being held a secret, however. They take a prominent place in the Janissary music, and were thence adopted by other military bands and by the orchestra.

The cymbals have, at their center, straps through which the hands are to be thrust. However, as they are often played by the bass drummer, one cymbal is usually fastened to that drum, and the other held in the drummer's left hand. Their duty is to mark time, and their effect is ringing and bright, but they are also used in uncanny and thrilling passages. Cymbals are not clashed together, center to center, as in that case the impact would doubtless cause them to break, but they are rubbed together with a sliding motion, that requires some skill. Wagner has taxed their repertory of effects, ordering a roll produced with a drumstick upon one cymbal, a soft tremolo by rattling the two cymbals together gently and a gong imitation by a single strong stroke upon a hanging cymbal. He also uses them in the expression of combat or unrestrained revelry.

DABBOUS — Sonorous Substances. Turkey. A rattle used by dervishes. A knobbed stick is hung with chains finished with bits of metal, that strike together when the stick is whirled.

DA-DAIKO — Vibrating Membranes. Japan. This drum was used upon the most momentous occasions. It was erected upon a special platform gaily draped and tasseled and provided with a gold railing and steps. Much skill was requisite in the drummer. He stood in front of the drum with his left foot on the platform and his right on the upper step to give him more force in striking. The drum was surrounded with a broad rim ornamented with phœnixes and dragons and having an edge of irregular points painted red to represent red flames. This was surmounted by a black lacquer pole supporting a golden sun one foot in diameter with rays 18 inches long. There are none now in existence. One sent to the Vienna exposition was lost in shipwreck.

The phœnix is very popular for use in the decoration of Japanese musical instruments and is usually represented as surrounded by red flames. Its story is typical of Oriental romanticism. The phœnix is a mythical bird known throughout the Orient and is supposed to have lived in the Arabian wilderness for 500 or 600 years when it built for itself a funeral-pyre of aromatic woods which the bird fanned with its wings causing flames to break forth. However from the ashes the phœnix sprang to fresh and vigorous life again. From this it has grown to be considered the insignia of immortality.

DAFF — Vibrating Membranes. Arabia. A hand drum with a square frame of wood and two heads of skin.

DAHAREH — See dayere.

DAIRI — Vibrating Membranes. Turkey. This Turkish tambourine has either a circular or an angular frame. It is often furnished with small rings and bells of metal. See tambourine.

DALDYOSHI — Vibrating Membranes. Japan. The name signifies "grand time beater," the instrument being used upon special occasions. It is beaten with one knobbed stick, and is supported on a lacquered stand. Its skin heads are over a foot in diameter.

DALUKA — Vibrating Membranes. Africa. Soudan. A small cylindrical shell with heads of skin.

DAMAM — Vibrating Membranes. India. A drum made of two human skulls, fastened together at the crown, the lower parts being cut away and the cavity covered with human skin. This ghastly affair is beaten in the temples.

DARABOUKKEH — Vibrating Membranes. Syria. A bottle-shaped hand drum, made of pottery or wood, which is held on the lap with the head projecting forward, and played with the flat of the fingers.

DAVIDHARFE — See spitzharfe.

DAYERE or DAHAREH — Vibrating Membranes. Asiatic Russia, Persia. A tambourine with a frame of wood, covered with a head of skin. Small rings and bells fastened to the interior add to the effect when played.

Deff — Vibrating Membranes. Africa. Algiers. A square frame of wood covered on both sides with parchment, which is struck with the hands.

Den-Den-Daiko — Vibrating Membranes. Japan. The fan drum. A wooden hoop covered with skin and having a short handle. It is used by the mendicant priests of Hokke, a Buddhist sect.

Dervish Drum — Vibrating Membranes. Egypt. A shell of metal or pottery covered with skin, and sometimes beaten with a leather strap. It is used by the dervishes. A modern one is seen in the Metropolitan Museum of Art. The dervish drum is similar to the daraboukkeh still used in Arabia.

Dessus — Bowed Strings. Europe. The French word meaning "above," which was applied to the treble viol and later was used in reference to the violin because of its high pitch.

Dhola — Vibrating Membranes. India. A shell bored from a solid block of wood, with heads of skin stretched over the opening, and held by leather strips fastened round hempen hooks. It is played with both hands or with a stick, and is sometimes equipped upon the side with metal rings, which are struck by sticks. The dhola is heard at weddings and upon other festive occasions. The dholaka is similar.

Dholaka — See dhola.

Differo — Double-Beating Reed. Europe. A name formerly given to a small variety of oboe not now in use. See oboe.

Dimplipito or Nagare — Vibrating Membranes. Persia. These hand drums have bowl-shaped shells and heads of skin, braced with cords.

Dital Harp — See harp-lute.

Djouwak — See chebeb.

Dobachi — Sonorous Substances. Japan. A large cup-shaped gong, about a foot in diameter, used in the temples, where it is placed on a cushion on a lacquered stand. It is struck with a short stick covered with leather. Its best tone, which is indeed beautiful, is produced by means of an upward stroke.

Do-Byoshi — Sonorous Substances. Japan. These are brass cymbals slightly conical in shape, and of different sizes. An embossed band and a heavy silk cord serve as decorations.

Dohol — Vibrating Membranes. Persia. A hand drum with a shell of wood or metal, which appears in many shapes. The heads are of skin.

Dombeg — Vibrating Membranes. Persia. A hand drum whose shell is of wood, and is shaped like a goblet. It has a skin head.

Dora — Sonorous Substances. Japan. An ordinary gong imported from China, where it is used by night watchmen. The shallow, circular plate of metal is about a foot in diameter.

Dorje — See drilbu.

Dosa — See sona rappa.

Dosho — Vertical Flute. Japan. Cane Flute. This was designed as a toy, but was seriously adopted, and bound with ornamental strings. It has never proved popular.

Doteku — Sonorous Substances. Japan. An antique bronze bell over a foot in height, struck with a wooden mallet.

Double Bass — See contrabass.

Dragon Flute — See yoko-fuye.

Drilbu or Dorje — Sonorous substances. India. The name signifies thunderbolt. This bronze bell is engraved with characters, and the handle is often carved to represent a deity. The priests sound it during prayer.

Duduk — See duduki.

Duduki, Duduk, Souffarah — Vertical Flute. Turkey. This short flute is made in various lengths, and has six or seven finger-holes.

DUFF — Vibrating Membranes. India. A tambourine with a head of skin stretched over a wooden frame, having several angles.

DULCIMER — Struck Strings. Europe. This ancient instrument is known in the East by the name of santir. Its trapeze-shaped sounding board generally has two sound holes. The strings are stretched from pegs placed in each side of the sound board, and pass over two bridges. The strings are struck between the bridges with little hammers. This places the dulcimer as a predecessor of the piano. The tone when forte is harsh, and there is no way of damping the strings when one has been used and another is to be struck. The dulcimer has gone out of use except among gypsies, and it is often heard in traveling Hungarian gypsy bands. The dulcimer is about three feet at the greatest width, and has from two to five strings of brass or iron wire to each note. The compass varies from two to three octaves.

DUNG-CH'EN — Cup Mouthpiece. China. A trumpet with a shallow cup-piece, originally coming from Thibet.

DUPLEX HORN — Cup Mouthpiece. Europe. Pelitti, of Milan, in the middle of the Nineteenth Century, made sets of duplex instruments, in which two instruments were combined in one. Each had a separate bell, but a common mouthpiece. They were furnished with a small valve in the center, by means of which the air could be directed into either form of instrument at the will of the operator.

ECHELETTE — French name for the xylophone, which see.

EKA-TARA — Plucked Strings. India. The body is small and globular, and is furnished with a long narrow neck, which passes through the body and projects on the lower side. A single string is stretched from end to end of the neck.

EKIREI — Sonorous Substances. Japan. A hollow metal ring is formed of two concave sections joined at the edges. Several of them are attached to a harness, and jingle together.

ELEKE — Sonorous Substances. Africa. A zanze of the Mpongwe Tribe, Gaboon, French Kongo. See zanze.

EL OUD — Arabian name for the lute.

ENGLISH GUITAR — See cither.

E'OUD — Plucked Strings. Syria. A lute played with a plectrum. It has twelve strings, four being of wire and eight of gut. See lute.

E'RAQYEH — Double-Beating Reed. Africa. Found in Egypt, and consisting of a cylindrical tube of wood, with a small air chamber situated just beneath the mouthpiece.

ERH-H'SIEN or HU-HU — Bowed Strings. China. A two-stringed violin, in principle identical with the hu-ch'in, but it never has more than two strings. It varies in construction, being sometimes a hollow bamboo tube, in which case it is called hu-hu, and sometimes half of a cocoanut shell, when it is called t'i-ch'in. It is popular all over China, the poorer classes being exceptionally fond of it.

ESRAR — Bowed Strings. India. The body of wood is rounded at the base, the sides curve in toward the center, and the belly is of skin. The neck is broad and flat, and is furnished with several metal frets. This instrument is well provided with strings, sometimes having fifteen.

E'SUZU — See waniguchi.

EUPHONIUM — Cup Mouthpiece. Europe. The smallest of the tubas in B flat, having a compass from B^2 flat to F. Wagner in his scores calls for numerous sizes of tubas, but ordinarily the euphonium is found in bands, and in military music. See tuba.

FAGGEISHAH — Sonorous Substances. Syria. Castanets. Several metal discs attached to a string to be shaken.

FAGOTT, FAGOTTO — See bassoon.

FAGOTTINO — Double-Beating Reed. Europe. The Italian name for a small bassoon having a compass of only an octave. Its pitch is a fifth higher than that of the ordinary bassoon. See bassoon.

FAGOTTO — Double-Beating Reed. The Italian name for bassoon, suggested by the resemblance in its bent form

ASHANTEE DRUMS.

Property of The Metropolitan Museum of Art.

The Ashantee tribe is found on the East Coast of Africa. Their drums are characteristic works of savage art. The use of skulls in ornamentation is exemplified in the drum to the right.

to a bundle of fagots. Fagott is the German name. See bassoon.

FENG-LING or WIND BELLS — Sonorous Substances. China. Small bells hung from the eaves of houses and pagodas. The clappers have streamers attached to catch the wind.

FETICH DRUMS — Vibrating Membranes. Africa. Instruments reputed by the Africans, along with other inanimate things, to be in close connection with a supreme being. The relation is supposed to be sufficiently strong to give the possessor of the article especial influence with the deity.

FIELD TRUMPET — See trumpet.

FIFE — Transverse Flute. Europe. A small transverse flute. It has been in use in England and other European countries for hundreds of years. Shakespeare speaks of "the vile shrieking of the wry-necked fife." It is practically a flute in B flat, although sometimes pitched in C. The bore was formerly cylindrical and the instrument was without keys, the tone being in consequence faulty and ear-piercing. In its modern form it has a conical bore, and besides six finger-holes, keys numbering from four to six. The fife is played in conjunction with the side drum in fife and drum bands, although its music is supplemented in a slight degree by flutes in F or in E flat, and by piccolos. The change in construction came about during the last quarter of the Eighteenth Century.

FLAGEOLET — Vertical Flute. Europe. A survival of the old straight flute à bec. It was introduced into general notice in the Sixteenth Century. It has four holes in front and two in the back. It appears both in single and double form. In the latter the two tubes are side by side in a single block, and are blown by one mouthpiece and the instrument is fitted with an appliance by means of which either tube may be silenced. It was invented at the beginning of the Nineteenth Century. At the present day the flageolet finds no place in orchestral scores, but the instrument in G is given a place by Mozart in his "Entführung aus dem Serail." Now, however, the part is transposed for the piccolo. Sullivan in a later day has given it a place in the part of Dr. Daly in "The Sorcerer." The flexibility of the instrument was appreciated by Du Maurier, who depicts Svengali training Trilby's voice by means of it.

FLAYERA — Double-Beating Reed. Greece. This is a cylindrical tube with a cap which regulates the pitch of the instrument, and enables the player to silence the upper holes without regard to the musical scale. It is similar to the Persian zourna. The name is also applied to a kind of vertical flute.

FLÜGELHORN — Cup Mouthpiece. Europe. In Germany the name formerly referred to the horn used in the chase to designate the paths to be followed. Now it refers to the adaptation of valves to the ordinary bugle. When used in military bands this instrument has the B flat pitch, but is found in the C and A pitch. It has the cornet compass, but owing to the large bore, the tone is more mellow than that of the cornet. It was originally heard in the chase. It is played in the Italian, German and English army bands, and was used during the Civil War in America.

FLUTE — Transverse Flute. Europe. The concert flute as it is used in the orchestra is the instrument which is generally considered as the flute proper. It has undergone many changes in passing from the recorder of former days to the instrument as it was perfected by Theobald Boehm in 1832 and 1847. Formerly the flute had been equipped with finger-holes, but Boehm furnished it with a complete system of keys manipulated by means of levers in such a way that the player has command over many more side holes than if he were compelled to apportion his fingers among finger-holes. The keys work in such a manner that the holes are open when not in use, thus lessening the length of the pipe and heightening the pitch. By means of the Boehm system of keys it became possible to play in many keys which had hitherto been beyond the flute's capacity.

The instrument has continued to be improved and it now consists of a cylindrical tube terminating at the end above the mouthpiece in a conical elongation. It is made of wood, silver, or German silver.

The compass of the flute is from middle C to the C three octaves above. The tones of the lowest octave are rather faint. Those of the second octave are produced by the same fingering as are those of the first octave, but require a more vigorous use of breath. They are much stronger than the first. The tones of the third octave require still more vigorous blowing and are very piercing, being suitable only for loud passages.

The flute is the most agile of the wind instruments and its tones are especially acute so that it can effectively carry any melody which the composer desires to predominate over the body of a harmony.

Its service in the orchestra is almost constant and it generally doubles the first violins in the melody. It always serves as the soprano instrument of the wood-wind group and is very brilliant in solos.

The characteristic voice of the flute is marked for suavity and gentleness.

FLUTE A BEC — Vertical Flue. Europe. See recorder.

FLUTE D'AMOUR — Vertical Flute. Europe. An antique flute standing in the key of A flat, and corresponding in pitch to the hautbois d'amour. Both were considered to possess a smooth and fascinating quality in tone, and hence the name. The bore was slightly larger than the present-day concert variety, and narrow in proportion to its length, to which fact it owed its peculiar quality. Although still made in the Eighteenth Century, it is now quite obsolete.

FLUTE DOUCE — See recorder.

FLUTE EUNUQUE — See onion flute.

FLUTE HARMONIQUE — Vertical Flute. Europe. A long narrow case containing a number of flue pipes of metal, on a similar principle to that of the flute douce. The instrument is furnished with little touches similar to the pistons used in brass-valved instruments, the naturals being white and the sharps black. An India rubber tube passes to the mouth, from which the wind is supplied. It was made in the Nineteenth Century.

Flute Polyphonique — Combination. Europe. A Seventeenth Century instrument of Italian origin. It is a combination of five flutes douces inserted in a hollow cross-piece of wood, and having a central mouthpiece. One displayed in the Museo Liceo Musicale, Bologna, is described as follows: The first, third and fifth flutes are parallel, and the second and fourth are placed at an angle. The third, or central flute, is pierced with seven holes in the front and one hole at the back, giving a diatonic scale of two octaves and one note, from A flat to B flat. The second flute is pierced with three small holes in front, giving a diatonic scale from B flat to E natural. The fourth flute has one hole near the bell at the back, and gives A flat, and the fifth flute also, with one hole at the back, gives C. The first flute has no holes and gives E flat. Its invention is attributed to Manfred Seltala, who resided in Rome about the middle of the Seventeenth Century.

Folding or Traveler's Violin — Bowed Strings. Europe. This is an instrument with a long narrow body, which can be dissected. Body, finger-board, bridge, tail-piece, and tail-pin can be separated from each other and packed snugly in a rectangular box. Even the bow folds up.

French Horn — Cup Mouthpiece. Europe. The horn now used in the orchestra is provided with valves for lowering the pitch, although the composers of the Eighteenth and the first part of the Nineteenth Centuries wrote for the natural horn. In this instrument the pitch could only be changed by means of crooks, extra pieces of tubing which were attached to the original horn at the end near to the player. This required a certain amount of time, and when a change in key occurred a rest of several bars in the scale was necessitated. Now the change can be made instantaneously, although the valves create a tendency toward a mechanical tone. The horn is of brass, and the tube, which varies in length from nine to twelve feet, according to the key, is coiled several times. It is a conical tube, gradually enlarging to the bell, and is played with a conical mouthpiece in the shape of which the horn differs from the other brass instruments.

In producing some of the higher harmonics the player increases the pressure of his lips against the mouthpiece, causing him to quickly tire when playing a passage in a high key. This naturally limits the compass in some keys. Some of the tones are not absolutely true, but any deficiency can be made right by inserting the hand in the bell of the horn and producing stopped tones, the quality of which adds to the pleasing effect of the horn. The chromatic horn, or that furnished with valves, has a compass of three octaves and six notes. The performer must be a musician, for he cannot successfully produce any tone unless he first has a mental impression of it. Composers use the horn in heroic or savage passages, and its tone can be made to depict poetic rusticity.

FURIN — Sonorous Substances. Japan. A bell with a broad, flat clapper, which extends below and resists the wind. Streamers are sometimes tied to the clapper. Furins were usually suspended from the eaves at the four corners of a temple.

FURI-TSUZUMI — Vibrating Membranes. Japan. An instrument carried by the leader in processions. Two cylinders with heads of skin are placed one above the other, and a handle passes through them. Several small bells are suspended from the sides of the cylinders, and when the handle is twirled between the palms of the hands the bells strike against the heads of skin.

GALOUBET — Vertical Flute. France. This instrument is used with the tabor. It is held in the left hand, while the right hand beats an accompaniment upon the tabor. It has a cylindrical bore. A set or family consists of the bass in C, tenor in F, alto in A, and treble in C. The bass in C is provided with a tube bent properly to bring the notes within reach of the player. Its range is two octaves. Only three holes can be made use of because of one hand being occupied with the drum. Chirula is another name. The English name is merely pipe.

GEIGE — Bowed Strings. Europe. An uncomplimentary name given by the Germans to the violin.

GEKKIN — Plucked Strings. Japan. A Chinese instrument much used in Japan. Its strings are tuned in pairs. It is called the moon guitar, owing to its circular body, which is over a foot in diameter. It has a short neck, and silken strings.

GEKKO — Vibrating Membranes. Japan. A circular shell of wood to which are riveted heads of skin. The fact that it is flat and circular has gained it the name of moon drum.

GELE-MASHA — Sonorous Substances. Turkey. Clappers consisting of narrow strips of metal bent together at the center like a pair of tongs, with prongs at either end which are filled with metal discs.

GENKWAN or SCHIGUENE — Plucked Strings. Japan. An instrument with an octagonal body and a slender neck, provided with twelve frets. The four strings are plucked with a plectrum. This is doubtless a development of the gekkin, in which the circular body is changed to the octagonal one. See gekkin.

GHETEH — Single-Beating Reed. Africa. An Egyptian contrivance consisting of a tube of bamboo terminating in a metal bell, and fitted with a mouthpiece containing a single-beating reed.

GHUTRU — Vibrating Membranes. India. The shell of this drum is shaped like a goblet. The head is of skin.

GINDAI — Plucked Strings. Japan. A kin of thirteen strings. The name is probably derived from the words meaning larger kin. See kin.

Gingroi — Vertical Flute. Egypt. Wailing Flute. Slender pipes scarcely thicker than a ripened corn-stalk. They were associated with funerals. Gingrois were found in the mummy case of the Lady Maket. They constitute the oldest evidence of the world's music. There is no knowledge of the kind of mouthpiece used.

Glass Harmonica — Sonorous Substances. Europe. The invention of Benjamin Franklin (1760), is not in principle wholly his. The glasses used for the instrument are blown to be almost hemispherical, and are thinnest towards the edges. They are arranged, each edge lapping over the next plate, upon a spindle which is suspended transversely in a case. An attempt to use a violin bow instead of the fingers proved unsuccessful. The idea of the production of a tone from a glass was known in the Seventeenth Century, for a book printed at Nuremburg at the time describes the steps necessary "to produce a merry wine music." In this case, however, the glasses were tuned by varying the amount of wine contained in them.

The glass harmonica held a place of high importance in the day of its prime. The Euterpiad (New York, Sept. 1, 1830) in referring to a new instrument of this kind called a grand harmonicon, quotes the following stanza:

So soft the heavenly strain arose,
The notes of each responsive close
Did seem the whispering voices dear
Of beings in a brighter sphere.

English writers give the credit of the invention to an Irishman, but Franklin's claim is clear to the invention of the instrument now designated by the name. In a letter dated July 13, 1762, he gives the following description of the affair: "To distinguish the glasses the more readily to the eye, I have painted the apparent parts of the glasses within side, every semi-tone white and the other notes of the octave with the seven prismatic colours, so that glasses of the same colour (the white excepted) are always octaves of each other. This instrument is played upon by sitting before the middle of the set of glasses, as before the keys of the harpsichord, turning them with the foot and wetting them now and then with a sponge and clean water. The fingers should be just a little soaked in water and quite free from all greasiness; a little fine chalk on them is sometimes useful to make them catch the glass and bring out the tone more readily. Both hands are used, by which means different parts are played together. Observe that the tones are best drawn out when the glasses turn from the ends of the finger, not when they turn to them. The advantages of this instrument are that its tones are incomparably sweet beyond those of any other; that they may be swelled and softened at pleasure and continued to any length, and that the instrument being once well tuned, never again wants tuning." (The Works of Benjamin Franklin, Boston, 1840, vol. vi, page 245.)

Franklin names a Mr. Puckeridge or Pockrich, an Irishman, and a Mr. E. Delaval, as having given him ideas. Goldsmith mentions the musical glasses as one of the few subjects of polite conversation touched upon by his fine ladies in The Vicar of Wakefield.

Performers on the glass harmonica were frequently heard in concerts. A notable instance is that of Miss Marianna Davis, who performed in the presence of the Imperial Court of Vienna at the celebration of the nuptials of the Duke of Parma and the Archduchess of Austria. Mozart, J. G. Nauman, and J. W. Tomascheck composed for it. Its use passed out in England with the Eighteenth Century, but in Austria it was continued in the royal circle until 1818.

Glassichord — Sonorous Substances. Europe. In this rather complicated device, one or more tiers of plates of glass were operated upon by hammers working downward. A keyboard of sharps and naturals impelled the hammers. Nineteenth Century.

Glockenspiel or Carillon — Sonorous Substances. Europe. Either bars or bowls of metal set in a wooden frame, having a compass of a little more than two octaves when struck with a hammer. The music is written with middle C or B flat as the lowest note, but the instrument sounds an octave higher. Formerly a series of bells were used, and a keyboard attachment has been employed. Some years ago the glockenspiel when combined with the harmonium proved very pleasant to its hearers. Wagner used it at the entrance of the toymakers' guild in "Die Meistersinger," and in the effective closing slumber scene in "Die Walküre." The glockenspiel also lends its tinkle in Mozart's "Die Zauberflöte." Carillon also refers to bells arranged in the diatonic scale and used in church towers. They are played by means of a keyboard, and are more effective than chimes because of the greater number of bells, made possible by the fact that they are fixed, and need not be allowed room to swing.

GONG — Sonorous Substances. This name is given to all instruments which answer to the description of a stationary bell in the form of a shallow bowl which is struck with a hammer. It has grown into use for giving calls on steamboats or in any place where a far-reaching sound is necessary. It has an Asiatic origin and is found in all sizes and shapes under various names. The tone, like that of all sonorous substances is not exact and is used by the Orientals in court and temple ceremonies, and in the theatre for the purpose of emphasis. They also use it as an instrument of call. It finds an unimportant place in modern orchestras and can be used in producing a long-continued loud noise by first being gently struck, the force of the impact increasing.

GOONGOOROO — Sonorous Substances. India. Ankle bells. These are used by dancers and post runners, and resemble small sleigh bells strung upon a cord.

GOPI-YANTRA — Plucked Strings. India. The resonator is a circular shell of wood, having a membrane over one end. From the center of the membrane a string is stretched to a peg which is situated in a cross-bar held in place by two strips of wood attached on either side of the upper edge of the drum.

Gotchnag or Batellus — Sonorous Substances. Syria. An Armenian gong constructed from a block of wood, and sounded with wooden beaters.

Goura — Africa. An instrument peculiar to the Hottentots. It is made from a flexible rod of bamboo, a short distance from the end of which is inserted a peg and a bit of flattened quill. From the latter is drawn a string to the opposite end of the bamboo, where it is fastened. When played, the quill is placed before or between the lightly closed lips, and the performer directs his breath so that the string vibrates like that of an æolian harp.

Gousli — Plucked Strings. Russia. A psaltery. The instrument is said to have originated with the Tchérémisses, a people of Finnish extraction, resident in Central Russia. It dates back to the Eleventh Century.

Gubo — Plucked or Bowed Strings. Africa. This consists of a narrow strip of wood, between the ends of which is stretched a string of fiber. A section of the shell of a gourd is attached to one end for a resonator, which is held against the body of the performer when the instrument is played. It is sounded by either plucking the strings with the fingers or a plectrum, or, in rare instances, by means of a bow. As in many of the African instruments, the tension of the strings is regulated by twisting them to form a loop, instead of winding them directly about the pegs. When the peg is turned, the loop acts. It is used by Kafirs and Zulus.

Guenbri — Lute Type. Africa and Syria. A hemispherical or pear-shaped body made from a hollowed block of wood, a gourd, the shell of a nut, or a tortoise shell. The opening is covered by a membrane. A straight round neck pierces the body and extends from it, and is often provided with very crude tuning pegs. Gut or fiber strings pass over a small bridge near the lower end of the body. It is sometimes played with a plectrum. Also spelled ganibry, gunibre, and gimbrede.

Guitar — Plucked Strings. Europe. A descendant of the lute which has six strings, three of which are gut and three silk overspun with silver. The body possesses a flat back, and in outline resembles a violin, the sides incurving similarly. Maple, ash, service, or cherry may be used in its construction, and the neck and finger-board, which is fretted, are of hard wood. The strings pass from an ebony bridge, near the lower part of the instrument, over a round sound-hole and along the neck to pegs at the extreme end. The guitar, which is in reality a Spanish instrument, displaced the English cither. It is especially adapted to voice accompaniment, and its dreamy tones recommend it to the people of sunny Italy and Spain. Almaviva in Rossini's "Barber of Seville" uses it in his serenade to Rosina. In playing the little finger is allowed to rest upon the soundboard, while the thumb is employed with the bass strings, and the remaining fingers with the three higher strings.

The guitar was at one time much more prominent than now, and Burney in Ree's Encyclopedia tells the following story: "About 1750 its (the guitar's) vogue was so great among all ranks of people, as nearly to break all the harpsichord and spinet makers. All the ladies disposed of their harpsichords at auction for one-third of their price, or exchanged them for guitars, till old Kirkman, the harpsichord maker, after almost ruining himself with buying in his instruments, for better times, purchased likewise some cheap guitars and made a present of several to girls in milliners' shops, and to ballad singers in the streets, whom he had taught to accompany themselves with a few chords and triplets, which soon made the ladies ashamed of their frivolous and vulgar taste and return to the harpsichord." He also says that during this reign of terror not a song was printed without its being transposed and set for the guitar.

Gusla, Guzla — Bowed Strings. Servia and Bulgaria. An instrument having but a single string of gut or hair. The body is bowl-shaped, and is formed from a solid piece of wood hollowed out. The top is of parchment and the string is carried over a bridge near the foot of the instrument. A very crude horsehair bow is used in playing it.

The gusla has a length of several feet, and is six or more inches in width.

Guzla — See gusla.

Haggum — Bowed Strings. Korea. A cylindrical body of wood with a slender neck of bamboo. It is similar to the erh-h'sien of China, and is played in the same manner. See erh-h'sien.

Hai-Lo — Vertical Flute. China. While reckoned among the stone instruments, this is not properly stone, but a sea shell flute of conical bore, with a hole in the apex through which to blow. This is used by soldiers and watchmen for the same purposes as the European bugle.

Halam or Cambreh — Plucked Strings. Africa, West Coast. Sometimes an oblong, sometimes a trough-like body of wood, hollowed from a block. The open side is covered with a membrane, in which is found a sound-hole. A cane passes from end to end of the body, and projects, forming a neck. Gut strings pass the length of body and neck and over a bridge situated just above the sound-hole.

Hand Horn — Cup Mouthpiece. Europe. A term applied to a horn in which the notes are stopped by the insertion of the hand into the bell. A noted horn player named Hampel, of the Court of Dresden, conceived the idea of placing cotton in the bell of his horn to soften the harsh tone, this method being used with the oboe. He found, however, that he had lowered the pitch of the horn, and, being ingenious, inserted his hand instead. Thus, a player, by inserting and withdrawing his hand, could bring the pitch within his power. The method continued in use until the introduction of valved horns. See cornet-trompe.

Han-Koto — Plucked Strings. Japan. (Half koto.) A tiny instrument used when journeying. See koto.

Hansho — Sonorous Substances. Japan. A bronze bell used in tea rooms five hundred years ago.

Hanteki — Sonorous Substances. Japan. A wooden gong carved to represent a fish with a ball in its mouth

HAO-T'UNG — Cup Mouthpiece. China. A long cylindrical instrument of the trumpet kind, with a sliding tube, which can be drawn out when wanted for use. In arrangement and form it is not unlike a telescope. There are two distinct varieties, the first comprising the instruments made of wood and covered on the outside with copper. These are exclusively used in funeral processions, and emit only one long grave note, which can be heard for a great distance. The other variety is made of copper alone, is of less diameter, and is used for military purposes only.

HAPPU — Vibrating Membranes. A very old Chinese drum with a shell of wood and heads of skin. It was filled with rice powder, which gave it a peculiar tone, and was hung in a frame representing flames. See da-daiko.

HARMONICOR — Free Reed. Europe. A cylindrical tube of wood furnished with touches which open keys, admitting the air to the free reeds. It possesses a long mouthpiece or a rubber tube, through which the air is supplied from the lungs of the performer.

HARMONIFLUTE — Free reed with keyboard. France. The first of these was made in 1852 by Boulon, of Paris. It could be played on the lap, on the knee, or on a stand. In the last mentioned sort, the bellows was worked by a pedal. It was a portable instrument, with vibrating reeds fed by a bellows. It comprised about three octaves, and was played by means of a keyboard. It had two stops, the flute and the vox humana, and was considered pleasing when accompanied by the pianoforte. It could be utilized as a vocal part in a duo, a trio, or a quartet. It was formerly heard at salons and concerts, and in small churches for the accompaniment of religious chants.

HARMONIPHON — Free Reed. Europe. A small instrument with a keyboard and a set of free reeds. It had a rubber tube, to which was attached a nozzle. The wind supply was furnished from the mouth of the performer. It belongs to the Nineteenth Century.

HARMONITROMPE — Free Reed. Europe. This resembles in form a member of either the brass or wood families. The resemblance, however, has nothing to do with the character of the instrument, whose form is indeed governed entirely by the caprice of the maker. Across the wide diameter of the instrument is placed a tube containing free reeds, operated upon by a series of keys, and sometimes giving a chromatic scale of two octaves.

HARMONIUM — Free Reed. Europe. An instrument patented by Alexandre Dubain in Paris, Aug. 9, 1840. It appeared after several efforts had been made to utilize the principle of free reeds evidently suggested by the Chinese cheng. The wind was applied to the metal springs called reeds by the so-called force system — that is, the wind apparatus forced a current of air upwards through the reeds. A free reed consists of a brass plate vibrator made fast at one end in such a manner, and fitting so exactly that it will bend to the pressure of the wind at the free end, passing either upward or downward without touching the sides of the free end. The keys open valves by which the wind from the bellows is allowed to act on the reeds, and the draw-stops open or close the communication with a whole row of reeds together. The wind is supplied from the reservoir bellows, but as this wind, as in the organ, is produced by constant pressure, the tones are of uniform or equal strength. By drawing the expression stop, the wind communication to the reeds is cut off from the reservoir-bellows, and opened to the feeders or treadles worked by the feet of the performer. Thus, by using different degrees of force in the pressure of the feet, piano or forte, crescendo or diminuendo, may be obtained. The expression stop is one of the greatest charms of the harmonium and the principal skill required for playing this instrument is exerted in producing the effects made possible by its use. The harmonium is a prototype of the reed organ, being used as a substitute for the pipe organ and also for a parlor instrument.

DALWAY HARP.

Property of the Metropolitan Museum of Art.

Of this Irish harp, dating from the early Seventeenth Century, only the pillar and curve are of the original, the sound-board having been restored. The carving is, in part, Latin and Irish inscriptions, giving the names and duties of the servitors of its owner, Sir John Fitz Edmond Fitzgerald, and the maker and player of the harp. The royal arms, and those of Sir John and his wife, are also depicted. One Latin inscription states "Domchadh Fitz Teige, the carpenter, made me. My hope is in God."

HARP — Plucked Strings. Europe. The harp as it appears in the orchestra is a thing of grace and beauty. The pillar is straight and symmetrical, and rises from a base in which eight pedals are arranged in a semi-circle. Next to him the performer holds the slanting sound-box, which rises from the base of the pillar, and at the top of the instrument connects with the pillar by a curved neck. The strings pass from the neck to the sound-box, the resonant part of the instrument. They are arranged in the diatonic scale, and are tuned in flats. That the performer may more readily recognize the strings, those in C flat are colored red, and those in F flat, blue.

The pedals, upon being depressed, set in motion a mechanism by which the strings are shortened. The pillar contains rods which connect with levers in the neck. Each lever controls two sets of discs, and two pins project from each disc. When at rest the pins allow the strings to pass between them, but by half-way depressing a pedal, for instance the one influencing the C strings, the rod with which it connects moves the discs half around, and each C string is caught by one of the pins and shortened enough to sound C natural. By depressing the pedal entirely, the strings will be shortened still more, and will sound C sharp.

This double-action is the invention of Sebastian Erard, who completed his improvements on the harp about 1810, and whose instrument has served as a pattern for succeeding makers. Abrupt changes to distant keys are not practicable, as each change requires the use of a pedal. As there are only seven strings needed for the diatonic scale, but seven of the pedals affect the strings, the eighth governing a damper. The strings are close together, and the hand can stretch a tenth upon the harp with as much ease as it can an octave on the piano. The strings are not plucked sharply, as in many instruments, but the hand touches them with a sweeping motion, producing a stately effect. The voice of the harp possesses great sweetness, and although Bach, Handel, Haydn, Weber, and others, have almost ignored it, many composers have used it in numerous ways. Berlioz, in "Childe Harold," caused the harp and the horn to unite in imitating a bell; in St. Saëns' "Danse Macabre," the skeletons come forth after the harps have struck the hour of twelve; and Wagner masses six harps and weaves into them a harmony of inexpressible sweetness in "Das Rheingold."

HARPA DOPPIA — See spitzharfe.

HARPANETTA — French name for spitzharfe.

HARP-LUTE, DITAL HARP — Plucked Strings. Europe. The harp-lute was an effort made by Edward Light during the last years of the Eighteenth Century to replace the guitar with an improved instrument. The strings were partly open as in the lute, and after a few years the inventor added thumb-keys, which, upon being depressed, caused metal loops to draw the strings down to a fret, hence adjusting the pitch. The twelve strings were of gut, and were each furnished with a thumb-key. By referring to the harp a resemblance in the mechanism governing the stopping of strings, will be recognized, which with the presence of thumb-keys instead of pedals of a harp explain the name.

HARPSICHORD — Plucked Strings. Europe. The action of the harpsichord, which Dr. Burney has described as "a scratch with a sound at the end of it," was the same as that of the virginal or spinet. However, in many respects the harpsichord was more complicated than these instruments. Instead of having one string to a note, the harpsichord was furnished with two or three and, in a few cases, four. The greater number of strings and the peculiar mechanism brought about individuality in the shape of the case. The bass strings were longer than those of the spinet, and required stringing in a harp-shaped frame rather than the trapezoidal one of the spinet. The name came from this disposition of the strings, the Italian name having been arpicordo.

Notwithstanding its complexities, the harpsichord dates from a time almost as early as does the spinet. The Rucker family, of Antwerp, during the Sixteenth and Seventeenth

Centuries, were the most prominent of harpsichord makers. A double-banked instrument from the hand of Jan Couchet, the grandson of Hans Rucker, the founder of the family, is in the Metropolitan Museum of Art.

Harpsichords, as they developed, were fitted with double and triple-banked keyboards. The upper row, or rows, of keys acted upon one string each, and the keys of the lower upon two. A series of strings, shorter by one-half, were fastened beneath the others, and sounded an octave higher, the others being tuned in unison. The expression was governed in a very small degree by the fingers, but the material from which the jacks were made was of greater importance in this respect. Quill was generally used, but those of leather softened the tone. The plectra were fixed in a small movable rail, and when the key lever raised them, the rail shifted in such a manner that the unnecessary plectra would pass between the strings and not cause them to vibrate. The idea of stops had been borrowed from the organ, and one of them shifted the rail. A second set of plectra that plucked the strings at a point near the bridge were often introduced. This was termed the lute stop, and added a tone that was somewhat reedy. A harp effect was obtained with the "buff stop," which consisted of a piece of buff leather brought into contact with the strings, at the moment they were plucked, with a set of plectra. A later addition was the Venetian swell, which, by folding and unfolding, increased and decreased the volume of sound, and made possible a sort of crescendo and diminuendo.

It is hard to describe the harpsichord as a type, for each maker had an individual idea which found expression. Even the Ruckers, who are called the Stradivari of the harpsichord, experimented mechanically and artistically in all of their instruments which have been preserved.

Much attention was paid to the outward appearance of the harpsichords, and the most celebrated painters often decorated them. This extensive decoration has been the cause of the destruction of many instruments in an attempt to acquire the works of art. Burney, in speaking of a Rucker harpsichord which he found in France, says that "it had been painted inside and out with as much delicacy as the finest coach, or even snuff box, I ever saw in Paris."

Although it had very small powers of expression, the greater volume of sound as compared with the other stringed keyboard instruments, gained for the harpsichord a prominent place in the orchestra. It was presided over by Signor Corsi behind the scenes in the production of Peri's "Orpheus and Eurydice" in 1600. Monteverde called for two in his orchestral compositions, and for over a century the leader of the orchestra played upon one, while opposite him at the other extremity of the group was another of the instruments. For nearly two hundred years it appeared in all orchestral scores, but Gluck, the innovator, discarded it.

Hatsu — See batsu.

Hautbois — Double-Beating Reed. The French name for oboe, derived from the words meaning "high" and "wooden." Identical with the English hoboy or hautboy, and the German hoboe. See oboe.

Heang-Teih — See So-na.

Hecklephone — Double-Beating Reed. Europe. The barytone oboe, which is pitched one octave below the oboe proper, and a fifth higher than the bassoon. Its use is not general, but it found a place in the large orchestra called for by Strauss in Salome, in 1905. See oboe.

Heem — Vertical Flute. Siam. Several pipes inserted in a hollow box or gourd which serves as a common mouthpiece. Similar to the Chinese cheng. See cheng.

Helicon — Cup Mouthpiece. Europe. A member of the tuba family, used chiefly to furnish the bass in military music. It was of German invention, and was first introduced into America in 1848. The name is of Greek origin, and refers to the pronounced coil in the tube. Its circular shape recommends it for military use, as it renders the larger ones much more portable, since they rest upon the performer's shoulder, even when not being played. The family comprises seven members, the soprano in E flat, the soprano in B flat, the alto in E flat, and the tenor and contrabass in E flat. The lowest natural tone speaks below the bass clef. The family has a compass of two octaves. See tuba.

HELICON — Plucked Strings. Ancient Greece. This name primarily referred to an instrument said to have been invented by Ptolemy, for the calculation of musical intervals. It possessed nine strings stretched across a square sounding-board.

HERRAUOU or LOKANGO VOATAVO — Plucked Strings. Africa. Similar to tzetze and coming from Madagascar. See tzetze.

HITEOGIRI — See hityokiri.

HITSCHI-RIKI or SHICHIRIKI — Double-Beating Reed. Japan. The sad-toned tube. This in appearance and structure resembles a small flute. It is made of bamboo, lacquered within, and bound with lacquered string. There are seven finger-holes above and two thumb-holes below. It is played with a loose reed mouthpiece. The tones are gruesome in the extreme. The performer makes a wailing slide through a full tone, finishing with an excruciating rise of a semi-tone more or less, cut off short.

HITSU-NO-KOTO — Plucked Strings. Japan. There are many varieties of this, the largest having fifty strings. See koto.

HITYOKIRI or HITEOGIRI — Vertical Flute. Japan. The flute is about a foot in length, and is rare because the bamboo from which it is made must give the desired length with one joint.

HNAI — Double-Beating Reed. Burmah. This primitive instrument has a conical tube, and the double-beating reed is made of the most simple substances, perhaps of palm-leaf. The tube generally terminates in a brass bell, and is fitted with a number of finger-holes.

HOBOE, HOBOY — See oboe.

Hokei — Vibrating Membranes. Japan. An ancient temple drum having a circular shell of wood, with heads of skin. It was suspended in a wooden frame, which consisted of four uprights supporting a peaked roof. These were decorated with representations of the phœnix. A hokei at the Metropolitan Museum of Art is twenty inches in diameter, and is in a frame thirty-five inches high.

Hooked Harp — Plucked Strings. Europe. So called from the hooks or crotchets, by turning which the strings passing over them are raised to semi-tone. This invention, which dates from about 1700, was the first attempt to apply mechanism for the production of semi-tones on the diatonic harp.

Horagai — See rappakai.

Horanawa — Double-Beating Reed. India. A tube of wood equipped with seven finger-holes and a metal bell, and having a mouthpiece fitted with a double reed.

Horanokai — See rappakai.

Ho-Sho — Transverse Flute. Japan. A transverse flute ornamented with the carved head of the phœnix, and furnished with side holes. The phœnix is found in the decoration of many Japanese instruments. An account of its significance is found with da-daiko.

Hsiao — Vertical Flute. China. A vertical flute consisting of a tube of bamboo measuring one and one-eighth feet in length. There are five holes above, one below, and one at the end through which it is played. It was formerly made of copper, jade or marble because these materials are not affected by changes of temperature. The hsiao is employed in ritual music.

Hsing — See po.

Hsüan — Vertical Flute. China. A Chinese ocarina invented some 2700 years before our era. It is a reddish-yellow cone of baked clay or porcelain, ornamented with designs of clouds, dragons and fantastic representations. It is fitted with a hole at the apex through which to blow, and with three finger-holes in front and three behind. It is held firmly in both hands when played. See ocarina.

HUAYRA-PUHURA — Vertical Flute. South America. An instrument of this sort contained in the Metropolitan Museum of Art consists of eight pipes of greenish stone. The second, fourth, sixth and seventh pipes are furnished with lateral finger-holes, which when closed lower the pitch a semi-tone. This is the copy of a huayra-puhura found in a Peruvian tomb.

HUCHET — See cor de chasse.

HU-CH'IN — Bowed Strings. China. A violin with a hollow cylindrical body, the upper end being covered with skin and the lower left open. This is pierced by a long arm to which are attached four silken strings. The bow passes between the strings in such a manner that close attention is required not to touch the wrong string. The body may be a round tube of bamboo, wood, or copper, but is frequently octagonal in shape, and ornamented with small pieces of ivory. The smallest have only two strings. The instrument is inexpensive, and is a favorite in Pekin.

HU-HU — See erh-hsien.

HUNTING HORN — Cup Mouthpiece. A horn which was the simplest of all wind instruments. It merely consisted of a tube wound about in a circular fashion, and in the days of the prevalence of the hunt was carried by means of an arm thrust through the coil so that the weight rested upon the shoulder. Only a few distinct tones could be procured as increased force in blowing was the only means of regulating them.

HUNTSMAN'S HORN — See hunting horn.

HURDY GURDY — Bowed Strings. Europe. This had a rosined wooden wheel just above the tail-piece instead of a bow. The right hand turned a crank situated in the tail-piece and connected with the wheel. The body was lute or guitar-shaped, and over its face was set what corresponds to the neck of the lute. This oblong box was fitted with keys which regulated the wires, and were depressed with the fingers of the left hand. A tangent wedge was in the rear of the key, and rubbed the strings. The instrument was held in such a position that the keys fell back into their rightful places from their own weight. The strings numbered from four to six. Two only were melody strings, and passed through the key-box. The others were drone strings. From the mechanism, it may be deduced that the music was harsh and crude.

The hurdy-gurdy had a long life for one of its kind, and was at its zenith about the Tenth and Twelfth Centuries. It is rather to be considered among the instruments favored in rural districts. It aided perhaps in the passing of the lute, for the old lutes were many of them altered into hurdy gurdies, or vielles, as they were called by the French. The lute-shaped sounding-box was thought to give the better tone. The passing of the hurdy gurdy occurred during the last century, when they could still be heard upon the street corners. The name is applied erroneously to a street piano of the present day.

A thousand years ago the vielle or hurdy gurdy was known as the organistrum, and sometimes it was built in such huge proportions that two performers were a necessity, one to turn the wheel, the other to touch the keys. As it was used much by beggars, it came to be known as the beggar's lyre. It was sometimes called rota, from the wheel. Donizetti has employed the hurdy gurdy in the accompaniment to two Savoyard songs in "Linda di Chamouni."

Huruk — Vibrating Membranes. India. A shell shaped like a long dumb-bell, with heads of skin braced with cords.

Hwangteih — Cup Mouthpiece. China. A trumpet with a cylindrical tube of wood. It is used by the Chinese in funeral processions.

Hyokin — See yan-kin.

Hyoshigi — Sonorous Substances. Japan. Two hard-wood clappers used in theatres, where they are beaten rapidly upon the floor to emphasize confusion. They are also used by night watchmen, and by the conductors of jugglers and athletes to draw attention to their performances.

ICBACARRE — Plucked Strings. Africa. A crude lute. One in the Metropolitan Museum of Art has a body made from a round tin can, the opening being covered with parchment. It has a wooden neck with one peg and a fiber string. This curious affair came from Mozambique.

ICHI-GEN-KIN or SOURNA-KOTO — Plucked Strings. Japan. The body is a flat piece of wood, having in some cases a convex upper surface, and standing upon four slender feet. A single silken string is stretched from a peg inserted near one end of the body, to the opposite end, being elevated meantime by a movable bridge before passing through an eyelet to the under side, where it is fastened. The string is plucked with a cylindrical ivory tsume. This instrument is said to have been invented by an exiled nobleman to drive away his melancholy. In the original the string was stretched across a bat which he caught in his cell. The Chinese claim that this was the departed spirit of a similar instrument of their own, which had appeared to the prisoner and had been snared by him. Specimens in the Metropolitan Museum of Art have a length of over forty inches and a width of about one-seventh of this.

ICHI-NO-TSUZUMI, NI-NO-TSUZUMI, SAN-NO-TSUZUMI — Vibrating Membranes. Japan. Three sizes of dumb-bell shaped drums used in place of the larger drums when the orchestra is standing.

IKUTA-KOTO — Plucked Strings. Japan. This is found almost exclusively in the west of Japan, although occasionally used by ladies in the eastern part. The dainty affair is covered with elaborate lacquer designs, and the strings are of different colors, which aid the beginner in remembering them. They are plucked with ivory or tortoise shell tsume set in lacquered leather stalls. See koto.

INVENTION HORN — Cup Mouthpiece. Europe. Name derived from an invention whereby the crooks or "certain accessory pieces of tubing applied for the purpose of altering the length of the tube and raising and lowering the pitch" were attached to the body of the instrument instead of to the mouthpiece. It was produced in 1760.

Jaw's Harp — See jew's harp.

Jester's Flute — Europe. A wooden instrument made in the form of a flute douce. It was not intended for musical performances, but was used by jesters to produce ludicrous effects. Between the imitation mouthpiece and the key-holes was a hollow wooden ball, which was filled with flour, and when the unwary spectator accepted an invitation to play the flute, the force of his breath ejected the flour into his face through two small tubes provided for the purpose.

Jew's Harp — Sonorous Substances. Europe. A small metallic tongue vibrating within an iron frame shaped like a horseshoe. When played it is placed between the teeth, and vibrations of the metallic tongue are produced by striking it with the finger while a tune is hummed. One theory of the name is that it was originally jaw's harp, from its position while being played, and another that it was first made and sold in England by Jews. It is shrill and peculiar in sound, and rather melancholy. Even in the Nineteenth Century the jew's harp retained its popularity. In 1860 no less than six million are said to have been produced in Steyer, province of Styria, Austria.

Jhang — Sonorous Substances. India. Cymbals used as accompaniments to native music.

Jindai Suzu — Sonorous Substances. Japan. Antique harness bells made from a narrow piece of metal strung on either side with small bells.

Jinniritsi — See schoschi-bouie.

Jouet — Free Reed. Spain and Italy. An instrument shaped like a human head, and made of composite material. It is pierced in the face to allow the passage of a tube containing a free reed. Each jouet is capable of only one note.

Junk — Plucked Strings. Arabia. In the Crosby-Brown collection in the Metropolitan Museum of Art is a junk twenty-six inches wide, furnished with a triangular sound-box having one sound-hole, and a neck of polished wood at one end. It is fitted with six strings. This is typical.

KACHHAPI VINA — Plucked Strings. India. The body is about four feet in length and is gourd-shaped, that is, the circular base tapers into a neck. The neck has many frets, and five strings pass from the base of the instrument over a bridge and over the frets.

KAGURA SUZU — Sonorous Substances. Japan. An instrument consisting of a handle of wood with two wire hoops at one end, upon which are hung a number of small bells. This is used to mark time in the orchestra and in the temples.

K'AI-TI — See so-na.

KAJIREI — Sonorous Substances. Japan. A time marker. It consists of hollow rings strung on a bent wire, to the ends of which is fastened a wooden handle by which it is shaken.

KAKKO — Vibrating Membranes. Japan. A small drum originating in Turkestan or Thibet, though now Japanese. It is placed on a stand and marks the time in the orchestra. The heads of skin are stretched over hoops of larger diameter than the shell, and the projecting edges are laced together with cords of skin.

KAKOSHI — Bowed Strings. Africa. This consists of a hollow body, sometimes with and sometimes without a sounding-board. Midway in its length is placed a cross-bar, from which are stretched strings to the pegs, placed rudely in the long neck. The cross-bar is held in place by cords. One from the Masango tribe, Angola, to be seen in the National Museum in Washington, D. C., in its outlines roughly resembles a violin.

KAN-DUNG — Vertical Flute. India. A flute made from a bone of a Buddhist priest and employed in the temple service.

KANOON or QANON — Plucked Strings. Turkey. A kanoon in the Metropolitan Museum of Art is composed of a body of wood over which are stretched seventy-five gut strings arranged in sets of three. The body is quadrangular in outline, having the upper end cut off diagonally. The strings pass from pegs in the upper end, over a bridge to the interior, where they are fastened. The upper part of the face is formed of wood and the lower of skin. The instrument is thirty-four inches long and fourteen inches wide.

KANTELE — Plucked Strings. Finland. A trapeze-shaped psaltery, the national instrument of Finland. Tradition has it that Wäinämöinen, the divine player, made its frame from the bones of the pike, and its tuning pegs from the fish's teeth.

KANUNA or KATYANANA-VINA — Struck Strings. India. A specimen in the Metropolitan Museum of Art has three straight sides and one which is cut off diagonally. Twenty-eight strings are carried from a like number of pegs, over a single bridge, to the opposite end. The instrument is nearly thirty inches in length and sixteen inches in width. The strings are struck with hammers.

KARABIB — Sonorous Substances. Africa. Morocco clappers. Two metal discs, with a boss in the center of each, united by a narrow band of metal. They are played in pairs, the hand grasping the center piece while the discs are beaten alternately. Karabibs are usually accompanied by the drum. They are used by the negroes in the Soudan.

KARNAL — Cup Mouthpiece. Persia. A trumpet of metal having a length of about two feet.

KASHOOKS — Sonorous Substances. Persia. Two wooden spoons with small bells attached to the bowls. They are shaken to produce a jingle.

KASSO — Plucked Strings. Africa, West Coast, Dahomey, Senegambia. The body is made from a section of a large gourd, closed with a membrane, and pierced with a long straight stick. Beneath the membrane are four other sticks which protrude at points near the edge of the gourd, two of them being parallel with the strings and two at right angles. The strings pass over the upright notched bridge, which rests upon the center of the membrane. Loops are used in fastening them instead of pegs.

KATYANANA-VINA — See kanuna.

KAZO — Vibrating Membranes. Japan. A skin stretched over a wooden hoop having a diameter of twenty or more inches.

KEIKEN — Bowed Strings. Japan. A four stringed Chinese fiddle, the strings being tuned in pairs. The cylindrical body is made of a short piece of bamboo, having a snake skin belly and a long slender wooden neck, in which four pegs are inserted. The strings pass from the lower part of the body along the neck, and are bound against it with a cord just below the pegs. A horsehair bow is twined in and out among the strings, so that single notes cannot be produced.

KEMANGEH, KEMANTCHE — Bowed Strings. Turkey, Persia. A spherical body having a slender, spike-like neck, passing through it and projecting at the base. It is strung with three or more wire strings, and is sometimes fitted with sympathetic strings.

KEMANGEH A'GOUZ — Bowed Strings. Africa. This name, of Persian origin, signifies "crooked" or "arched," and thus a bowed instrument. It is found in many forms among the Mohammedan nations, and doubtless owes its appearance to the invasion of Persia by the Arabs in the Seventh Century. The instrument is held with the lower edge resting either against the left hip of the performer, or against the shoulder as with the ordinary violin.

KEMANGEH A'QOUZ — Bowed Strings. Arabia. A specimen in the Metropolitan Museum of Art has a body of cocoanut shell and a belly of skin. A neck of polished wood passes through the body and projects at the lower edge. Two horsehair strings are attached to a metal ring passing over the lower end of the neck, and are wound about two pegs in the upper end. The diameter of the gourd is three inches, and the length of the instrument is thirty-nine inches.

KEMANGEH ROUMY — Bowed Strings. Africa. A kemangeh with sympathetic strings. See kemangeh.

KEMANTCHE — See kemangeh.

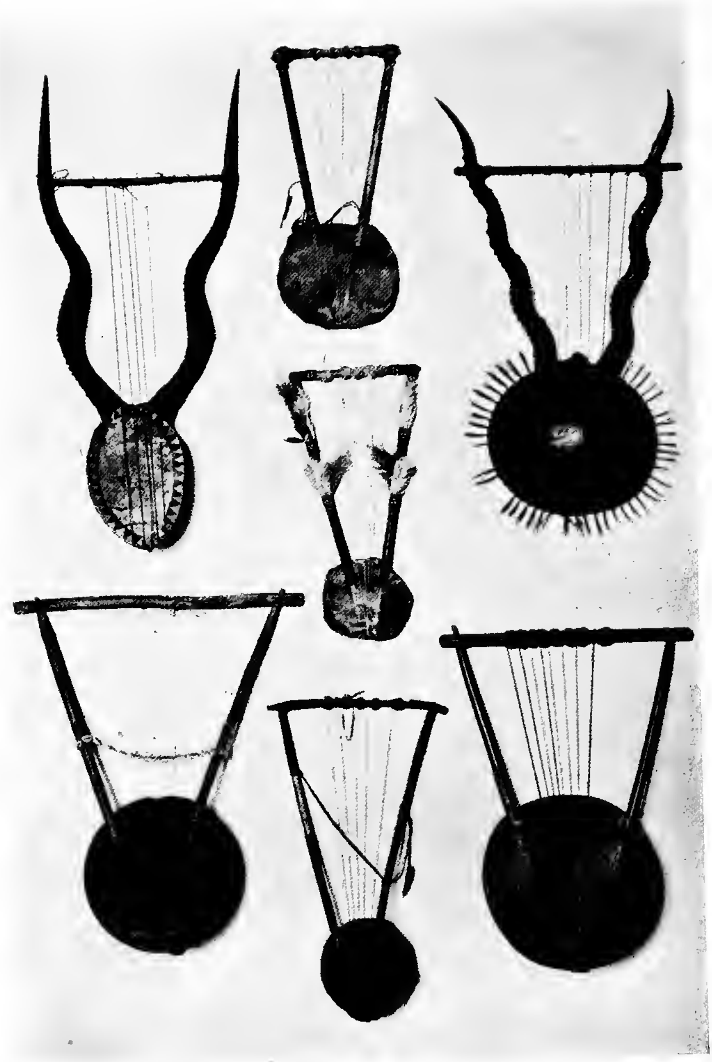
KENT HORN — See bugle.

Kero — Vibrating Membranes. Japan. A small drum coming from China, where it is used to signalize the appearance of dawn. It is used in Japan to mark the time in the processional orchestras, being hung about the leader's neck by a cord, which he holds in his left hand.

Kettle Drum — Vibrating Membranes. Europe. This is the only instrument in which stretched skin is employed giving different tones. The great hemispherical basin of copper is covered with calfskin, strained tightly enough to give musical vibrations. The tension of the instrument is regulated by a ring of metal moved by screws turned with a key. The changes in the tension make possible the production of sounds which are clearly different in pitch. A change is necessary with every new note, and the process requires a rest in the music. However, a machine has been invented by which instantaneous changes can be made. Several effects can be produced with the various sets of sticks. Some have flat heads and are of felt, furnished at the end with a whalebone button, and those of wood may have a piece of sponge at the tip.

Kettle drums are always played in pairs, and at times three are called for. Those having heads of transparent skin are considered best. It is difficult to play them well, and the performer must strike fearlessly and accurately. The two drums in general use have a combined compass of an octave. The larger one is capable of producing the notes from F below middle C to middle C, and the smaller from B flat to F above.

Beethoven gave the drum a new importance. It had previously been used merely to increase the noise in loud effects. The composers following him have gradually transformed the kettle drum into an instrument of importance to the melody. Three are required in the overture of Weber's "Peter Schmoll," in that of Auber's "Masaniello," and in Spohr's "Historical Symphony." Meyerbeer has written a passage with notes requiring drums in G, C, D and E, in "Robert le Diable."



AFRICAN KISSARS.

Property of The Metropolitan Museum of Art.

These rude instruments, which are found principally in the eastern districts of Africa, have a variety of names, owing to many localities where they are popular. The strings are plucked, and the most casual observer will remark a family resemblance between this instrument of the savage and the lyre of the Greeks.

At times the drums are struck simultaneously, and Wagner uses them muffled. A concerto for the kettle drums alone has been written.

KHEW — Sonorous Substances. Burmah. Wind bells to be placed on eaves. A leaf of thin brass is attached to the clappers to intercept the wind.

KHUDRA KATYAYANA-VINA or SAR MUNDAI — Plucked Strings. India and Burmah. This instrument at times has an angular body, at others a circular one, which narrows into a short neck. Twenty or more strings are struck in the manner of those of the dulcimer. See dulcimer.

KIN — A Chinese instrument of very ancient use. It has from five to twenty-five strings and is played like the lute. See ch'in.

KINANDI — Plucked Strings. Africa. Devil's harp. A variety of ancient Greek lyre which may have been brought to Africa by the Phœnicians. Exceedingly rude ones have been made from common tin basins covered with camel skin. Some tribes consider this instrument to be endowed with magical power. No white man would be allowed by the guardians to approach these precious possessions without first uncovering his feet.

KINNARI — Plucked Strings. India. Constructed from a piece of bamboo or blackwood upon which are frets, sometimes formed of the scales of the scaly ant-eater, though usually of bone or metal. Three gourd resonators are fixed beneath the stem. An ostrich egg shell answers this purpose in an instrument in the Metropolitan Museum of Art.

KISANJI — Sonorous Substances. Africa. A zanze of the Angola, West Coast. See zanze.

KISSAR — Plucked Strings. Africa. An instrument found in many countries and among many of the tribes of Africa. It may be described as the lyre form of harp. The body is generally round, and consists variously of a gourd, a turtle-shell, or even a human skull. From the body, and extending some distance above it, rise two uprights with a cross-bar. Its appearance bears some faint resemblance to a rude lyre. The strings are stretched from the cross-bar over a bridge to the lower edge of the body. In the lake countries, antlers are used for the uprights, the material and workmanship being exceedingly crude. The native, in playing some forms of the kissar, holds the frame in the left hand while resting the edge of the body on his hip. This position of the instrument strongly suggests that of the lyres on Assyrian bas-reliefs.

KIT — Bowed Strings. England. A miniature violin probably a little later date than the pochette. Its extremely small size made it possible to be carried in the pocket. It was used by dancing masters. See pochette.

KITHARA, CITHARA — Plucked Strings. Ancient Greece. A large form of lyre upon which it was possible to produce the deeper tones. It was portable, and in the sculptures it is found supported by a ribbon passing over the player's shoulder. See lyre.

KLONG KHEK — Vibrating Membranes. Siam. This drum has a cylindrical shell and heads of skin, which are held in place with hoops laced together with strips of bark or skin.

KLONG PONG PING — Vibrating Membranes. Siam. A hand drum with a shell shaped like an hour-glass, and having skin heads.

KLONG TA ROTI POTE — Vibrating Membranes. Siam. A small drum supported in a frame.

KLONG YAI — Vibrating Membrane. Siam. These drums come in sets of three, and have cylindrical shells and skin heads. In a set at the Metropolitan Museum, two drums have a height of twelve and one-half inches and the other of seven and one-half inches. The respective diameters are eighteen and one-half inches, seven and three-quarter inches, and seven and three-quarter inches.

KLUI — Vertical Flute. Siam. A vertical flute fitted with a number of finger-holes.

KO-DAIKO — Vibrating Membranes. Japan. A small drum used principally in processions, although sometimes in orchestras. In the first case it is plain, in the second decorated. This drum is placed in a cubical frame suspended from a pole, and carried on the shoulders of two men. The drummer walks at the side to deliver vigorous blows on the parchment heads with two plain, thick sticks of wood, with knobs of leather. Before the procession starts, it is placed outside the temple gate and struck continuously for two hours or more to summon the people.

KOKIU — Bowed Strings. Japan. A Japanese fiddle whose ultimate form is the result of numerous changes. The four strings are fastened to a spike projecting from the lower part of the body, and carried over a bridge to the peg box in the long slender neck. The body is square and has a frame of wood and a belly and back of cat-skin.

KOMOUNKO — Plucked Strings. Korea. The body is similar in form to that of the Japanese koto. It is played with a plectrum. See koto.

KOTIN — Bowed Strings. Japan. A two stringed variety of the keiken. The body is shorter and uncovered at the back. The neck is of bamboo. See keiken.

KOTO — Plucked Strings. Japan. A number of strings of tightly twisted silk soaked in wax and stretched over a long narrow sounding-board. It is the chief modern instrument, and has assumed many forms. There are kotos with movable bridges, with stationary bridges, and without bridges. The sounding-board may vary somewhat in shape, and the strings may differ in number and in the manner of being attached to the sounding-board. Some of the many forms are elsewhere briefly mentioned.

KO-TSUZUMI — Vibrating Membranes. Japan. A shoulder drum usually highly decorated, the color of the silken cords denoting the grade of the musician. The drum is placed upon the right shoulder, where it is held in place by the left hand and struck with the fingers of the right.

KO-TZE — Vertical Flute. China. A whistle made of gourd, and over an inch square, which is fastened to the tail feathers of pigeons. The noise occasioned by the flight of the birds through the air frightens off birds of prey.

Kouitara or Kuitra — Plucked Strings. Africa. This is popular in Tunis and Morocco, where it is found highly decorated owing to Oriental influence. The pear-shaped body is fitted with a narrow neck, and usually with four pairs of strings. A still more primitive form is constructed from a bottle-shaped gourd.

Koundyeh or Ngiemeh — Bowed Strings. Africa. A rude fiddle from Sierra Leone. It is made from a cocoanut shell, its opening being covered with a membrane having a sound-hole. It has a long neck and one string.

Koy — Cup Mouthpiece. Siam. A musical horn about a foot in length, and having a diameter of two inches at its bell.

Kra Chapee — Plucked Strings. Siam. A circular wooden body with a long slender neck. Often played with a small piece of horn. A kra chapee in the Crosby-Brown collection in the Metropolitan Museum has an extreme length of fifty-nine and one-half inches and a diameter of fourteen inches.

Krap Puang — Sonorous Substances. Siam. Castanets formed from strips of metal fastened between two strips of wood, and strung together on a cord.

Krumhorn, Cromhorn — Double-Beating Reed. Europe. Obsolete. A round tube curved upward at the lower end. The tube was cylindrical, and the instrument was sounded by a double-beating reed similar to that of the bassoon, placed within a cap so that the lips of the performer had no direct influence upon it. The instrument was of the same diameter throughout its length, and the wooden tube was often covered with leather. Near the end of the tube was sometimes placed an extra finger-hole, which regulated the pitch. It generally possessed seven finger-holes, but larger instruments had more, and the lowest were governed by keys. A set consisted of high soprano in C, soprano in G, alto in D, tenor in G, and bass in D. It was in general use throughout the Fourteenth, Fifteenth, Sixteenth and Seventeenth Centuries, and was used in the music of La Grande Ecurie of the King of France until about 1730.

KU — Plucked Strings. Japan. Has a circular body and is similar to the genkwan. It differs from others of its class in its rich ornamentation with gold lacquer designs. See genkwan.

KUAN-TZU — Single-Beating Reed. China. A small tube of bamboo about eighteen inches long. It has seven holes above and two below, and is blown by means of a coarsely made reed inserted in the upper end. The sound does not fall pleasantly upon foreign ears. It is used in funeral and marriage processions.

KUITRA — See kouitara.

KULEPA-GANEZ — Sonorous Substances. Oceania. This instrument is found in New Ireland of the Bismarck archipelago. It is composed of four slabs of wood. The performer moistens his fingers, and by rubbing the surface of the wood can produce four distinct tones.

KUNDI — Plucked Strings. Africa. Another name for the nanga. See nanga.

KUNJERRE-VINA — Plucked Strings. India. The body tapers to the neck, which has a large number of frets over which the strings pass. The instrument is often four feet long.

KURNA — Cup Mouthpiece. India. A trumpet with a slender conical tube of metal expanding into a bell.

KURTAR or CHITTIKA — Sonorous substances. India. A pair of clappers with round backs and curved handles. Four pairs of metal discs are inserted in the body, while several groups of small bells jingle upon the sides. It is held in one hand with the fingers through the handles.

KYEE-ZEE — Sonorous Substances. Burmah. A gong made from a triangular plate of metal having curved edges. The sides are several inches in length.

LADAKEH — Vibrating Membranes. India. A shell of wood with parchment heads. Instead of sticks it is struck with small balls at the ends of cords fastened to the center of the shell.

LAH CH'IN — Bowed Strings. China. The body of wood, perhaps two feet long and half a foot wide, has a convex upper surface and twenty silken strings pass over ten movable bridges, which are shaped like inverted prongs.

LA KANG — Sonorous Substances. Siam. This small gong is triangular with curved edges.

LA-PA, CHA-CHIAO OR TUNGKEO — Cup Mouthpiece. China. A long trumpet with a sliding tube similar to that of the hao-t'ung. It gives four notes and is properly a military instrument. Nevertheless, it is used in wedding processions, and itinerant knife-grinders consider it their privilege to employ it to make known their whereabouts. Another variety is crooked and is therefore called cha-chiao.

LAUD — Spanish name for the lute.

LIRA — Single-beating Reed. Africa. A short tube of bamboo used in modern Egypt. The end is split and when a current of air is directed against it, the split section vibrates. Also the Italian name for the lyre.

LITUUS — Cup Mouthpiece. Roman. Used by the Roman cavalry. It was in shape similar to the shophar, the cylindrical tube being bent upward like a crook at the lower end where it enlarged into a small bell. One of these was discovered near Rome in 1827 and a reproduction is contained in the Metropolitan Museum of Art. Its appearance is much like that of the letter J. It is pitched in G, an octave above the buccina of the Roman infantry. The name is said to be derived from the fact that the shape strongly resembles an augur's staff.

LO, SU-LO, TANG-TZE — Sonorous Substances. China. This is a gong cast in the shape of a platter or a Chinese straw hat with a large brim. It is suspended by a string and struck with a mallet. The use of this noisy instrument is very general. Placed at the gates of houses it announces the arrival of visitors, the number of strokes denoting their rank. In armies it gives the signal of retreat. In processions it is struck to frighten and drive away evil spirits. On board ship it announces departures. During eclipses "it frightens away the heavenly dog when about to devour the moon." In song it marks the time. In the streets, a small gong may serve as the sign of a candy merchant, while a large one announces the approach of the district magistrate with his retinue.

LO-CHU — Sonorous Substances. China. A rattle having a straight wooden handle with globular heads of paper-maché.

LÖFFELGEIGE — Bowed Strings. Europe. In shape strongly resembling a soup ladle, and thus deriving its name. It was first made in Hanover and was formed of a solid piece of wood, the hollow being covered with a deal sounding-board while the sound-holes were round. Strings were attached to loops of D string coming from pegs set underneath the fiddle. The high bridge elevated the strings above the finger-board.

LOKANGO VOATAVO — See herrauou.

LO-TSEIH — Sonorous Substances. China. A small metal gong suspended in a metal ring and struck with a wooden beater.

LUR — Cup Mouthpiece. Scandinavia. A prehistoric variety of the brass instruments. It had a long conical tube and was curved over the player's left shoulder and forward over his head. Its modern form is pastoral in use and it is made of wood.

LUTE — Plucked Strings. The home of the lute can be traced to ancient Egypt where it appears in sculptures. Later it is encountered as the favorite instrument in Arabia, where it is known as el oud. Gradually it found its way into Southern Europe where, in Spain, it is known as the laud, and thence its use spread over the entire continent. During the Fifteenth, Sixteenth and Seventeenth Centuries, it enjoyed a place in the homes of the people and was only supplanted in popularity by the keyboard instruments. The body of the lute was pear-shaped with a long neck and a fretted finger-board. The lute was frequently a thing of beauty when arrayed in the ornamentations its makers delighted in bestowing upon it. The lines of the body were good in the first place, and the small strips of wood which were glued together to make the back afforded an opportunity for fine workmanship. The geometrical roses or sound-holes were often artistic creations. It early attained what was considered perfection, as no material change has been made in it since the Fourteenth Century. The lute has now gone out of use, but during its prominence it was subjected to many alterations and in each new guise received a name such as theorbo, chittarone, etc. One of small size was named mandura in Spain and was changed in several respects, and now we have the mandolin, an instance of its importance in the evolution of musical instruments.

The lute was exceptionally hard to tune, and Mattheson (1720) calculated despondently that "if a lute-player have lived eighty years, he has probably spent about sixty years tuning his instrument." Mary, Queen of Scots, is recorded to have required persons from London to tune her lute. Mace, likewise, is generally quoted as recommending that a lute, when not in performance, should be kept in a constantly used bed, and adds that, generally, in a year or two at most, a new belly will be made necessary by the strain of the strings which tend to warp it.

The lute had originally eight thin gut strings arranged in pairs, each pair being tuned in unison. When an increase of power was desired, the only available method was to increase the size and tension of the string. The lute is believed to have given rise to the harp, as indeed to all those instruments which are struck with the fingers.

It had a tablature especially its own which is now, however, entirely obsolete. It disputes with the organ the honor of first having compositions written for it. Much literature has been published concerning it and song and story are full of allusions to "the whispering lute," "the trembling lute," and most popular is "the warbling lute." Mace was in no wise chary of his praise for it, remarking that "there is no limitation to its vast bounds and bravery." His hearing was poor and he found that he could not distinctly hear the ordinary lute, but made for himself a double lute with fifty strings, and which proved to be the "the lustiest or loudest lute" he had ever heard.

Very recently there has been a revival of interest in the more important ancient musical instruments, including naturally the lute.

In the Elizabethan days of England the gallants could pay no prettier compliment than to send the faire ladye on the feast of St. Valentine, bunches of lute strings tied with gay ribbons. The strings were put to far less poetical use by the barbers. In place of newspapers for reading, or of gossip, their patrons were furnished with lutes or virginals upon which to while away the time. When, through constant use, the lute strings broke, it was the fashion to hang them outside the door, each bearing a discarded tooth — the sign of the dentist whose profession the barber frequently followed.

J. Sebastian Bach left a number of pieces for the lute, and even gave it a part in "St. John's Passion." Fackenhagen and Beyer are also prominent among the later composers for the instrument.

Lyra, Lyre — Bowed Strings. Modern Greece. An instrument of the rebec class having a pear-shaped body, and played with a bow. A bridge is not always provided, a peg sometimes acting as a nut to sufficiently elevate the strings from the belly and neck.

Lyra Viol — See viola bastarda.

Lyre — Plucked Strings. This instrument is found in both Egyptian and Assyrian bas-reliefs. It was especially popular with the Greeks, this partly owing, no doubt, to its extreme beauty of outline. Their sculptures abound in representations of the instrument, Apollo with his lyre being of frequent recurrence. Any innovation affecting the lyre was long looked upon with severe disfavor, but the prejudice must have gradually disappeared, for in course of time we meet a proverb in which to be unusually clever is to add "a new string to the lyre." To Mercury was attributed the invention of the lyre but he soon gave it to Apollo. Then comes the unfair contest between Apollo with his lyre and Marsyas with his flute and Apollo's contrite breaking of the strings of his lyre.

Its adaptability to reproduction, owing to its simplicity in outline has been realized at all times, and in the Fourth Century, Christ is depicted in the guise of Apollo playing the lyre. It also appears in modern sculptures. The lyre possessed a hollow resonance box from which projected vertically, two arms which were curved at varying degrees and connected at the top with a bar. From this bar the strings were stretched, sometimes to a bridge, sometimes over it. The strings differed in number, the more ancient examples having, as a rule, three, and this number increased gradually to ten. There was no finger-board, but the strings were plucked with a plectrum held in the right hand. The plectra varied in size and substance, the Scythians, for instance, using the jaw bone of a goat. Others were handsomely carved pieces of ivory, fine wood and metal.

The Aryan race is credited with having brought the lyre to its new home in Europe and from it are traced all instruments whose strings are struck with a plectrum or a hammer. The haze enshrouding the nomenclature of instruments partly arises from the error made by classical writers in calling all stringed instruments lyres. An amphora in the British Museum which depicts Apollo with his lyre, affords definite information as to its nature, the manner of playing also being detailed clearly.

The name lyre is used also in reference to a bowed instrument. This has two necks from the higher one of which were drawn several strings clear of the finger-board and acting as drones. It was made in three sizes, lira da braccio, lira da gamba, and archivole di lira. Haydn wrote several pieces for the bowed lira.

MACHETE — Plucked Strings. Spain. A small guitar used in Spain and Portugal. It has a shallow sound-box and four strings and has the compass of an octave. It is a pastoral instrument and a possession of many of the country people who enjoy hearing a number of them together. Often a group of machetes are accompanied by a large five-stringed guitar.

MANDURA — Spanish name for a small lute.

MADIUMBA — Sonorous Substances. Africa. A zanze from the Kongo. See zanze.

MAGADIS — Plucked Strings. Egypt. A small sounding-board over which are drawn strings to a cross-piece. They are plucked with a plectrum.

MAHAMBI — See marimba.

MAMBAN-TETSU-NO-FUYE — Vertical Flute. Japan. Vertical flute often three feet in length and made of iron.

MAMM — Probably Single-beating Reed. Egypt. These were twin pipes, similar to the gingroi. It was dedicated to the goddess Mama, lady of the gods, and was played by women, who were recommended thus to cherish the melodies of the songs belonging to their race. Called monaulos when there was a single pipe and no reed mouthpiece.

MANDOLA, MANDORA — Plucked Strings. Europe. Tenor mandolin. Larger in size than the ordinary instrument. See mandolin.

MANDOLIN — Plucked Strings. Europe. This instrument was first generally adopted in the United States in 1880, Spanish students bringing it into notice. It has increased steadily in popularity until every American college has a mandolin club. The tone is sympathetic and the instrument comparatively easy to learn. There are two varieties, the Neapolitan and Milanese. The Neapolitan has generally four pairs of strings and the Milanese five or six. The Neapolitan is the more popular. It has a compass of three octaves and, as a rule, wire strings, which are struck with a plectrum, or piece of tortoise shell held between the fingers. It is beautifully formed, with a pear-shaped body made of strips of wood glued together and quite convex. The strings are tuned in fifths like those of the violin and the fingering is that of the violin. It is used for melodic passages. Its tone is thin and somewhat nasal, but nevertheless pleasant. The practicable compass of the mandolin is limited to the first octave above E, highest string when it lies open. Beethoven wrote a sonatina for the mandolin, and Mozart employed it for the accompaniment of the serenade "Deh vieni" in "Don Giovanni;" Paisiello in "The Barber of Seville;" and Handel, in "Alexander Balus."

MANDORA — See mandola.

MARIMBA or MAHAMBI — Sonorous Substance. Africa. This instrument is variously called mihambi, timbali and balafo, according to the part of the country in which it is found. It is quite common and can boast great favor with the negroes and Kafirs. It consists of any number of bamboo bars from perhaps five to twenty-five, arranged over either a frame or a hollow resonance box. The marimba is usually suspended at the waist by a cord or an arched wooden handle, and is beaten by two rubber tipped sticks.

MAROUVANE or VALIHA — Plucked Strings. Egypt. This in its most primitive form consists of a tube of bamboo with strips of bark cut between two joints and raised from the surface by small bits of wood placed at both ends of each string. A palm leaf resonator is often added. The point of the leaf and the stem are fastened one to each end of the tube, and the leaf allowed to flare naturally. The more ingenious kinds have wire strings. Found in Madagascar and other regions.

MATHALA — See mridang.

MAYURI — See tayuc.

MBE — Vibrating Membranes. Africa. A drum found in the French Kongo, having a long cylindrical body of wood one end of which is covered with skin.

MEGYOUNG — Plucked Strings. Burmah. An instrument in which the body is carved to represent a crocodile. The strings are stretched from the head along the belly to the tail. They are few in number and pass over a number of frets and a high bridge near the tail.

MEIJIWIZ — Double-beating Reed. Syria. A double reed pipe made of bone and bamboo. It is played by taking the reeds quite within the lips and blowing while fingering the holes, of which there are six.

MELODEON — Free Reeds. America. In 1836, Jeremiah Carhart of Dutchess County, N. Y., introduced a change in the manner of the action of air on reeds in the rocking melodeon, harmonium, etc., by adopting the exhaust system which, briefly speaking, is this: A vacuum is practically created in the so-called air chamber below the reeds by the exhausting power of the foot pedal and a current of air rushes down from above to fill the vacuum and in its course passes through the reeds. Naturally, this causes them to vibrate and sound or, in technical terminology, to speak. The bellows is single and is operated by a pedal similar in appearance to the pianoforte pedal. A second pedal operates a swell. The instrument has a case in piano style. In 1859, over twenty thousand were made in the United States. It is now out of use, being supplanted by the reed organ.

MELOPHONE — Free Reeds. Europe. Invented in 1837 by Leclèrc of Paris. There is one contained in the Metropolitan Museum of Art. The case is guitar-shaped and the short neck has one hundred and four ivory touches arranged in eight rows. These open, by means of levers and connecting wires, round brass keys hidden beneath a case. Below the brass keys are five rows of free reeds with steel tongues. The wind is supplied by a double action bellows concealed within the instrument and actuated by a piston working through the lower end of the case. Beneath the neck is a lever acting as an octave coupler. It is a prototype of the harmonium. Regondi added interest to the melophone by playing in concerts upon it.

MIHAMBI — See marimba.

MINJAIRAH — Vertical Whistle. Syria. A simple pipe.

MINJAIREH — Vertical Flute. Syria. A bamboo tube with a number of finger-holes.

MINTEKI — Vertical Flute. China. A flute made of bamboo and having seven finger-holes.

MIRLITON — Vibrating Membranes. France. A cylindrical tube of reed closed at both ends by a thin membrane. On either side of the tube is a large hole and by humming into one of these the membranes are set in motion and a curious nasal tone produced as in the onion flute.

M'KUL — Sonorous Substances. Africa. This drum when used in time of war is struck in the middle. It is struck in the center and at one end when used to accompany the mbe in the song and dance of peaceful times. In West Africa, these wooden drums are made to answer almost the same service as the telegraph of civilization. Each village has a drummer and a drum call, making it possible for the scattered settlements to be put in speedy communication with each other. Such information as the approach of travelers, their number and equipment, can be announced hours before their arrival. The drum signal system is capable of minute detail of information. For instance, it is related that a certain missionary in South Africa was caught in the rain some distance from home and desired an umbrella. The man in the palaver house struck the drum several times and presently a boy came running up with an umbrella. The sticks had designated in the code the location of the missionary and his necessity. The m'kul is cut from a block of wood and its center is hollowed out.

MOCHANGA — Sonorous Substances. India. A metal jew's harp. See jew's harp.

MOHUR — See tayuc.

MOKKINE — Sonorous Substances. Japan. This consists of a hollow box over which from thirteen to sixteen transverse wooden bars are laid. A melody can be produced by striking the bars with knobbed beaters after a method similar to that of the xylophone. See xylophone.

MOKU-GYO — Sonorous Substances. Japan. A wooden prayer gong struck with a padded stick. It was formerly shaped like a fish with its tail in its mouth but is now found in the form of a bird in the same position.

MOKURI — Sonorous Substances. Japan. A jew's harp formed of a strip of bamboo having a narrow tongue cut in its center. It is used chiefly by the Ainos, a tribe of northern Japan representing the primitive population and not of the Japanese race or language. See jew's harp.

MONAULOS — Double-beating Reed. Ancient Rome. One found in the Tiber has a cylindrical tube of large bore, composed of pieces of bone united by cement. There are four finger-holes. The sound is produced by means of a double reed inserted in a socket at the upper end of the tube. Also the name given to a single tube mamm, an Egyptian instrument.

MOON GUITAR — See yueh-ch'in.

MOUTH HARMONICA — Free Reed. Europe. The same instrument was known as mund-harmonica (mouth harmonica) in Germany and hence, doubtless, our present name. It is also known colloquially as mouth organ. The name æolina was bestowed upon it between 1825 and 1830, because of a similarity in principle and in tone to the æolian harp. It consists of a small rectangular frame of wood and metal with sixteen rectangular apertures on one edge which differ in length according to the tone required. Into these apertures are fitted elastic metallic laminæ or springs fixed at one end. They are placed with great accuracy but are allowed to vibrate freely. In the side of the case, leading to each spring are air channels through which the air is conveyed. The instrument is moved back and forth before the mouth in performance. The strength and rapidity of tone lies wholly within the taste and skill of the performer. Books of instruction were issued during the early part of the Nineteenth Century and its use was recommended even for fair lips.

A recent invention is one with four sides, sixty-four double holes and one hundred and twenty-eight reeds. It can be played in four different keys. Consider the dexterity required for its performance. A probable ancestor of this little toy, which is of no musical consequence whatever, is mentioned in Hamlet as follows: "There is much music, excellent voice in this little organ, . . . give it breath with your mouth and it will discourse most eloquent music."

MOUTH ORGAN — See mouth harmonica.

MRIDANG or MATHALA — Vibrating Membranes. India. This is probably the most ancient of the Indian drums. It consists of a hollow shell of wood larger at one end than at the other upon which are stretched two heads of skin fastened to wooden hoops and strained by interlaced leather braces passing the length of the drum. It is beaten in a peculiar manner by the hands, the finger tips and the wrists. To beat the mridang is an art in itself and years are necessary for the attainment of proficiency. Nearly identical to the pakhwaj.

MUET — Plucked Strings. Africa. In this essentially primitive affair, a stalk of "building palm" in many instances constitutes the basis, to which are fitted one or several resonators. Strips of bark are raised from the stalk and a notched bridge passed under them. The tension of the strings can be regulated by movable loops of fiber. Found in the Fan tribe, the Gaboon, and in the French Kongo.

MUND-HARMONICA — German name for the mouth harmonica.

MURALI — Transverse Flute. India. Is found both in wood and in metal and is often highly decorated with colors or with carving. It has about six finger-holes.

MUSETTE — Double-beating Reed. Europe. A French name for the oboe in high F. The contemporary name in Germany was schalmey. See schalmey.

MU-YU — Sonorous Substances. China. A block of wood hollowed out and shaped somewhat like a skull, and painted red. It is used by the priests to mark time during the recitation of their prayers when begging from door to door or in performing ceremonies. They beat it with a stick having a large head covered with leather.

NAGARA — Vibrating Membrane. India. A large kettle drum used in the temples and beaten with two curved sticks.

NAGARE — See dimplipito.

NAGELGEIGE — See nail violin.

NAGGAREH or NAKKARAH — Vibrating Membranes. Syria and Arabia. A small brass double drum in the form of kettle drums with a head of skin and played with wooden drumsticks.

NAG-PHENI or TURI — Cup Mouthpiece. India. A trumpet whose tube near the mouthpiece is bent like the letter S. It expands into a bell at the lower end.

NAIL VIOLIN or NAGELGEIGE — Sonorous Substances. Europe. This was invented in 1740 in Russia by the violinist Wilde. It consists of a circular sound-box of wood in the circumference of which are inserted iron pins which diminish in height as the tones rise in pitch. The chromatic nails are bent. It is played with a violin bow. A later improvement (1780) had the addition of sympathetic strings. These were used by Senil of Vienna, who was famed for his nail violin playing. The idea originated from the fact that one day Wilde, having returned from a concert, was hanging his bow upon a nail when it scraped against the iron and produced a vibration which in turn gave a sound.

Some of the existing specimens are remarkably crude. Because of the resisting quality of the nails, an unusually coarse, black horsehair bow is required. An evolutionist would find a prototype of the nail violin in the zanze of the Africans. See zanze.

NAKKARAH — See naggareh.

NALLARI — Double-beating Reed. Korea. This is one of the most popular instruments of Korea. The conical tube is fitted with finger-holes and a double-beating reed mouthpiece.

NANGA — Plucked Strings. Egypt. This has an oblong, box-like body, covered with skin. To one end is bound a narrow arched neck and from this to the further end of the body are drawn several strings, sometimes of gut, sometimes from the tail of the giraffe. The nanga and the ombi bear a striking resemblance to the boat-harps of the Egyptians and the Greeks.

Natural Horn — See hunting horn.

Nay or Nei — Vertical Flute. Syria, Persia and northern Africa. A tube of bamboo furnished with side holes. It was made in various lengths.

N'Dungo — Vibrating Membranes. Africa. This has a long wooden body tapering slightly near the ends. In the center of one side is a handle. The ends are made of sheepskin, as a rule, laced together with strips of hide or of fiber cord. The manner of playing is unique. The instrument is carried on the shoulder of one man while a second walks behind, beating it. These drums are often ornamented with skulls. Forbes tells of one weirdly embellished with twenty-four of them.

Nefir — Cup Mouthpiece. Persia. This instrument, which is used by the dervishes, is made from the horn of an animal.

Nei — See nay.

Ngiemeh — See koundyeh.

N'Gom or Be — Plucked Strings. Africa. The name given the ombi by the Fan tribe and the Mpongwe. See ombi.

Ngoma — Vibrating Membranes. Africa. Virtually a large kettle drum. The body is cask-shape, the head being of skin. It is struck with the fingers. The ngoma is native to East Africa and received its name from the dance, which is the delight of the Kafirs. This recreation continues from sunset to sunrise and everyone participates either in the dance, which consists in swaying the body and stamping the feet or in making the music.

Ngonge — Sonorous Substances. Africa. A wooden bell, cut from a solid block of wood, sometimes globular and sometimes irregular. One or more wooden clappers are hung within by a cord. Ngonges are worn by women as ornaments, but are also used on live stock and dogs. The African dog never barks and his master can locate him only by his bell. In Central Africa, ngonges are used in the funeral dances, in which instances they are hung upon the backs of the mourners.

NICHIN — Plucked Strings. Japan. A circular koto of four strings. See koto.

NICKO SHO — Sonorous Substances. Japan. Two small circular gongs of metal suspended in a wooden frame having a handle. Wooden beaters tipped with bone are used. The frame is about a foot high.

NI-DAIKO — Vibrating Membranes. Japan. A portable drum, a variety of the da-daiko used in small religious processions. It is swung from a black lacquer pole which is carried on the shoulders of two men while the drummer walks at the side and beats it with sticks. It is surmounted by one red flame. The tone is very poor and thin. See da-daiko.

NI-GEN-KIN — Plucked Strings. Japan. The body is a flat piece of wood with a convex surface into which are inserted small pieces of metal acting as frets. It is furnished with slender feet and is placed upon a low table when played. The instrument is strung with two strings which first pass over a bridge having two notches and then over one having a single notch. After passing through the one notch they are tuned in unison. Heavy cylindrical tsume are used in plucking the strings.

NIJUGO-GEN — Plucked Strings. Japan. An instrument having an oblong body about three feet in length. In width it tapers from eight to six inches and the upper surface is slightly convex. The nijugo-gen is furnished with twelve pairs of strings and one other. These are fastened to one end of the body and after passing over a bridge are carried to the interior through thirteen holes which are placed diagonally across the face.

NI-NO-TSUZUMI — See ichi-no-tsuzumi.

NKONJO — Sonorous Substances. Africa. A drum used among the Mpongwe, the Gaboon and French Kongo tribes to accompany a dance bearing the same name. The heads are of skin which, as is usual in these sections, are beaten by the fingers and palms alternately, drumsticks being a rarity.

No—Double-beating Reed. Siam. A conical tube having finger-holes and terminating in a bell. It is fitted with a double reed mouthpiece.

No-Kan — Transverse Flute. Japan. A bamboo or iron flute played transversely and having finger-holes.

Norfe — Plucked Strings. Egypt. A pear-shaped body of wood with a long neck or finger-board provided with frets, one found at Thebes still having the remains of frets of camel gut. The strings are plucked with the fingers or a plectrum. When the instrument appeared in the hieroglyphics it meant "good."

Nyastaranga — Vibrating Membranes. India. A pair of conical tubes flaring at the ends. They are played by placing one on either side of the throat, the vibrations of the vocal cords setting in motion small films of spider web inserted in the tubes by which the sound is produced.

Nyckelharpa — Bowed Strings. Norway. An instrument which somewhat resembles the hurdy gurdy and is a modern form of the schlüsselfidel. It differs from the hurdy gurdy, however, in that it is played with a short, curved bow. Instead of stopping the strings upon a fretted finger-board, the instrument is provided with several keys to which are attached tangents acting upon the strings much as those in the clavichord. Sympathetic strings are often provided and several octaves are within reach of the keyboard. See hurdy gurdy and schlüsselfidel.

Obah — Plucked Strings. Africa. A triangular frame of wood with one corner inserted in a gourd and furnished with fiber strings. The gourd is held against the body when the instrument is played.

Oboe — Double-beating Reed. Europe. The name comes through the old English hoboe, from the French form hautbois, which signifies a wooden instrument with a high pitch. The tube is conical with a small bell at the lower extremity, and is fitted with a double reed mouthpiece. The reeds are fastened with silk thread to the brass staple which is inserted in the end of the instrument. The compass is two octaves and a half, with B below middle C as the lowest note. Some instruments have the lower B flat also. Keys closing holes near the end of the tube extend the compass by three notes. This instrument requires much less breath for blowing than does any of the other wind instruments, and rests found in scores are intended to allow the performer to exhale naturally, rather than to inhale. The oboe does not transpose.

It has an individual function in giving the pitch to the entire orchestra. This dates from the time of Handel, when the oboe was the most difficult instrument to tune in the orchestra. Now the clarinet, which has since come into use, might better do that work as it is even less tunable. The oboe can depict a variety of emotions, and its versatility and acute tone have caused it to find favor among orchestral composers. Extremely high or low notes have a rather harsh quality. The loud tones are piercing, yet the naturally gentle voice can tell of tenderness, innocence and pastoral scenes, and grief and pathos are characteristic emotions, although gaiety, when required, can be expressed.

OBOE DA CACCIA — Double-beating Reed. Europe. Old name for cor anglais. See cor anglais.

OBOE D' AMORE — Double-beating Reed. Europe. Oboe in A, a third lower than the ordinary oboe. It has a compass of a little over two octaves, and transposes a third lower. Its passing out of use is deplored by some writers because of its gentle, mellow voice. Bach recognized its good qualities, and made frequent use of the oboe d'amore. See oboe.

OCARINA — Whistle. Europe. A small, earthenware vessel with an egg-shaped body and nine or ten finger-holes. On one side is a projection to be used as a mouthpiece. It has no bell. The ocarina resembles a flageolet in tone and its fingering is like that of the flageolet. A set of them comprises bass in G, tenor in G, alto in C, soprano in G and high soprano in C. These are the modern representatives of the ancient Chinese hsüan, supposed to have been invented 3000 B. C. They have no value musically, but are interesting from their tonal individuality due to their peculiar cavity and the absence of a bell.

OCHINGUFU — Sonorous Substances. Africa. This primitive instrument has a wooden body in the form of a deep box with an open top. It is struck with two beaters.

OCTAVE SPINET — Plucked Strings. Europe. A spinet tuned an octave above the ordinary pitch. These instruments were small and a place was often designed for them in the case of the ordinary spinet. They could be played alone, nevertheless. It is thought that their use with the larger instrument made the performance more brilliant.

O-DAIKO — Vibrating Membranes. Japan. A drum having a diameter of about two feet, used occasionally in temple services. It rests on a black lacquer stand and its surface is elaborately decorated with gold clouds or colored dragons. It is provided with handles as it sometimes appears in processions. It came from China.

OHOTNITCHIYEROG — See Russian horn.

OLIPHANT HORN — Cup Mouthpiece. Europe. A hunting horn made of elephant tusk and hence its name. Some examples are highly carved.

OLUMBENDO — Vertical Flute. Africa. A vertical flute of the north coast.

OMBI — Plucked Strings. Africa. The native harp of the Bakalai, a tribe near the equator. It is also popular among the tribes of the west coast. The body is box-like and over its open side is stretched a piece of skin, sometimes an elephant's ear, sometimes a snake skin. A long curved neck of small circumference extends from one end of the body outward and upward. Fiber strings are stretched from the neck to a bridge, generally located within the sound-box.

ONION FLUTE or FLUTE EUNUQUE — Vibrating Membranes. Europe. This consists of a conical tube of wood, the hole having at one end a covering of membrane over which is placed a perforated bulb. The instrument is played by humming into this hole. The name is due to the fact that in mediæval times onion skin was often used in place of membrane. The childish method of humming upon a comb covered with paper has the principle of the onion flute.

OOMPOOCHAWA — Sonorous Substances. Africa. A zanze of the Ashantee tribe. See zanze.

OPHICLEIDE — Cup Mouthpiece. Europe. A brass instrument, the bass of the trumpet family, in existence during the Nineteenth Century and now obsolete. The application of keys made it an improvement upon the serpent. It was bent upon itself.

The etymology of the name is a combination of the Greek words for snake and door-key. It was invented in 1790 by Frichot, a Frenchman who had adopted London as a residence. Its disuse may be largely attributed to the fact that its peculiar quality of tone did not blend with the other instruments of the orchestra.

Spontini first introduced it into the operatic score, that of "Olympie" in 1819. Mendelssohn wrote parts for it in several pieces. A family consisted of bass in C, tenor in E flat, alto in E flat, soprano in B flat. It may be considered as the last representation of the side-hole principle in cup mouthpiece instruments. The compass was great, but always varied, for in its short life it underwent many changes and additions. In its completed form, it possessed as many as twelve keys.

ORCHESTRAL HORN — See French horn.

ORCHESTRINA DI CAMERA — Europe. Invented early in the Nineteenth Century by W. E. Evans of London. It consisted of a series of instruments built somewhat upon the principle of the harmonium. They were designed as their name signifies to act as a substitute for parts of the orchestra. They were placed upon a standard and were played by a keyboard operating upon a bellows. The bellows admitted air to pipes fitted with reeds so shaped and placed as to imitate almost perfectly the clarinet, flute, and numerous other wind instruments. Even the transposing instruments were provided with a shifting keyboard to render their use less complex. In addition to supplying vacancies in small orchestras, the inventor designed them to be used in duets or trios with other instruments.

ORGANISTRUM — A name applied to the hurdy gurdy in the Ninth Century.

ORGANO-PIANO — Europe. An instrument, in the upright case of which was contained the workings of both an organ and a pianoforte. By means of stops the performer could control each instrument separately or in conjunction. The keys communicated with the hammers of the pianoforte action in much the usual way. The action of the organ was below the pianoforte action and the bellows were actuated by treadles. The valves were lifted by means of forks extending from the backs of the keys which communicated the motion through various methods. The instrument was of no practical use.

ORPHARION — See pandore.

ORPHICA — Bowed Strings. Europe. A clavier, which was in use during the latter part of the Eighteenth and earlier part of the Nineteenth Century. It was the invention of August Röllig in 1795. In form it was a recumbent harp attached to a box containing keys and mechanism. It was a portable affair and the celebrated Mary Cosway is painted as playing upon an orphica which she holds upon her lap. The instrument is fastened to her waist with a sash. It somewhat resembled a hurdy gurdy in that the strings were sounded by means of a bow placed within the instrument and worked automatically. Power was conveyed to the bow by means of pedals. For a further idea refer to piano-violin.

OSOBUKI — Vertical Flute. Japan. Bamboo or metal flute with side holes, and about a foot in length. The name is also applied to a short whistle not having finger-holes.

OYO — Sonorous Substances. Japan. A temple instrument of wood carved to represent a recumbent tiger having a serrated back. A broom or a stalk of bamboo split into shreds is rubbed along the back at certain points in the ceremonies. The oyo resembles the Chinese yu. See yu.

OZEE — Vibrating Membranes. Burmah. A hand drum with a shell of wood shaped like a goblet and having heads of skin braced with strips of the same material.

PAKHWAJ — Vibrating Membranes. India. A drum having a circular shell of wood and skin heads which are braced with strips of the skin laced back and forth between the two heads.

PA-CHIAO-KOU — Vibrating Membranes. China. A Chinese tambourine with an octagonal frame of wood and skin heads, metal discs being inserted in the sides.

P-AI-HSIAO — Vertical Flute. China. This was invented when the Chinese did not know that different tones could be got from one pipe by uncovering the holes made in it at different places. So they bound tubes of varying lengths together in the form of Pandean pipes. The first of these was made with ten tubes and bound with a silken cord. It now has sixteen tubes arranged in a carved and ornamented frame typifying a phœnix with spread wings. The sounds are supposed to represent the voice of this bird.

PAN BOMBA — Vibrating Membranes. Europe. An earthenware jar over the open end of which is stretched a membrane, through which are passed one or more sticks. These sticks are rough and the instrument is played by moving them rapidly backward and forward through the holes in the membrane. It was originally Spanish, but is also found in Italy. It is often of crudest construction, for the earthenware jar being substituted, for instance, a tin vessel. One shown in the Metropolitan Museum of Art is constructed from a common flower-pot. The tone it is needless to say, is very indefinite.

PANCHAMA OTTU — Cup Mouthpiece. India. A trumpet over two feet in length and formed of thin metal tubing which terminates in a bell.

PANDEAN PIPES — See Pan pipes.

PANDEIRO —Sonorous Substances. Europe. Jingle ring. A circular framework of metal carrying discs of same and sometimes bells. It was used as an accompaniment to Spanish dances.

PANDORE, BANDOLA, BANDORA — Plucked Strings, Europe. An obsolete member of the cither family, being the largest of a group of three, the others being called orpharion and penorcon. The varied number of strings were either of steel or gut. See cither.

PANDURINA — Plucked Strings. Europe. One of the many instruments of the lute family found in Italy. The body is smaller and more shallow than that of the ordinary lute, the pandurina being in reality the treble of the family. See lute.

PANG KIANG — Sonorous Substances. Korea. A bell hung to the eaves of the houses, to be swung by the wind. The body is of metal. A thin sheet of brass, sometimes cut to represent some object of nature, is attached to the clapper to catch the breeze.

PANG-KU — Vibrating Membranes. China. A small, flat drum with a body of wood, the top covered with skin and the bottom hollow. It rests upon a wooden tripod when used in the popular orchestra where it serves to beat time and accompany songs and ballads.

PAN PIPES, PANDEAN PIPES — Vertical Flute. Ancient Greece. An instrument coming down to us in story and in fact from ancient Greece and Rome. Its counterpart is also found in Asiatic countries. It is considered as an ancestor of the pipe organ. Pan pipes consist of a series of vertical whistles which are sounded when a column of air is directed toward the edge of the only opening at the top of the pipes. The method corresponds to that of the flute. A series of notes can be obtained by moving the mouth along the top of the instrument. Early in the Nineteenth Century, it was used by traveling mendicants who went about in bands performing upon a series of these instruments which in pitch represented bass, tenor, alto and soprano. Each performer would fasten the pipes just beneath his neck, allowing his hands to be free for supplication while playing. The instrument was called syrinx by the Greeks and that is its present German name.

The story goes that the rough shepherd, Pan, wooed the pretty Syrinx and in her desire to be rid of him she sought refuge in a growth of reeds. The importunate lover was not deterred by this and sought to reach her even then. As a last resort, Syrinx was turned into a reed and the shepherd made a bamboo pipe, upon which he breathed his adoration for his lost love.

PAR DESSUS — See quinton.

PAT-MAH — Vibrating Membranes. Burmah. A barrel-shaped shell of wood with a head of skin, braced on the sides with strips of the same. Highly ornamented as to frame. In a specimen in the Metropolitan Museum of Art, the frame is as high as an ordinary man and almost square, making the instrument of imposing proportions.

PATTALA — Sonorous Substances. Burmah. A hollow wooden frame which supports a number of bars of wood capable of producing about three octaves of tones when struck with beaters. It bears a resemblance to the xylophone. See xylophone.

PAWA — Transverse Flute. India. A flute played transversely and furnished with six or more finger-holes.

PEE — Double-beating Reed. Siam. The tube of this instrument is of rather singular construction. It bulges slightly at the center and flares at either end. The mouthpiece is fitted with a double-beating reed.

PEECHAWAR — Double-beating Reed. Siam. A conical tube expanding into a bell at the lower end and fitted with a double-beating reed mouthpiece.

PENORCON — See pandore.

PHANG — Free Reed. Siam. An instrument formed of a hollow block of wood into which free reed pipes are inserted. Similar to the cheng of China. See cheng.

PHEK — Sonorous Substances. China. Five pieces of wood are fastened together with a silken cord and are used in the manner of castanets as time markers. See castanets.

PHILOMELE — Bowed Strings. Europe. A form of the bowed zither. While in the shape of its sound-box and sound-holes it greatly resembles the violin, the finger-board is that of the zither. The strings are tuned as those of the violin, but G is the only one of the same substance as the violin, E and A being of steel, and D of brass.

The instrument is held while playing with the head upon the edge of a table and the body in the lap of the performer. A foot attached to the head holds it steady.

PHUNGA — Cup Mouthpiece. India. A trumpet with a long slender tube of thin metal expanding into a small bell at the end. The tube of a phunga at the Metropolitan Museum of Art is forty-nine inches long and has a diameter of two inches.

PIAI-PAN — Sonorous Substances. China. Castanets. These consist of two small slabs of a kind of red-wood attached with a silken cord, upon which a third slab of wood is struck to beat time. It is of common use in popular orchestras.

PIANOFORTE — Struck Strings. Europe. In the pianoforte, necessity has assuredly been the mother of invention. Since Cristofori's first instrument in 1710, each improvement has required another to counteract the change produced in the instrument's equilibrium. Cristofori's pianoforte was made entirely of wood, it was strung with poorly made wire, and the action and tone were weak and crude. The action consisted of a first or key lever depressed by the fingers and furnished with a pad which with an upward movement raised a second lever, pivoted near one end, and bearing a hopper at the other. As the first lever struck the second, the hopper was sent upward and came in contact with a projection connected with the hammer, near the circular butt upon which the hammer moved. The hammer-head was thereby sent against the string, causing it to vibrate. Beyond the point at which the second key lever was pivoted was a vertical stem, having at its extremity the damper, which rested against the string until the lever was struck, when the same motion which was transmitted to the hammer carried the damper away from the string. This is called single escapement; that is, it was necessary for all parts of the action to resume quiet before a second stroke upon the key lever would be effective.

Johann Andreas Stein, of Augsburg, was another successful maker of the Eighteenth Century. He produced what is known as the Viennese action. In Cristofori's action, the hammers were situated on a separate bar, but in the Viennese, they were attached to the rear of the key lever. The shank of the hammer worked in a brass socket, fastened by an iron pin in the lever. The hopper was placed in an upright position behind the key and as the lever was depressed the butt of the hammer was caught by a projection on the hopper and was lifted against the string, instantly allowing the hammer to resume its former position. The instruments of Stein were highly commended by Mozart, both as to the speed with which the dampers quieted the vibrations of the strings and as to the agility with which the action responded to the touch of the performer's fingers.

Stein was assisted in his work by his son, Andreas, and his daughter, Nanette. The daughter finished his pianofortes and also became a prominent maker, Beethoven using her instruments whenever possible. She married Andreas Streicher, who possessed a profitable knowledge of music and who improved the action of Stein by causing the hammers to strike from above, thereby increasing the extreme lightness. By his advice the family removed to Vienna, whence the name by which the action is known.

About 1770, the principal scene of activity in pianoforte making was changed to England. In 1766, Johannes Zumpe carried the industry from Germany to London, where he set up a workshop. Meanwhile, the famous firm of Broadwood was founded. Thirty years before, Shudi (Tschudi), the harpsichord maker, had set himself up in business. One of his most valuable assistants was a Scotchman, John Broadwood, who early evinced an inventive mind and who eventually succeeded Shudi in the business which has ever since been carried on by the Broadwoods with such success that their pianofortes are known throughout the musical world.

With the making of pianofortes in England came the English action, possessing great simplicity. It was the action used by Cristofori improved by English makers, among them Stodart and Broadwood. The hammer had a position of rest on a small rail immediately above the key. At the end of the key lever was situated an upright wire having a head of leather. Upon depressing the lever, this hopper struck the hammer, sending it against the string. At the end of each key was also a piece of whalebone which raised the damper from its normal position against the string with the same motion that acted upon the hammer. Pianofortes having this action were fitted with three stops, two of which were capable of increasing the possibilities of sound by raising the dampers from the strings, the other, capable of softening the tone by bringing against the strings a movable bar of wood covered with felt.

Until 1771, no special attention had been paid to the pianoforte by composers. During this year, however, Müthel, of Riga, composed a duet for two harpsichords or two fortepianos, as the pianoforte was at first interchangeably called. Three sonatas by Muzio Clementi, his Op. 2, which was published in 1773 in London, is considered as the first strictly pianoforte music. The first mention of the pianoforte as an accompanying instrument was made in 1767 on a play bill of "The Beggar's Opera." Between the first and second acts, "Miss Brickler" was announced to sing a popular song from "Judith" accompanied upon the new instrument by "Mr. Dibdin." John Christian Bach in London, June 2, 1768, was heard in a pianoforte solo, the first of its kind.

In 1783, pedals were first adapted to the pianoforte by Broadwood. The loud pedal acted upon the dampers, removing them from the strings, while the soft pedal caused a piece of cloth to come in contact with the strings in order to mute them. This variety of soft pedal has gone out of use with the passing of the square pianofortes. That found in the grands shifts the hammer so that it cannot strike all of the unison strings and that found in the upright shortens the distance the hammer travels to reach the string and so weakens the force with which it strikes.

The gentle plucking of the strings in the harpsichord had made possible wires of light weight. With the use of hammers heavier wire was required to resist their action. Cristofori recognized the impossibility of the sounding-board withstanding the tension of the heavier wire if the hitch pins were placed immediately in it. Consequently, he inserted the hitch pins in a separate rail. The first metal to be employed in the construction of the pianoforte was used about 1785, in steel arches situated in the space between this wrest-plank and the sounding-board and designed to assist in withstanding the tension. The use of metal in the pianoforte was established in 1808, when James Broadwood first applied iron tension bars situated above the strings, an arrangement which exists even now.

In 1800, the upright piano was patented by John Isaac Hawkins of Bordentown, N. J. This was an original idea, as the upright instruments heretofore had merely been squares or grands turned on end with the keyboard attached at the lower end. Hawkins, however, had invented an entirely new instrument with strings extending below the keyboard. The growing tendency to economize space caused the upright case to be readily accepted by the public and today more uprights than grands are manufactured.

Sebastian Erard, whose action in the harp has remained unchanged for a century, in 1808 began developing a double escapement action, which he finally improved in 1821, when his nephew, Pierre Erard, procured a patent for it. By means of the invention, control for a second stroke could be regained over the key lever while the hammer was striking the string. The hopper, after putting the hammer into motion, was removed by a backward escapement and regained its position of rest. As the hammer was striking a string and escaping, a second impulse might be sent through the key lever to the hopper, so that the hopper might be in readiness to transmit the impulse to the hammer as soon as the latter resumed its position of rest. Erard's purpose was to combine the lightness and rapidity of the Viennese action with the greater strength of the English. As he patented it, the mechanism was very complicated and its manufacture and repair were extremely difficult. Therefore, the modern tendency is toward greater simplicity, although the principle is in use by all makers of any pretensions whatever.

As the weight of the wires was increased the problem of resistance constantly confronted the maker and to strengthen the frame of the pianoforte more metal was required. In the new wire, two metals, brass and iron, were employed and they presented difficulties in tuning because of the inequality of resistance to tension and to atmospheric changes manifested by them. To overcome this, an employee of Stodart named Allen, in connection with James Thom, on January 15, 1820, produced a patent for a compensating frame designed of plates of iron and brass and hollow tubes. The two metals were distributed in such a manner as to act in opposition to the changes liable to occur in the length of the strings.

The action had by this time assumed a comparative perfection, but the framing was still in a crude state. The compensating frame of Allen was gradually improved until Alpheus Babcock of Boston in 1825 patented a square pianoforte having an entire frame of cast iron. Babcock's idea assumed a more practicable form in the hands of Conrad Meyer of Philadelphia in 1833. Jonas Chickering of Boston, in 1840, applied the iron frame to the grand pianoforte.

Karl Philipp Emanuel Bach borrowed his method of playing from that of the organ upon which he was a renowned performer. The Bach method existed for many years. In it there was a marked absence of wrist movement in striking the keys. With Franz Liszt, born in 1811, came a new and much more powerful school of pianoforte playing.

Use of the wrist was acquired and consequently the fingers were converted into veritable hammers capable of striking the keys with much force, so that the more energetic performers were in danger of snapping the weak strings as they brought forth the melody. Attention was thus directed to the strings and the knowledge of metal composition and wire drawing has advanced in rapid strides during the past century. In 1775, blued steel strings had been adopted in preference to the imperfect wire formerly in use, as they did not rust as easily and were capable of producing a much fuller tone. Now the best wire is highly specialized and comes from Germany.

In 1833, overstringing was introduced in square and upright pianofortes. The bass strings were placed diagonally across the treble, affording them greater length and equalizing the strain produced by the tension. The bridge could also be placed nearer the center of the sounding-board, allowing a better tone. This system was in general use in America for fully two years before European makers adopted it. Jonas Chickering, about 1853, combined this overstringing with the iron frame and the most essential features of the modern pianoforte had come into existence. Nevertheless, invention has in no wise ceased in connection with the instrument, for every maker is striving to further perfect some part in order that his pianoforte may excel all others, and commercialism is assisting art. Although every workshop is equipped with massive machinery for sawing, clamping and casting, the pianoforte requires more hand work than perhaps any similar product of man's ingenuity.

The pianoforte stands as the instrument which is played upon most generally and the mechanism of which its player understands the least. The construction is complicated and each successive feature must be exactly mapped out by a draftsman before it reaches the workman The tonal qualities of the least important parts must be considered while the designing is in progress. The wood must be selected, the iron must be cast, and the few bolts placed to the best advantage in tone production. However, theory tends to carry the maker beyond the possible, when it must give way to practise, as is exemplified in the weights of the strings.

The wood, which is such an important factor in the pianoforte, is selected with almost as much care as was used by the violin makers of Cremona in their search for the backs and bellies of their instruments. Those who are entrusted with this work are capable of distinguishing favorably between the tones emitted by blocks of wood when struck. In the pianoforte the strings have such a meager vibrating surface that the sound vibrations produced by them alone could not reach the ear of the listener with any reasonable force. Therefore, the strings are carried across a bridge by which the vibrations are transmitted to the sounding-board, which, with its greater expanse of surface, repeats and increases them and at last transmits them to the air. Spruce, pine, maple, oak, mahogany and other varieties of wood are used. After it has been sawed into strips it is weather-seasoned from three to ten years, the length of time depending upon the use to which it will be put. It is then taken to the drying room and submitted to extreme artificial heat for a number of weeks, when it is placed in a dry atmosphere until used. After the long process is completed. the wood is sawed into widths, all less than six inches, which are glued together to form the wooden parts of the pianoforte. The wood is cut with the grain running vertically and horizontally and in the parts needing strength the strips are glued together with the grain alternating to make them more substantial and less likely to warp. On the other hand, in those parts designed for the transmission of vibrations the strips are glued together with the grain exactly matched, so that the vibrations can follow the grain without interruption.

The foundation of the entire pianoforte is the frame or more technically the rast. In the upright instruments, the rectangular frame is strengthened with cross-pieces, while in the grand, strips of wood emanate from a common center and are bent to fill out the rounded outline of the cases.

Everything else is attached to the frame, which shares with the metal plate in resisting the strain of the strings, and to it is glued the wrest-plank, in which are inserted the tuning pegs. The under side of the grand case and the back of the upright, which is the sounding-board, is built up of strips of spruce, three to four inches wide, running diagonally, and is one-fourth of an inch thick under the bass strings and about three-eighths of an inch thick under the treble strings, the difference in thickness causing the surface to be undulating. The grain runs from the lower bass corner to the upper treble and the strips are so arranged that those having wide grain lie opposite the bass strings, while those of finer grain are grouped with the treble strings. Much of the tonal excellence of a pianoforte depends upon the grain of the sounding-board, and pine bars varying from nine to sixteen in number are glued to the back in a diagonal direction and serve in retaining the necessary curve, without which the tone is tinny.

The iron plate is a casting which holds the entire structure in line. It is bolted to the sounding-board and contains the hitch pins. Its casting is a delicate task and the dimensions called for in the pattern must be accurately carried out or the pianoforte will be a failure. The plate is cast from an iron mold which is one-eighth of an inch larger than the finished plate, allowance having been made for the shrinkage of the cooling metal. In turn the mold was cast from a wooden pattern which for the same reason is one-eighth of an inch larger than the plate.

The strings, to withstand whose tension the plate has been so carefully fashioned, vary in length and weight but never in the degree of tension to which they are drawn. The number of their vibrations per second required for the tones of the scale, varies from 26 in the lowest bass string to 4136 in the highest treble. As the vibrating length of the string producing the highest treble tone is 2.145 inches in length, theoretically the deepest bass would require a length of thirty-two feet. However, this impossibility is overcome by making the wire heavier, having the steel wound with copper or soft iron wire, the increase in weight offsetting the discrepancy in length. Each note, except in the lower bass is furnished with three strings tuned in unison. Following these, as the wire grows heavier and needs more room for vibrating, there are from ten to eighteen strings in pairs, and in the last octave or so each note has but one very heavy string. Together they offer tension varying from twenty-five tons in poorly strung instruments to forty tons in the best grands.

Under the term action, is included the entire complicated system of levers and rods and hammers that meets the eye when the cover of a piano is lifted and which must act in perfect unison in producing correct vibrations in the strings. The different parts of the action are fashioned, assembled and secured in place with extreme nicety. Each key lever, hopper and hammer must be individually perfect and should act in such unison that, with the least possible resistance, the hammer will come in contact with the string with the greatest possible force, for there are three prominent qualities to be desired in an action, viz.: lightness, elasticity of touch, and sensitiveness to degrees of attack. The hammer is not driven positively against the string, but throughout the action momentum is being gathered by which the hammer makes the final stage of its journey. Naturally, the greater the distance at which the hammer rests from the string, the stronger will be the tone produced. This fact has been recognized in the soft pedal of the upright instrument which brings the hammer nearer. Basswood, ash, cherry and cedar have been used in the action, but best results have come from American rock maple. Much attention must be paid to the direction in which the grain runs and in those parts that work close together the grain runs across, preventing the wood from expanding under certain atmospheric conditions.

The hammers are furnished with a round shank and a pear-shaped head. The wedge-shaped center of the head is wood, which is covered with two layers of felt, the second of a heavier quality made in Germany. The covering of the hammers acting upon the treble strings is not as thick as that which is used on those acting upon the bass. The ordinary piano has a compass of seven octaves and three notes, for which eighty-eight hammers are needed. A single strip of wood is covered with the felt and is then cut into the required number of sections.

Likewise the keys are in one section at first. White pine is used, strips of which with the grain running in the direction of the finished key, are glued together. They are then carefuly spaced off into the proper widths for the keys and the ivory and ebony coverings are glued in place. As the hammers must strike the strings in diverging lines, the key levers cannot lie entirely parallel within the case, but must be bent in the correct directions.

The tuning is the last process which the pianoforte undergoes. The strings are subjected to sixteen tunings before they are drawn to the correct tension which is just short of the breaking point and when this standard has been reached and the desired result is still lacking, attention is turned to the hammers. Each tone is built up of a number of harmonics which accompany the fundamental, and some of the hammers cause their strings to create too many. This defect is overcome by pricking the felt of the hammers to soften it at the point where it comes in contact with the strings, thus damping the unnecessary harmonics.

The pianoforte is second to the orchestra in the possibilities it presents to the composer and to the performer. In many instances it takes the place of the orchestra in accompanying and nearly all selections for the body of musicians is in time arranged for the pianoforte. Since the latter part of the Eighteenth Century, composers have recognized it as worthy of some of their best efforts. Years of application are necessary to acquire the art of playing, popular though it is, and there are hosts of inferior performers as there are hosts of inferior instruments. The routine of practice soon palls upon the student and he loses interest because what will take several years is not accomplished in several months. Others who may strongly desire to learn cannot devote sufficient time and the invention of practicable pianoforte players in 1895 has been heralded as the beginning of a new era in music. They have made it possible for the music-lover who has been denied the privilege of learning the art, to interpret the best compositions with perfect accuracy. The tone is somewhat mechanical but with a good musical ear and a thorough acquaintance with the method, the performer on the player can acquire expression.

A detailed account of the player would be uninteresting and unintelligible to the general reader. It has appeared under many names, but in principle the varieties are alike. The first patent applied for covered a player placed within the case of the pianoforte. However the large number of instruments without players already manufactured made the construction of the new instruments impracticable and a detached player was devised. It was inclosed in a case of its own and was placed immediately in front of the pianoforte when used. Gradually instruments with the player enclosed have appeared until their use has become general.

A vacuum is created by foot bellows and from it tubes lead to an opening in a path over which a perforated sheet of paper passes. The perforations are so arranged that, as they cross the opening in the path, the outer air rushes into the vacuum, and, directed by the position of the holes, strikes the rear of corresponding key levers. The force of the suction depresses the lever and the action responds in the same manner as when the fingers strike the keys. In the separate players, the air acts upon hammers which strike the visible keys of the piano and in reality two actions are necessary. The length of the perforations determines the length of the tones produced.

Not only have the players assumed prominence from their use in music rooms, but conservatories and music teachers are employing them in demonstrating difficult passages which the student can learn much more easily after hearing them accurately played.

PIANO-VIOLIN — A curious instrument, invented in 1837. It was a common piano, containing a violin arrangement, which was set in motion by a pedal. When this instrument was played upon it gave the sound of both violin and piano.

PIBGORN — Single-beating Reeds. A rustic instrument used mainly among the Welsh and Celtic peoples. The name is thought to have come from "Pib" or "piob" meaning pipe and "corn" meaning horn. It was often constructed from the shin bone of an animal combined with a bell of horn though more often of hollow wood. It is supposed to have been used to accompany the hornpipe. It is also called the cornicyll and cornepype.

PIN — Plucked Strings. Siam. This instrument of the lute family has the usual pear-shaped body of wood, terminating in a narrow neck. The body is only a few inches in width, however, and the instrument averages about forty inches in length.

PINA — Vertical Flute. China. A flute of bamboo with five finger-holes.

PINAKA — Plucked Strings. India. The body is a narrow strip of wood, at times highly polished, and decorated. It is mounted with a single string which is plucked with the fingers or with a plectrum.

PIPE — Vertical Flute. Europe. This name is applied to the wind instrument which the English peasants used with the tabor in accompanying their dances. The instrument was extremely simple in construction and was a little larger than the flageolet. It was played with the left hand while the tabor was played with the right. See flageolet. See tabor.

PIPE ORGAN — Whistles and Beating and Free Reeds. Europe. The accepted origin of the pipe organ is in the Pan pipes. The same principle underlies both, that of directing air against a group of pipes capable of giving tones of various pitches and, in the organ, of various qualities. Pan pipes in the most primitive form were passed back and forth before the lips of the player. An improvement upon this arduous method appeared in a wind-box, into which the base of the pipes was inserted and which was furnished with a single mouthpiece. Air can be furnished from the lungs with only moderate force and pairs of hand bellows were adapted to perform this duty. An instrument of this sort with pipes, sound chest and bellows is readily recognized as the organ in embryo and a knowledge of it can be traced to a date several centuries before Christ.

The bellows appeared in one or several pairs, and were compressed alternately, in order that the wind supply might remain uniform. The hand bellows were superseded by those compressed by the weight of human bodies. Men stood upon them and compressed them alternately by treading. There exist numerous pictorial representations of this method. In a later method, the bellows had weights of lead or stone attached which were regularly raised and let fall. At as late a date as 1890, the four blowers of the organ in the Nicolai Church in Leipsic, ran up a stairs and jumped from a height upon the bellows below. Any of these methods explain the prevailing tendency in the older organs toward an unsteady tone due to a non-uniform supply of wind.

Ctesibius, an Egyptian barber living about 200 B. C., applied the principle of hydraulic pressure to the organ in an attempt to equalize the wind supply. From a cylinder having a piston on the order of that in the common bicycle pump, air was forced into a tank containing water. The compression of the water regulated the bulk of the air and the amount which entered the pipes. The hydraulic organ was made as late as 826 A. D., although it is hard to reconcile the probable presence of damp due to the use of water, with the constant effort on the part of modern organ makers to exclude it. A prejudice against the hydraulic instrument finally arose and the pneumatic organ superseded it.

In very primitive organs — those blown with the mouth — holes in the pipes were closed by the fingers when the pipes were not required for use. Later, each pipe was fitted with a slider, a strip of wood through which a hole had been bored. The sliders, or linguæ as they are called, were pulled in and out at the base of the pipes allowing the air to enter when the perforation corresponded with the aperture of the pipe. Owing to the great resistance which always accompanies a pull, an easier and quicker method was devised and the key, depressed by a blow which offers less resistance than a pull, was adopted. The name key was given because it unlocked the sound within the pipe. The first keys were of an extraordinary size, having a width of from three to five inches and a length of several feet. Players were called organ beaters and struck the keys with their fists or elbows. The first keyboard to be credibly recorded belonged to an organ built about the end of the Eleventh Century at Magdeburg. It had sixteen keys, each one forty inches long and three inches wide. The distance to which each key was depressed was proportional to the length and size of the pipe it served and the action was naturally slow.

At first each key was placed just beneath the pipe which it operated and the reaching capacity of the human arms made it impossible to enlarge the number of pipes. This was done away with by the introduction of a method for arranging in the shape of a fan the backfalls, or wooden levers conveying the action of each key to its pipe. Another system employed rollers compactly arranged above each other and transmitting the motion from the key levers to the valves of the pipes. Each method made it possible for a pipe to be out of line with its key lever. Following these inventions, the pipes were arranged in much the same order in which they now appear. In the center are the short ones which give the high tones and to the right and left, in the form of wings, are the longer ones which give the deeper tones. Following the new arrangement, the keys became narrower and, about the Twelfth Century, five keys occupied the space of eight of the present size and one key operated upon more than one pipe.

The early organs were indeed curious. The bellows required vast amounts of leather and in itemized statements of the expenses of their construction, mention is made in one case of the use of a horse's hide for each bellows and in another of seventy cow hides for twenty-one bellows. The tone was much lustier than at present, for time and again writers speak of organs whose music could be heard throughout the town and whose voices were so strong that listeners could not venture near with uncovered ears. An instrument of Arabian make is recorded to have had a tone of such "softness" as to cause the death of a female.

Organ building appeared first in the East and was carried by way of Greece through Europe. The first mention of the use of organs in churches is by Julianus, a Spanish bishop living about 450, who refers to their existence in his dominion, but not until the Seventh Century did Pope Vitalian of Rome introduce the instruments into congregational singing. The Greek church has always refused to recognize them.

The swell, by which expression is gained, was invented in 1712 and was used immediately in England, although it has been only slowly accepted by German makers. A German writer in 1890 decries the crescendo made possible by its use on the ground that "it would rob the organ tone of its majestic passionlessness and tend to a sentimental or pathetic mode of playing."

The great wind pressure when many pipes were in use caused the keys to offer several pounds resistance when depressed. This was overcome in 1832 by what was termed the pneumatic lever. Under each key was situated a small bellows which by means of compressed air could be adjusted so as to impart any degree of elasticity. Pneumatics have since been still more successfully applied.

In its entirety the organ has a most complicated structure, but as it is studied it resolves into sections, which add interest and assist the student to comprehend. These sections make possible a system of development dissimilar to that found in other instruments. There is no limit to the individual characteristics which an organ may possess. Modern ingenuity has led the makers so far that musicians have often decried the newer instruments because of the attention which the organist must devote to the various mechanical adjuncts.

The organ may be regarded as a piece of furniture or preferably as a part of the building in which it is to be used. Many of the finest effects obtainable by good organs are often lost because of the cramped condition of some of the sections or because of its inappropriate position, due to the fact that its requirements have not been considered when building the place to be its home. When a new organ is to be built, the advice of an organ architect is as necessary as are the specifications of the makers. However, the ornamental work may be designed by the building decorator irrespective of the organ maker.

The vast internal mechanism must be noiseless, hence felt is used in some instances to deaden sound. Rollers must travel in stocks, shutters must open and close, and leathern bellows must expand and contract without adding a single sound to those produced by the pipes. The organ is termed the king of instruments and the accuracy with which some of its pipes bearing corresponding names can imitate such orchestral instruments as the violin, the flute, the oboe and the clarinet makes it the combination of many instruments in one — a veritable orchestra. Its voice is majestic and can create effects impossible to anything else, unless it be the new telharmonium of Dr. Cahill.

The banks of keys, sometimes five in number, appear sadly confusing to the novice, as do the hundreds, sometimes thousands of pipes above. The pipes are arranged in groups termed stops, capable of imitating some orchestral instrument or of producing a special effect, while the diapasons give the individual organ tones, such as no other instrument gives.

Each keyboard connects with a separate row of pipes and usually possesses a compass of fifty-six notes, although the tendency is to extend this to the complete five octaves. The range of an organ computed in the number of vibrations of the tones produced, is from 16 to 8272, which may be compared with that of the pianoforte, 27 to 4136, and that of the violin, 82 to 1044. Draw-straps on the keyboard also bring into use couplers which connect the different keyboards. For instance, when the "swell" to "great" is drawn and keys on the "great" are depressed, the corresponding keys on the "swell" will act also. The sliders of both stops having been drawn the combined pipes create a greatly increased sound. By using all the couplers, the entire range of pipes may sound, producing a mammoth effect.

The principal keyboard or manual is known as the "great" organ. The one above is called the "swell" and connects with a series of pipes enclosed in a box, which can be opened by a shutter like a Venetian blind and which is manipulated by means of a pedal. When the box is closed, the tones are subdued but when crescendo is desired the box is opened. The manual below the "great" is the "choir," connecting also some flute and reed solo stops. In larger organs the fourth or "solo" manual is above the "swell" and connects with pipes on heavy pressure designed for especially loud effects, and above it at times is placed the "echo" keyboard connecting with pipes in another part of the building.

With the hands so completely employed, the organist must also be expert in performing upon the pedals, which are larger keys played with the feet and having a compass of about thirty notes. To play upon them is difficult as the organist must find the pedals entirely by instinct.

The pipes are of metal or of wood. The cheapest metal and that most commonly used is composed of one part tin and three parts lead. When the proportion of tin is increased to half it appears on the surface in scintillating spots and the alloy is termed spotted metal. The increased use of tin adds brilliancy and power to the tone and durability to the pipes. Lead in larger quantities on the other hand makes inferior pipes. Zinc has a limited use. The metal is cast in sheets, which are planed to the exact thickness of the finished pipes and are cut into sections, having a width the same as the circumference of the needed pipe. The smaller sheets are then formed into cylinders, having the edges soldered together. Each pipe in every stop varies in thickness, length and diameter. One side of the cylinder or body of the pipe is flattened to form what is known as the lip. The foot is a metal cone whose base has the same diameter as the body and whose smaller end or toe is rounded until almost closed. One side of the base is made flat. The air enters the narrow end, but is checked by an inner projection and, rushing through a slit which gives it a flat form, is cut by the upper lip and then passes up the pipe which may be open or stopped. Pipes termed open allow the air vibrations to escape at the top. Those which are stopped are fitted with a plug at the upper end and in order to escape, the vibrations are caused to travel the length of the pipe twice and consequently to produce a tone just an octave lower than it would in an open pipe of the same length.

Wood pipes are made from well seasoned, perfect pine and are rectangular in outline. Their walls vary in thickness from two and a half inches to less than one-eighth inch and as in the metal pipes, there are open and stopped varieties.

Reed pipes are grouped together forming the stops which produce the imitations of the orchestral instruments and other special effects. A cylindrical brass tube, termed the reed and to which is attached a brass tongue, is enclosed at the base of the pipe and the passage of the air causes the tongue to vibrate, producing the tone. There are three varieties of reeds, the open, the closed, and the free. In the first class, the opening in which the reed vibrates extends the entire distance up; in the second, the opening is partly closed; and in the third, the tongue does not strike in vibrating.

Foundation stops are groups of pipes giving tones of unison pitch and their octaves, further variations being made possible by groups of pipes in which the members are not of unison pitch, but often tuned in fifths. Beneath the feet of the pipes of each stop is a slider, a long, flat piece of wood pierced with holes, which can be moved in and out by means of mechanism. By pulling out a draw stop rod in the front of the organ, a corresponding slider is withdrawn until its perforations correspond with the lower openings in the pipes. However, these openings are individually closed by pallets, which are pulled away by the action of the key lever, allowing the wind which has been stored in the wind-chest to enter the pipes.

The bellows, which occupy nearly the entire ground space of the instrument, are filled by feeders which work alternately, one giving up its contents to the air reservoir above it while the other is being filled. Weights of cast iron are arranged at the top of the reservoir, and by a wind-gauge the pressure of the air is visibly registered so that the force of blowing may be regulated. In carefully constructed organs, separate reservoirs are placed beneath the wind-chests of the different stops and tend to do away with the unsteady tone which might result from sudden changes from very soft to very loud passages.

In 1833, an English maker introduced tubular pneumatic action. Small metal tubes about an eighth of an inch in diameter lead from the keys to the pallets which close the entrance to the pipes. The tubes are so slender that they can be bent to pass around many corners and can be carried to a great length. When the key lever is depressed a valve is opened allowing the wind to enter a tube situated at the tail of the key. At the other end of the tube is a valve which connects with another valve which imprisons the air in the wind-chest. This last valve when opened by the air allows the diminutive bellows holding the pallet shut to exhaust, bringing the pallet down and allowing the air to enter the pipes. The action is light, but not quick in returning and the tone lingers, presenting serious drawbacks when a rapid shake is attempted.

The more modern electric action is even more sensitive to the touch and is exceptionally quick. Upon depressing the key lever, an electric contact is effected and the current is sent over wires, charging a magnet drawing away a disc of iron, which is held in place at the opening of the pipe by the pressure of air.

Self-playing organs act on the same principle as do self-playing pianofortes. The player is enclosed within the case of the organ and, as in the pianoforte player, a vacuum is created by exhaust bellows operated by the feet. Tubes lead from the vacuum to the tracker board or path over which the perforated paper is drawn. The paper is perforated in the same manner as is the sheet used with the pianoforte. The arrangement of the holes is such that as they pass over the opening in the tracker board, the outer air is drawn through by suction and is directed through tubes against the valves leading to the reeds or pipes which are to be sounded.

Like the self-playing pianoforte, the self-playing organ is by no means a modern invention, but has been undergoing improvements for many years. The player was first applied to the reed organ in which the air, without passing through pipes, causes the reeds to produce sound vibrations. Later it was used in conjunction with the vocalion system, by which the tone of the reed organ is rendered much more like that of the pipe organ. The air, before or after reaching the reeds, is sent through pipes which add to the tones certain qualities which are not possible in the ordinary reed instrument. The newer instruments, which can also be played by means of the keyboard, are growing in use in music rooms and in churches. Although the pianoforte is primarily the instrument of the home and will remain so for some time to come, yet grander effects, especially in adaptations of orchestral selections, can be produced by the self-playing organ, which perhaps substantiates the claim of the makers that the instrument is much more satisfactory than the piano player.

The player has even been applied to the pipe organ, although owing to the great cost and the existence of so many large organs the combination is not in general use.

Po, Hsing, Seaou-Po — Sonorous Substances. China. These cymbals are made on quite the same principle as Occidental cymbals. They are said to have come originally from India. Their use is most conspicuous (and particularly disagreeable) to foreigners at theatrical performances. On numerous occasions such as after a quotation, a verse, or a command the cymbals are sounded ten to fifteen times in rapid succession, nearly drowning the voice of the actor.

Pochette — Bowed Strings. France. A miniature instrument having a body either boat-shaped or violin-shaped. From Kricher in 1650 is gained the idea that the first named is the older form. Its outlines give rise to the theory of its descent from an Arabian instrument. It was easily portable and was looked upon as a boon by dancing masters, for it could be played while displaying the steps. Pochettes have gone out of use, but the beauties lavished upon them by the makers render them dear to the heart of the collector, the date of their favor being the Seventeenth and early Eighteenth Century.

Pochette d'Amour — Bowed. Europe. Pochette with sympathetic strings. See pochette.

Poet's Viol — See rebab esh sha'er.

Pommer — Double-beating Reeds. Europe. This was known before the Sixteenth Century. The bass instrument was a forerunner of the oboe and bassoon. It consisted of a double-beating reed fitted into a conical tube. In the contrabass it attained to great length, being sometimes ten feet long. Some of the longer pommers were furnished with a long brass crook which was curved in such a manner as to bring the keys within reach of the performer. The keys which were often applied to the instrument worked under a pierced cover of wood, only the heads extending above for accessibility to the fingers.

A family consisted of contrabass in FF, bass in deep C, tenor in C, alto in F, treble in C and high treble in F.

Po-Fu — Vibrating Membranes. China. This small drum rests upon a table a foot high and is prominent in religious ceremonies.

Postilion's Horn — See hunting horn.

Prillarhorn — See bukkehorn.

Psaltery — Plucked Strings. Europe. An instrument first used by the Greeks. It has a sound-box like a dulcimer, but differs from it in that it is plucked with the fingers or a plectrum. In the latter part of the Seventeenth Century it was considered second to no other instrument when played by a skilled hand. It is considered as the predecessor of keyboard instruments with plucked strings. It is still made. The psaltery was usually trapeze-shaped or triangular and was portable, being often carried by means of a ribbon about the neck of the performer and deposited upon a table when it was to be played. In its outlines Prætorius found a likeness to a pig's head, referring to it in his writings as "instromento di porco." In German the name is Schweinskopf. It is mentioned by Chaucer and from several contemporary sculptures an idea of the original instrument may be found.

Puloay — Vertical Flute. Burmah. A small flute often of wood and fitted with finger-holes.

Qanon — See kanoon.

Quinton or Par Dessus — Europe. A five-stringed treble viol of high pitch. It belongs to the Eighteenth Century. See viol.

Rackett — See wurst fagott.

RANA-SHRINGA — Cup Mouthpiece. India. A metal trumpet shaped like the European serpent. See serpent.

RANAT EK — Sonorous Substances. Siam. A wooden frame shaped like a boat supporting strips of wood laid side by side. Sounded with wooden beaters, and greatly suggestive of the xylophone. See xylophone.

RAPPAKAI, HORANOKAI, HORAGAI — Cup Mouthpiece. Japan. Conch-shell trumpet used for signals.

REBAB ESH SHA'ER — Bowed Strings. Syria. A stringed instrument quadrangular in frame with unequal sides and covered with snake skin. A bow is used. This is sometimes called the poet's viol.

REBEC — Bowed Strings. Europe. This ancient instrument was one of the first of the ancestors of the violin. It had a pear-shaped body like the mandolin, and three strings but no finger-board. It was usually made of a single piece of wood hollowed out, with a carved figure at the end of the peg-box. It was held by the player with the tail piece resting violin-like under the chin or a trifle lower upon the breast. It has its counterpart in the Arabian rebab. The question remains whether the Spaniards derived the rebec from the Arabians, or the Arabians the rebab from the Spaniards. See rebab.

RECORDER — Vertical Flute. Europe. An obsolete instrument existing from an uncertain date to the middle of the Eighteenth Century. It was of cylindrical bore and was held vertically for playing. This gained for it the name flute à bec, in recognition of a resemblance to the beak of a bird. Another name was flute douce, derived from its pleasant voice. The etymology of the name "recorder" baffles researchers, although the word is used by Shakespeare in the sense of "to sing" and this meaning no doubt led to its use as a name.

Overblowing was not especially successful and the second octave was difficult to produce. An open pipe was furnished with a number of finger-holes, at least seven, and larger varieties fitted with one or more keys to lower the pitch.

The recorder appeared in two families, one being larger than the other. The smaller instruments were pitched, as bass in F, tenor in B flat, alto in F, treble in B flat, and high treble in F. The larger were contrabass in D, bass in C, tenor in G, alto in C, treble in G, high treble in C.

Some of the instruments were furnished with a fipple mouthpiece. The fipple was a block of wood inserted within the end of the pipe, at once narrowing the bore of the tube to the dimensions proper for the entrance of the current of air from the performer's lips, and directing the air in a flat form against the sharp edge of the tube through a slit in the block. This was a later invention and overcame the difficulty of blowing directly against the open end of the tube, the fipple being an imitation of the lips of the player. The mouthpiece was sometimes taken immediately into the mouth and at others was enclosed in a cap which in some instances contained a sponge for gathering the moisture from the breath. Other recorders were furnished with an extra hole, which was covered with a vibrating membrane which imparted an undertone when the instrument was blown.

The recorder enjoyed great popularity especially in England, this fact creating the impression that the instrument was of English extraction. Notwithstanding its popularity the compositions for it were, for a very long time, of a very mediocre quality, as the composer was generally a performer upon some other instrument and did not understand the recorder. Henry VIII. favored the recorder, and had a variety of them in all sizes and made of many materials. During the Seventeenth Century, composers began to treat the instrument more carefully and there exist from that period numerous selections for the recorder and the violin.

Two famous books of instruction for the recorder are The Genteel Companion, issued by Humphrey Salter, of London, in 1683, and The Delightful Companion, issued by John Playford and John Carr, also of London, in 1686.

The recorder had a long life but, after a struggle, gave way before the German flute played transversely and having a cylindrical bore fitted with numerous keys. See flute.

REGAL — Whistles and Reeds. Europe. This was the name given by the Germans to a very small organ. The idea was derived from the pipe organ, but only a single row of pipes was used. The invention was attributed, but not authentically, to an organ builder in Nuremberg, called Roll, in 1575.

Henry VIII. possessed eighteen regals at the time of his death. Some of them had one pipe to a note and others two. The instruments were contained in cases representing books, whence came the name bible regal. See bible regal.

RIATA — Double-beating Reed. Africa. An Algerian instrument similar to the zourna. See zourna.

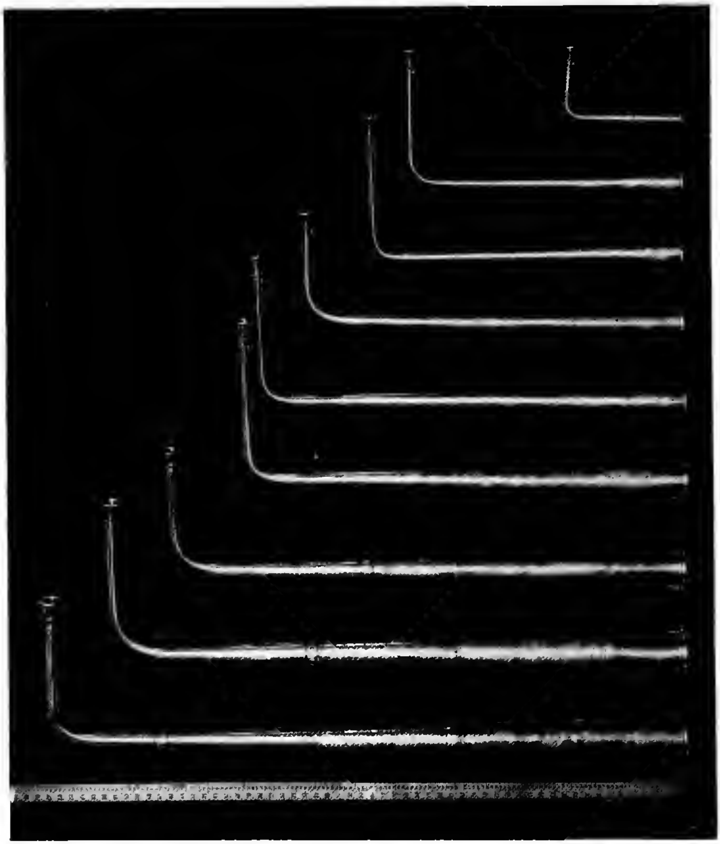
RIKK — Vibrating Membranes. Syria. A tambourine of wood and skin. See tambourine.

RITCHUKU — Vertical Flute. Japan. Pan pipes, generally twelve pipes strung together with a silk cord finished with a tassel. See Pan pipes.

ROCKING MELODEON — Free Reed. Europe. This was introduced into the United States about 1825. It was ultimately found to be unsightly, tardy in sounding, and harsh in tone. It consisted of an oblong case, at the bottom of which was placed a pair of bellows constituting the blowing apparatus. By pressing down the left hand side of the instrument, the bellows were filled, the lower ones being distended by a strong spring. By maintaining the rocking motion a constant supply of wind was provided. On the upper side were either keys or touches commanding generally about three octaves. This instrument was also called a teeter melodeon. The old blowing force system was thus employed.

ROTA — A name applied to the hurdy gurdy because a wheel formed part of its mechanism.

ROTE — Bowed Strings. (?) Germany. This was in shape similar to a narrow lyre. One was found in an old



RUSSIAN HORNS.

Property of The Metropolitan Museum of Art.

The individuality of the Russian Horn lies in the fact that it is incapable of giving more than one tone, except in the instruments of high pitch, which can repeat the fundamental an octave higher. Regardless of their meager compass the horns have been grouped into an orchestra, each performer occupied with a single note.

tomb in southern Germany, lying upon the bones of a Seventh Century knight. Its shape was evidently derived from the old kithara, a form of lyre. It was probably the original of the Welsh crwth. Although there is no positive evidence that the bow was used with the rote, this instrument figures as one of the ancestors of the violin, doubtless because of its resemblance to the crwth. We learn from the ancient manuscripts that to be proficient upon the rote was considered a requisite of the jongleurs who accompanied the troubadours in their travels and acted as their aides.

RUFHORN — Cup Mouthpiece. Europe. A German call horn of the days of simple horns. The German "ruf" denotes call, voice, wind.

RUMANA — Vibrating Membranes. Siam. A small drum having a circular shell of wood, and riveted skin heads.

RUSSIAN HORN — Cup Mouthpiece. Russia. A conical brass tube bent at a right angle near the mouthpiece. It is also known as chotnitchiyerog. The following description of a Russian horn band is taken from the catalogue of the Royal Conservatory of Brussels.

> In 1751, J. A. Maresch, cornetist of the Chapelle de l'Impératrice Elizabeth of Russia, conceived the idea of forming a band composed of these horns. To thirty-seven musicians he gave an equal number of horns, varying in length from one foot to seven feet, which produced between them the fundamental sounds of all chromatic degrees of a scale of three octaves. Each performer was able to produce but one sound with the exception of those having the twelve horns giving the highest notes of the series, who were able to produce over the fundamental sound, its repetition an octave higher, which completed the fourth octave of this curious orchestra. One can easily appreciate the difficulties that Maresch had to encounter in order to execute with precision certain rapid movements. His success, however, was enormous, and these orchestras were much in vogue at that period.

RYUTEKI — See yoko-fuye.

SABI — See sebi.

SACKBUT — Cup Mouthpiece. Europe. The sackbut was an instrument similar to the slide trombone, the present form of the latter bearing indeed the other name as early as the Sixteenth Century. Virdung, in 1511, gives a drawing of a sackbut similar to the slide trombone in principle. Lengthy discussions have been indulged in regarding the etymology of the name. The Spanish term, sarabuke, means pump and the first syllable of the sackbut is probably from the kindred Spanish sacar, meaning to draw, and the second syllable from the Latin buxus or pipe. The name was given to the sabeca of the Bible which, however, is believed by authorities to have been a stringed instrument. A Ninth Century drawing depicts an instrument of the sackbut kind lacking a bell.

The sackbut was evidently looked upon by the makers as a means for the expression of unbridled fancy, the mouthpiece, for instance, frequently being a mask, such as a serpent's open mouth. An ingenious Nineteenth Century maker bent the bell in a half circle above the player's head.

The sackbut retained its popularity in Germany until a later date than elsewhere, that is to say until the Nineteenth Century. It was much in use in England and attained to great royal favor in the reigns of Henry VIII. and Queen Elizabeth. J. S. Bach wrote for the soprano instrument. Its use in military bands long prevented its employment for the finer orchestral effects, its speech being held by orchestral composers as too blatant to be used with the group of low-voiced instruments which formed the orchestra of that time.

SA FA FIR — Vertical Flute. Egypt. Modern rustic Pan pipes. See Pan pipes.

SAGAT — Sonorous Substances. Africa. Egyptian castanets. See castanets.

SAIHWANG — Free Reed. Korea. An instrument in which bamboo pipes are inserted in a gourd with a mouthpiece on the side. Similar to the Chinese cheng. See cheng.

SALMODIKON — Bowed Strings. Norway and Sweden. A shallow oblong body with a many fretted finger-board and having a fixed bridge over which is stretched a single string. The instrument is occasionally provided with sympathetic strings. Salmodikons, some of which are capable of giving two or three octaves, are used in Norway and Sweden to accompany the voice.

SAMISEN OR SIAMISEN — Plucked Strings. Japan. This was brought from China to Japan in 1560 since which time it has become the national instrument. It is more portable than the biwa and more suitable for the accompaniment of lighter songs. It has three strings. The square body was once covered with snake skin but cat skin is now used, the value being proportionate to the number of nipple marks. See biwa.

SAMUIUS — Plucked Strings. Africa. An instrument whose body is a flat and narrow strip of wood. A short distance from one end occurs a small hole and a metal string or a cord is stretched from end to end of the wood. The performer places his mouth against the back of the bow over the hole and by varying the tension of his lips five notes can be produced. The Kafirs use the samuius in their songs of love and war, alternating the instrumental with the vocal music.

SAN-GEN-DAKIN — Plucked Strings. Japan. An instrument with a trapezoidal wooden box mounted with some forty strings. These pass over two bridges and are fastened at either end to pegs.

SAN-GEN-KIN — Plucked Strings. Japan. An instrument having three strings. The body is a half cylinder with a flat upper surface, often formed from a bamboo stalk. The strings pass from a small block of wood near one end over two bridges, to the opposite end where three pegs are inserted diagonally across the face.

SAN-HSIEN — Plucked Strings. China. This three-stringed guitar has a shallow cylindrical body and is covered top and bottom with snake skin. It has a long neck and three strings and is sometimes played with the hand but more often with a plectrum. It is the favorite instrument of the street ballad singers.

S'ANKHU — See shunk.

SAN-NO-TSUZUMI — See ichi-no-tsuzumi.

SANTIR — Plucked Strings. Turkey. This is an instrument similar to the khudra katyayana-vina, but having nearly four times as many strings. See khudra katyayana-vina.

SARANGI — Bowed Strings. India. An oblong body of wood with three gut strings and sympathetic strings of wire. Its tone resembles that of the viola. It is considered as rather vulgar and is chiefly found among the low caste Hindus and Mussulmans. A smaller, similar instrument is called the chekara and is much used by the common people.

SARINDA — Bowed Strings. India. The body is cut from a solid block of wood, part of the opening being covered with parchment upon which the bridge is placed. It has three strings of silk or gut and is played with a bow. It is usually highly carved and is popular with the lower classes.

SAR MUNDAI — Struck Strings. Burmah. See khudra katyayana-vina.

SARRUSOPHONE — Double-beating Reed. Europe. Invented in 1856 by M. Sarrus, a band master in the French army. It has a conical tube of brass fitted with a double reed, and like the wood-winds, has round holes closed with keys. It is similar in its timbre to the oboe, the cor anglais and the bassoon according to the pitch of the instrument; though louder and more metallic than these. A family is composed of soprano in B flat, alto in E flat, tenor in B flat, barytone in E flat, bass in B flat. The instrument most used is the contrabass in the military band. The sarrusophone, which is a combination of reeds and brass, has not been adopted by the orchestra.

SATSUMA-BIWA — Plucked Strings. Japan. A smaller and more delicate instrument than the bugaku-biwa. It is poetically termed the "Phœnix voiced." See bugaku-biwa and da-daiko.

SAUSAGE BASSOON — See wurst fagott.

SAW TAI — Bowed Strings. Siam. Has a pear-shaped body with a long narrow neck. In many instances the sound box is a gourd faced with skin. This is another Siamese instrument of great length. The body is not large comparatively, being but six inches in diameter.

SAX HORN — Cup Mouthpiece. Europe. A family which resulted from the improvement made in brass instruments by Adolphe Sax, who during the Nineteenth Century, strove to produce unity among the various instruments of this class by applying valves throughout, whereas formerly keys and valves were used with equal prominence. The perfected instruments do not possess voices which blend especially well with the strings and wood-winds of the orchestra, but appear to advantage in the military band. The most important are pitched in soprano in F, E flat, or D; contralto in C, the tenor in F and E flat, the barytone in C and B flat, and the contrabass in B flat. Some of them have acquired the special names of althorn, baryton, euphonium, bombardon. See althorn, baryton, euphonium, bombardon.

SAXOPHONE — Single-beating Reed. Europe. Invented in 1840 by Adolphe Sax, from which it takes its name. It is made of brass and has a conical tube. Owing to the fact that its mouthpiece resembles that of the clarinet, it is placed in this class, although the fingering is more like that of the oboe. Its tone is somewhat similar to the clarinet but of rich and distinctive character. There are twelve varieties of the saxophone, two belonging to each of the six classes, soprano high pitch, soprano, alto, tenor, barytone and bass, Their compass is about two octaves and a half. They all but one transpose, the music being written from a semitone below middle C to E flat, two octaves above.

Saxophones are effectively used in military music, especially in France, but have not been adopted to a great extent in the orchestra. An instance, however, is the melody in Bizet's "L'Arlesienne" for the alto in E flat.

Philip Hale says: "Regarding the saxophone, the treatise-maker says, 'It has a voice rich and penetrating.

The rather veiled quality of the tone partakes at once of the cello, the cor anglais, and the clarinet, but with more intense sonority. If Halévy called for saxophones to add to the anguish and despair of humanity on the Last Great Day, so Bizet used it to express gentle melancholy, inexpressible sadness, resignation, hopelessness, grief, that which is ghostly, the remembrance of happy days in present stress of sorrow, "the depth of some divine despair," the odor of leaves in the late autumn, the room in order awaiting the guest that has gone forever — what instrument is more suggestive to the hearer of sentiment or imagination?' "

SCHALMEY — See shawm.

SCHEITHOLD — See tromba marina.

SCHELLENBAUM or CHAPEAU CHINOIS — Sonorous Substances. Turkey. The schellenbaum was derived by the Germans from the janissary music in the Turkish wars. It was originally the pasha's standard and was borne before his regiment during battle. A pole having a crescent at the top was surmounted by a Chinese hat or pavilion. The entire device was generously hung with little bells. It is now practically obsolete. It was formerly carried at the head of military bands.

SCHIGUENE — Plucked Strings. Japan. An instrument having an octagonal body and a slender neck. It possesses four strings which are played in the manner of the guitar. It is essentially the genkwan.

SCHLÜSSELFIDEL — Bowed Strings. Europe. An instrument of the Sixteenth Century in which the principle was almost exactly that of the modern nyckelharpa of Norway. See nyckelharpa.

SCHOSCHI or SEOUNOFUYE — Vertical Flute. Japan. Pan pipes composed of about twelve wooden pipes of different lengths strung together with a silk cord. See Pan pipes.

SCHOSCHI-BOUIE or JINNIRITSI — Free Reed. Japan. This consists of some twelve tubes of different lengths, each fitted with a free reed and tied together with a cord.

SCHUMGHA — Plucked Strings. Africa. An ordinary bow shaft, perhaps a yard long, with the single bowstring tied back. The instrument is held horizontally, one end supported in the hollow of the performer's right thumb and the other gripped in his teeth. The tone may be increased and the tremolo effect added to it by the performer blowing on the back of the bow. This is probably the most primitive example of an African instrument.

SE — Plucked Strings. China. An instrument, which according to tradition had originally fifty strings. It came to have twenty-five in this wise. A certain Miss Su performed one day upon it before the august emperor, Huang Ti. The strains, however, made him so sad that he forthwith ordered the number of strings to be reduced one-half, and thus it has ever since remained.

The se is made on the same plan as the ch'in. Each string is elevated over a movable bridge, the bridges being painted in five colors, blue, red, yellow, white and black. These instruments are used in imperial and religious ceremonies. See ch'in.

SEAOU-PO — See po.

SEA TRUMPET — See tromba marina.

SEBA — See sebi.

SEBI, SEBA OR SABI — Vertical Flute. Ancient Egypt. This flute was a long tube of natural reed pierced toward the lower end with five finger-holes. The instrument was held almost vertically and blown across the upper edge. It is considered as an ancestor of the European recorders. Its present form, the nay or nei, is the representative national instrument.

SEE SAW DUANG — Bowed Strings. Siam. A cylindrical body with a skin belly and having a long neck, and mounted with two or more strings. Like many other Siamese instruments the body is very slender, only a few inches in diameter, and about twenty-five inches in length.

SEE-SAW-OO — Bowed Strings. Siam. A fiddle having a globular body and a long neck. Generally furnished with two strings of twine. The instrument is about thirty inches in length and the diameter of the body is four inches.

SEITEKI — Transverse Flute. Japan. A primitive Chinese flute made of plain bamboo and having six finger-holes. Its chief peculiarity lies in the fact that between the upper finger-hole and the lip-hole there is another hole covered with paper which lends a quaint buzzing sound to the music. The seiteki is ornamented with cord and tassel.

SEOUNOFUYE — See schoschi.

SERAPHINE — Free Reed. Europe. This, a precursor of the harmonium, was invented in 1833 by John Green of London. It had a keyboard and bellows similar to an organ. One pedal served to operate the bellows, and another to move a swell shutter over the reeds beneath the instrument. The sound produced was harsh.

SERINETTE — Wind with automatic mechanism. French. A miniature barrel organ, so called because it was played by bird fanciers in teaching the finch (serin) and other birds to pipe.

SERPENT — Cup Mouthpiece. Europe. This consisted of two hollow shells of wood or brass bent into serpentine shape and held together with a covering of leather. The mouth tube was curved towards the performer and the mouthpiece was cupped. The instrument originally had six holes and was later fitted with keys. It was bent in order to bring the finger-holes within reach of the player. Its tube was frequently over eight feet long, its fundamental note being in consequence two octaves and a whole tone below middle C. It was sometimes used in poor villages in France in place of the organ. Handel held it in no high esteem, considering its tone unbearable, but Beethoven and Mendelssohn did it the honor to write parts for it and it occurs in the earlier compositions of Wagner.

Burney in The Present State of Music in France and Italy (1771) remarks that he frequently mistook the tone of the serpent for that of the organ; but soon found it had in its effect, something better and something worse than that instrument. At the Notre Dame Cathedral he found that it accompanied the choir more often than did the organ.

SEZE — See tzetze.

SHAKUGIO — Sonorous Substances. Japan. A sistrum. A wooden handle with a ring at one end on which are hung other metal rings. See sistrum.

SHAKUHACHI or SIAKUHACHI — Vertical Flute. Japan. A flute of thick bamboo and in many cases twenty inches or more in length. It is difficult to play, but when well played is the mellowest of wind instruments. Smaller varieties are made.

SHAWM — Double-beating Reed. Europe. The tenor of the pommer family. The German name was schalmey. See pommer.

SHICHI-GEN-KIN — Plucked Strings. Japan. A seven-stringed kin identical with the ch'in or scholar's lute of China. See kin or ch'in.

SHICHIRIKI — See hitschi-riki.

SHIME-DAIKO — See uta-daiko.

SHI-YO — See sho.

SHO or SHI-YO, SHONO-FUYE — Free Reed. Japan. A primitive mouth organ made of seventeen thin bamboo reeds placed in a compact bundle and fixed in a circular lacquered wind chamber of cherry wood or hard pine. Each pipe has a slit which must be covered before a tone can be produced. The bamboo used in the construction of the sho is often procured from old country houses. Some performers warm the wind-box over a hibachi, the small stove of the Japanese, to prevent the accumulation of moisture. It is like the Chinese cheng.

SHONO-FUYE — See sho.

SHOPHAR — Cup Mouthpiece. Hebrew. This is the only existing instrument that may be assigned to the Jews as a nation. In the course of their wanderings, all others which may have been theirs have been lost. The shophar is made of ram's horn straightened under great heat. The rabbis sound it in the synagogue on the Jewish New Year, in accordance with the mandate of Moses: "And in the seventh month, ye shall have an holy convocation; ye shall do no servile work; it is a day of blowing the trumpets unto you." Only a few notes can be produced, but the ritual requires a certain series. The interior as in other such horns is conical.

SHUANG-CH'IN — Plucked Strings. China. An octagonal guitar made of hard wood with a long neck furnished with frets. The strings are tuned in pairs and are played with a plectrum. It is very costly and in consequence is rarely used.

SHUN — Sonorous Substances. China. This is the literary appellation of an instrument shaped like the mortar. Its popular name is ch'ing. It is struck with a wooden hammer. When used at religious ceremonies it is placed in a kind of silken purse richly ornamented with rare fish scales.

SHUNK or S'ANKHU — Cup Mouthpiece. India. A conch-shell trumpet used only in temples in religious ceremonies or carried in processions to the shrine of Hindu deities.

SIAKUHACHI — See shakuhachi.

SIAMISEN — See samisen.

SIDE DRUM — Vibrating Membranes. Europe. Also known as the snare drum, from the cords of gut which are stretched over the under side and which vibrate sympathetically with each stroke. The two heads are of skin and are stretched over the ends and fastened in the same manner as those of the bass drum. See bass drum.

The side drum is used in orchestras and marks the time for marching in military bands and gives a few signals in the army. The playing requires great skill, and instruction should begin in youth to develop it.

In La Gazza and Fra Diavolo, the side drums are used with good effect, but it is the tendency of composers to use them injudiciously. In the Dead March from Saul a continuous role of muffled drums is used, and the blessing of the poniards in Meyerbeer's Les Huguenots is made more impressive by their use in crescendo passages.

SINDI — Sonorous Substances. Persia. Persian cymbals. See cymbals.

SISTRUM — Sonorous Substances. Ancient Egypt. This instrument originated in the worship of Isis. Metal rods passed through a metal hoop and were hung with tiny bells. The hoop was furnished with a handle by which it was shaken. This jingling instrument was carried with the pagan worship to Rome, in the last years of her supremacy, and it was found in Italy as late as the Eleventh Century in use in the Roman Catholic churches. It was also known by the Oriental people and mention of the sistrum is made by Josephus.

SITAR — Plucked Strings. India. Also called sundari. This instrument has a flat, circular body of wood and a long straight neck. It is played with a wire plectrum secured upon the forefinger, while the thumb is pressed firmly upon the belly in order that the position of the hand should vary as little as possible. The tone is singularly sweet and plaintive and the smaller ones are sometimes used by the native ladies.

SLIDE TROMBONE — See trombone.

SNARE DRUM — See side drum.

SO-NA — Double-beating Reed. China. There is no instrument in more general use in China than this shrieking and detestable contrivance. When heard in the morning it announces a funeral and in the afternoon a wedding. It consists of a wooden pipe fitted with a double-beating reed and a copper bell. There are seven holes on the upper side and one on the lower for the thumb. As in the European oboe, the mouthpiece is a small reed affixed to the upper end. The smaller size is called k'ai-ti. Also called heang-teih. See oboe.

SONA RAPPA OR DOSA — Cup Mouthpiece. Japan. A copper trumpet over a foot long having a bell over four inches in diameter. It is used by candy venders and hence can scarcely be called a musical instrument.

Song Nah — Vibrating Membranes. Siam. A cylindrical drum with skin heads braced with strips of skin.

So-No-Koto — Plucked Strings. Japan. A Chinese instrument used in playing Chinese music in Japan. There are thirteen strings which are played with the tsume, two bits of ivory fastened to the fingers.

The story goes that a noblewoman about 670 A. D. was sent to a rural district for her health. One day while gathering flowers, she was attracted to a grove by beautiful strains of music. Within the grove she found a man in the guise of a Chinaman, whom instinct told her to be a god. He called her to him and began to instruct her upon the beautiful instrument which he played. The lessons continued for many days and with the acquisition of knowledge, health returned, until a day came for her reappearance at court. There she displayed her new instrument and her new art and taught others. As soon as possible, however, she returned to her rural retreat only to find that the god and the grove had disappeared and that only a fleecy cloud had been left in their stead.

Sonorophone — Cup Mouthpiece. Europe. A coiled variety of the bombardon, constructed of metal. Sonorophones were still made in the Nineteenth Century. See bombardon.

Soor — Double-beating Reed. India. The conical tube terminates in a metal bell and is furnished with a double-beating reed mouthpiece. The instrument is fitted with a varying number of finger-holes.

Soorsringa — Plucked Strings. India. A gourd body is furnished with a neck carrying sixteen frets. A specimen in the Metropolitan Museum of Art is forty-six inches long and the body has a diameter of nine inches.

Soote — Vertical Flute. Persia. A short flute possessing several finger-holes.

Souffarah — See duduki.

Soung — Plucked Strings. Burmah. A harp whose body is shaped like a boat. A curved neck rises from one

BURMESE SOUNG.

Property of The Metropolitan Museum of Art.

This graceful boat-shaped harp is the forerunner of the present triangular orchestral instrument. During all ages and among all people the boat-shaped has been used; but its beauty — its most striking feature — robs it of all possibility of perfection, as without the support of a third side, the neck cannot withstand the great strain of the strings.

end, and assists in the support of the strings, whose tension is altered by slipping them along the neck, or by pegs in it. In some instances the frame is elaborately carved, and there are often about thirteen strings.

SOURNA-KOTO — See ichi-gen-kin.

SOUTAK — Vertical Flute. Persia. A musical toy whose foundation is a jar filled with water. Notes resembling those of a bird are produced by blowing through the spout.

SPINET — See virginal.

SPITZHARFE or DAVIDHARFE — Plucked Strings. A double sound-box with strings on both sides, the bass on one and the treble on the other. It was a double psaltery designed for playing duets. The instrument had a base and could be placed upon a table between two performers. The spitzharfe, literally meaning pointed harp, is also known as harpa doppia. The story goes that it was this variety of instrument which David used, bringing about the name davidharfe. This name and the name harpanetta, which is also at times applied are both erroneous as the strings run over the sound-box instead of from it, as in the harp.

SPOON FIDDLE — See löffelgeige.

STONE HARMONICA — Sonorous Substances. England. In one of these instruments in the Metropolitan Museum of Art there are twenty-two slabs of stone varying in length from two feet and two inches, to nine inches. The slabs rest upon ropes which are stretched across a frame. William Till of England was the collector and the Museum catalogue says: "In selecting these stones it was found that the rocks should be perfectly sound gneiss and hornblende schist in which there was no slate, in order to produce a musical note, and in tuning them it was discovered that chipping away the end sharpened the tone, while at the center similar treatment flattened the tone." When once in order the tone never changes.

STREICH-ZITHER — See bowed zither.

STROHFIDEL — See xylophone.

Su-D'Zu — Sonorous Substances. Japan. A globular brass bell resembling the ordinary sleigh bell, used in worship by the Shintos, a religious sect.

Su-Lo — See lo.

Sundari — See sitar.

Sung — Plucked Strings. Siam. An instrument of the guitar type, with a circular body and a long neck. Similar to the Chinese yueh-ch'in. The face is twelve inches or more in diameter. See yueh-ch'in.

Syrinx — Vertical Flute. See Pan pipes.

Tabbalat or Tabl-Shamee — Vibrating Membranes. Arabia. This hand drum has a shallow shell of wood and is carried about the neck. A pair of them are called tabbalat arrakeb.

Tabbalat Arrakeb — See tabbalat.

Tabla — Vibrating Membranes. India. These instruments are small drums, either tenor or bass. A cylindrical shell of wood or metal has heads of skin braced on the sides with strips of the same passing over wooden cylinders placed midway between the heads to secure the regulation of the tension. The custom is for the drums to be tied in a cloth about the performer's waist.

Tab'l Bel'edee — Vibrating Membranes. Turkey. The shell is cylindrical and the heads of skin are held in place by hoops braced upon the sides with cords.

Tabl-Shamee — See tabbalat.

Tabor — Vibrating Membranes. Europe. A shallow drum much used in the Sixteenth Century, with the pipe at rustic dances. It was hung on the left arm and beaten with the right hand of the performer while the left fingered the pipe. It figured in the morris dances from the Fifteenth to the Eighteenth Centuries. It is called the tambourin à cordes when used in association with the galoubet.

Taiau — See thio.

Takachihokin — Plucked Strings. Japan. The outlines of the body are in the form of a bird. Thirteen strings are fastened at one end on the inside and pass through eyelets to the upper surface where they are carried over two bridges to metal tuning pegs at the opposite side.

TA'KHAY — Plucked Strings. Siam. The body is designed to resemble the back of a crocodile. The strings seldom number more than three and are fastened at one end of the body. They extend over a number of frets to a high bridge over which they pass, and are then carried to the interior where they are wound about pegs.

TAMBOURA — See tanbour.

TAMBOUR DE PROVENCE — Vibrating Membranes. Europe. A French drum. It has a long barrel of wood with heads of skin braced with cords. It is usually attached to the left arm and beaten with a stick held in the right hand while a little pipe is played with the left hand in the manner of the English pipe and tabor. It is found in use at rural dances.

TAMBOURIN A CORDES — See tabor.

TAMBOURIN A CORDES — Struck Strings. France. Literally a small drum with strings. It is used with the galoubet or chirula in accompanying rustic dances. It has an oblong sounding-board with a few gut strings stretched over two bridges and played with a small stick held in the right hand while the left manages the galoubet. It is a rude form of dulcimer. It is also called tambourin du bearn.

TAMBOURIN DU BEARN — See tambourin à cordes.

TAMBOURINE — Sonorous Substances. A hoop of wood or metal covered on one end by skin which is tightened or loosened by means of nuts in the sides. Loose plates of metal are fastened by a wire through their centers to the sides of the hoop and clash when the instrument is shaken or struck with the fingers. The tambourine is used in dances and is of Oriental origin.

TAMBURA — Plucked Strings. India. A bulbous body with a long straight neck, sometimes made entirely of wood, sometimes with the body of a gourd. The belly is usually slightly convex. It has four strings. The instrument often has a length of four feet, and in the body a width of one foot.

TAMBURELLO — Vertical Flute. Europe. Italian name for tabor. See tabor.

TAM-TAM — Vibrating Membranes. India. A small kettle drum used by beggars. See kettle drum.

TANBOUR — Plucked Strings. Europe. This member of the lute family is found in Asiatic Russia, Turkey and Persia, always preserving its distinctive pear-shape. It is of the present day.

TANBOUR or TAMBOURA — Plucked Strings. Persia and Turkey. Has a pear-shaped body and a slender neck. The strings are plucked with a plectrum. The size varies. Among four specimens in the Metropolitan Museum of Art the smallest is ten inches in length and the body has a diameter of two inches while the largest is thirty-three inches in length and the body seven and one-half inches in diameter.

TANBOUR BOUZOURK — Plucked Strings. Turkey. A very large instrument of the lute family. The body is pear-shaped and the strings are plucked with a plectrum.

TANBOUR KEBYR — Plucked Strings. Turkey. This large instrument, four feet in length, has a globular body and an extremely long and narrow neck. The body is about twelve inches in diameter.

TANBOURICA — Plucked Strings. Europe. A Bulgarian instrument having a small triangular body and a sounding-board pear-shaped in outline. The neck is long and thin. It is similar to the Egyptian norfe and the tanbour of the Mohammedan countries.

TANBOURITZA — Plucked Strings. Roumania. Roumanian instrument of the lute family about two feet in length, and having four strings. See lute.

TANG-TZE — See lo.

T'AO-KEN — Vibrating Membranes. China. A handle passes through a small barrel from which two balls are suspended by cords. When the drum is whirled by means of the handle the balls strike the skin heads. One small size is used by itinerant millinery merchants for the purpose of making known their whereabouts. This variety generally is provided with a small gong on the upper side to add to the din.

TAOOSEE —See sitar.

TAPAKA — Vibrating Membranes. Africa. A circular tambourine from the North Coast. See tambourine.

TAR — Vibrating Membranes. Africa. A circular tambourine from Morocco and Algiers. See tambourine.

TAR DE MESSAMAH — Vibrating Membranes. Africa. A circular tambourine found in Algiers. See tambourine.

TAUS — See tayuc.

TAYUC, MAYURI, TAUS, ESRAR or MOHUR — Plucked or Bowed Strings. India. This variously named instrument is a form of the sitar with movable frets. It is carved to represent a peacock, the head and body of the bird forming the lower part of the instrument while the tail is represented in the long neck. It is painted in the colors of the gorgeous feathers. A specimen in the Metropolitan Museum of Art possesses twenty wire strings passing over twenty-two movable frets. It is nearly four feet in length. The tayuc is at times played with a bow. See sitar.

T'E-CH'ING — Sonorous Substances. China. For this a stone is cut in the shape of a carpenter's square, the side which is struck with the performer's hammer being longer than the other. It is suspended in a frame by means of a cord passing through a hole bored in the apex. In other days it was cut in fantastic shape to represent a monstrous animal or fish, or a dragon or the like. The dimensions of a specimen in the Metropolitan Museum of Art are eight inches by nine inches.

TEETER MELODEON — See rocking melodeon.

TEIKIN — Bowed Strings. Japan. A Chinese fiddle about three feet in length and having a narrow body. A long slender neck passes through the body and projects on the lower side. Two strings are carried from this projection to the pegs in the other end of the neck.

TEKKIN — Sonorous Substances. Japan. An oblong wooden box supporting on its surface two rows of metal bars, which are struck with a wooden beater. It somewhat resembles the glockenspiel. See glockenspiel.

Telharmonium — America. The telharmonium is the invention of Dr. Thaddeus Cahill, whose laboratory has been located at Holyoke, Mass., for a number of years. The first instrument was completed in 1900 and the ensuing time has been spent in making improvements. This new system of utilizing electricity has been treated of in the majority of recent periodicals. It has been discussed musically and scientifically and every writer and reader in the end possesses a belief that the telharmonium is one of the most wonderful inventions of the age.

Sound travels through the air in waves. The strings of the violin are rubbed into vibrations which, unless corresponding vibrations were created in the air, would not produce the effect upon the ear drum which is termed sound. In demonstrating this the experiment has been made of creating string vibrations within a space from which the air had been excluded and the ear remained insensible to the vibrations.

Electricity travels in the same manner of waves as does sound, but in the ether and not in the air. Dr. Cahill recognized a possibility and employed electrical vibrations in producing sound vibrations. He built dynamos giving forth alternating or vibrating currents, which are sent over wires to a refined receiver similar to one used in an ordinary telephone. This receives them from the ether and repeats them in the air in the form of sound vibrations. The receiver is not held to the ear, but is furnished with a funnel into which the vibrations are sent with such force that a music hall, ball room, or restaurant may be filled with beautiful music.

The underlying principle of the telharmonium is the underlying principle of tone production. Each tone that is produced by any instrument is made up of a fundamental or ground tone which in every case is made up of the same number of vibrations if given the same pitch. In other words the foundation of a like tone of the flute, the horn, the oboe, or the pianoforte is the same. The individuality which distinguishes the voices of different instruments is due to harmonics or partials, vibrations which accompany the fundamental. They are much faster and less distinct, but their number governs the quality of the tone of an instrument. With the ordinary instrument the player cannot fully regulate the number of harmonics and consequently many tones are imperfect. Dr. Cahill had conceived an instrument or instruments which might be capable of producing tones in which the fundamental would be accompanied by a correct number of harmonics and his experiments have resulted in one great instrument which can do perfectly what scores of lesser instruments heretofore have done imperfectly.

The telharmonium is furnished with a keyboard similar in appearance to that of the organ or the pianoforte. Each key is connected with a dynamo by a wire. Upon the depression of a key the dynamo gives off the electrical vibrations or alternating currents of which it is capable and a fundamental tone is produced, but is unaccompanied by harmonics. It is merely a tone without individuality. The harmonics are furnished by draw stops which are situated on the keyboard. The stop for the first harmonic produces 870 vibrations and that for the second 1305. One hand of the performer is employed with keys and the other hand draws out the stops. The vibrations are produced by rolls which are circumscribed by teeth, the number of vibrations being limited by the number of times each tooth passes around the roll. Sometimes the rolls are geared to revolve 1440 times per second, but the number of vibrations is more usually increased by adding more teeth. However, the instrument is perfectly dumb unless connected with the receiver which translates the electrical waves into sound waves.

Sixteen stops have already been in use, but eight more are needed for the tones of the stringed instruments. Dr. Cahill remains at his laboratory in Holyoke working upon improvements and time will eventually bring his highest ambitions to a realization. The commercial side of the venture is in the hands of business men and all efforts tend toward making the telharmonium the instrument of the people. Through it music of the highest order, played with a perfection not attained by many orchestras, and entirely lacking the mechanical effect of phonographs and mechanical players, will be offered to the public at what are termed popular prices.

For a complete orchestra twelve or fifteen keyboards will be needed. They will be grouped about a director in a public hall in which will be receivers so that the musicians may have a realization of the effects they are producing and their music will be carried to hundreds of homes and public places over wires similar to those used for telephones.

In Telharmonic Hall, New York City, the first central station after the instrument had come into commercial use, the keyboards were situated in an auditorium in which were also several funnels connected with telephone receivers. The wires from the keyboard led to the basement where the electricity was generated. Here were 145 dynamos, and the usual machinery of an electrical power station created pandemonium. Reserve power was boxed up in 400 telephones. During the early part of 1907 additions costing $60,000 were made, two new keyboards having been added. The cost of the original instrument was over $200,000.

TELYN—Plucked Strings. Welsh name for harp. See harp.

TENOR DRUM — Sonorous Substances. The tenor drum is used in military music. It is constructed like the side drum, but is not provided with snares. See side drum.

TENOROON — Double-beating Reed. Europe. The former name for tenor oboe. See oboe.

TERZINA — Plucked Strings. Europe. Italian cither played as a guitar and tuned a third higher, hence its name. See cither and guitar.

T'GUTHA — Bowed Strings. Africa. An instrument of the Hottentots similar to the kemangeh. See kemangeh.

THAN-HWIN — Sonorous Substances. Burmah. Metal cymbals. See cymbals.

THAN-KHANJANI — Vibrating Membranes. India. A tambourine made of skin or vellum stretched over a hoop in whose sides are slits where pieces of metal are strung and in playing are clashed together. The pitch is regulated by pouring water over the vellum which renders it taut. See tambourine.

THARI — Plucked Strings. Asiatic Russia. The body is shaped something like a figure eight and has a skin belly. It is furnished with a slender neck fitted with a peg box. The strings are few in number, but are not limited. They are plucked with a plectrum.

THEORBO — Plucked Strings. Europe. A large lute with an elongated neck in which was a second set of pegs to give greater length to the bass strings. The theorbo was used to accompany the voice and also in the orchestra. In the orchestra it made its last appearance in 1732 in Handel's oratorio, Esther.

THRO OR TAIAU — Bowed Strings. Burmah. This member of the viol tribe has a body whose outlines are somewhat similar to the violin. It is furnished with three strings of silk or fiber and is played with a horsehair bow. At times the finish is far from crude.

THONE — Vibrating Membranes. Siam. A hand drum having a narrow neck which expands into a globular head of skin which is fastened to the body by a network of wire.

TIBIÆ IMPARES —See aulos.

T'I-CH'IN — See erh-h'sien.

TIMBALI — See marimba.

TI-TZU — Transverse Flute. China. This is the flute ordinarily encountered in China. It is made of bamboo bound with a waxed silken cord and sometimes ornamented with tassels. There are eight holes, one to blow through, one covered with a thin reedy membrane, and six to be played upon by the fingers. It is played transversely. It is indispensable to every Chinese orchestra and is used in theatrical performances, and funeral and marriage processions.

To — Sonorous Substances. China. An ordinary bell with either a metal or a wooden tongue and having a handle at the apex. Four different kinds of tongued bells were formerly in use in the Chinese army. Their ringing was to convey to the soldiers the injunction to stand still and be silent in the ranks, and they came thus to be associated with respect and veneration. When music was performed to illustrate the valor of warriors and the merit of faithful ministers and the like the to was used to symbolize obedience. At present the to is used only by priests to mark the rhythm of their prayers.

Tolo Tolo — Struck Strings. Africa. The name given by the Basuto tribe, Zululand, to an instrument whose body is a tube of bamboo into each end of which a flexible stick is inserted. A single string passes between the two and is tapped with a stick while the instrument is held to the mouth of the performer.

Tonkari — Plucked Strings. Japan. A slender body of wood with a flat surface and short neck containing five pegs. At its head the neck broadens into a flat disc. This is one of the instruments of the Ainos, the primitive people of Japan.

Toomerie Nagassaran — Double-beating Reed. India. An instrument sometimes made of metal and wood, sometimes entirely of metal, and having a mouthpiece fitted with a double-beating reed. The number of finger-holes differs.

Tootoore — Cup Mouthpiece. India. A curved metal trumpet incapable of many notes.

Torbane — Plucked Strings. Europe. A Russian form of the theorbo, still in use. See theorbo.

T'oungsye — Vertical Flute. Korea. A bamboo tube fitted with finger-holes.

Trapezoid or Box Fiddle — Bowed Strings. Europe. An instrument of small importance by Savart. The inventor reasoned that the arches and curves of an ordinary violin are the only places where vibrations cease in the surface of the sound-box, and that the F^2 holes are so shaped as to counteract their resistance to vibration. Therefore he eliminated all these points and used straight sound-holes. Although favored by the French Academy, this instrument cannot be called a success.

TRAVELER'S VIOLIN — See folding violin.

TRIANGLE — Sonorous Substances. Europe. A steel rod bent into the form of a triangle with one angle open. It is struck with a second steel rod. The triangle is numbered among the orchestral instruments. A tremolo effect is gained by rapidly striking two of its sides alternately. Although the triangle is used to best advantage in dance music, it is recognized in Beethoven's Ninth Symphony, Schumann's First Symphony, and Haydn's Military Symphony, while Auber writes for it in Le Cheval de Bronze.

TROMBA MARINA, TRUMSCHEIT, SCHEITHOLT, CHORUS — Bowed Strings. Europe. This instrument is considered as one of the first in Europe with which a bow was used. The body was oblong and possessed a number of sides, from three to seven. The lower part broadened into a flat base upon which the instrument was rested while being played. At the top the body was narrow to accommodate the hand of the performer while holding the instrument in position. It was fully six feet in length and sometimes more. The one melody string was of heavy violoncello wire. In later specimens there were other interchangeable strings which served in accompanying. One foot of the bridge was loose and as it vibrated with the string, produced a reedy sound which constituted the chief charm. A heavy horsehair bow well rosined was used.

Here is afforded another of the many discussions as to the etymology of the names of musical instruments. Some authorities contend that because of its reedy tone, it was used in giving signals on vessels, hence marina from mare, the sea; and others, that the name has been given because of the instrument's use by the nuns in their devotions to the Virgin, marina in this case being derived from Maria.

Its use in convents continued to the present time and this instrument with its rough, unpleasant voice was even heard in concerts as is testified by the following advertisement which appeared in the London Gazette, Feb. 4, 1674, "A rare concert of four trumpets marine never before heard in England."

Trombone — Cup Mouthpiece. Europe. The name signifies the bass of the trumpet family. It has enjoyed a long life and earlier is found under the name sackbut. The tenor trombone is the one most used in the orchestra and has an entire length of nine feet. It possesses a long cylindrical tube of brass, which becomes conical only in forming the bell and is bent upon itself twice, making three parallel lengths. The central one of the three sections is doubled so that the outer tube can slide over the inner and increase the length. The slide is provided with a handle operated with the right hand and when in the bass instrument the arm's length is not sufficient to produce some of the required intervals, the handle is jointed. The trombone has seven positions. The first is with the slide closed, each succeeding position lowering the pitch a semitone. It is a non-transposing instrument. A family of slide trombones consists of the contrabass in B B, bass in G, tenor in B flat, alto in F and soprano in B flat. The bass is also found in F, the tenor in C and the alto in E flat. The voice is solemn and rapid passages are not successful. Trills occur only on the higher tones. The former style of playing was quiet and smooth, but gradually the mannerisms of band players have crept into the orchestra, until the present tone would doubtless be a blatant blare to Beethoven, Mozart or Schubert. Mozart used the trombone in sounding the Trump of Doom in his Requiem; Beethoven gave the instruments much to do in the Finale of his Ninth Symphony; Schubert used them in many of his symphonies and masses, and Mendelssohn honored it with his strongest

AFRICAN CALL HORNS.

Property of The Metropolitan Museum of Art.

It is to horns of this description that the trumpet, trombone, French horn, and other cup mouthpiece instruments owe their parentage. Some are the horn of an animal, with its natural curves or straightened; others are of wood covered with the skin of an animal; and still others are of ivory. Each tribe has its call which serves in war, and which can be distinguished instantly by the tribesmen.

phrases, the first and last sentences of the Hymn of Praise.

Lately a valve trombone has been introduced finding favor in military bands, as it is much easier to master and can execute more rapid passages. However, with the exit of the slide goes the individuality of the trombone, for the delicate gradations of tone are only possible with this appliance.

TRUBA—Sonorous Substances. Siberia. A metal jew's harp. See jew's harp.

TRUMPET — Cup Mouthpiece. Europe. The trumpet possesses the greatest sonority of any of the portable instruments owing to the shallow mouthpiece. The tube is of brass, mixed metal, or silver, the last two being preferred. It is eight feet in length in the C trumpet, being only half the length of that of the horn and consequently the pitch is an octave higher. The bore is narrow, being about three-eighths of an inch in diameter and is cylindrical until fifteen inches from the end when it becomes conical and forms the bell. The tube is bent to form two lengths in the simple or field trumpet. In the orchestral trumpet it is bent to form three lengths, the first and third lying close together, the second separated from them about two inches. The orchestral form was for a time provided with a slide, the invention of Thomas Harper, an English player of the Nineteenth Century. Later one valve was added and used in conjunction with the slide, but the present form is entirely valved. With the valves the most difficult passages are practicable, notably a passage in Handel's Dettinger Te Deum, which was originally arranged for two sets of trumpets, one of large bore similar to those of today and the other of smaller bore to take the higher and more florid passages.

The open notes are the more successful on the trumpet although it is provided with a mute, but the tones formed by its use are devoid of the natural keenness and clearness, and Wagner in his Meistersinger von Nürnberg recognizes their strong similarity to the tone of toy instruments and accompanies the entrance of the toymakers' guild with muted notes.

The trumpet does not transpose. Its music is written in the key of C. Crooks bring the instrument into different keys, some transposing upwards; namely, those in D, E flat, E and F; and those in B, B flat, A, A flat and G, transposing downwards. The one in B flat is used most frequently. Others not mentioned are rarely used. The brilliant quality is augmented in the higher pitched varieties.

Wagner again uses the trumpets in fanfares in Tannhäuser and Lohengrin. In the bass solo, "The trumpet shall sound," in Handel's Messiah, they accompany the voice, and this effect is often used. Verdi's imagination puts the trumpet into the hand of Gabriel when he introduces the last trump in the Manzoni Requiem. Mozart favored the instrument but little, although it appears occasionally in his scores.

TRUMSCHEIT — See tromba marina.

TSENG — Plucked Strings. China. The body is of wood and has a convex upper surface. The strings number fourteen and are fastened to pegs placed diagonally across the body. They pass over a similar number of movable bridges and are fastened in the interior. The performer uses his finger tips. The instrument is usually played at imperial festivals and on joyous occasions.

TSU-KU — Vibrating Membranes. China. A large drum used in important ceremonies. It is attached to an upright post when played.

TSUMA-KOTO — Plucked Strings. Japan. A koto of thirteen strings with a sounding-board in the form of a trapezoid. See koto.

TSURI-DAIKO — Vibrating Membranes. Japan. A hanging drum. The shallow, slightly convexed cylinder is hung in a circular frame on a stand sufficiently high that the drummer sitting in front of it may easily strike the center of the face. The sticks have leather covered knobs and when not in use are placed in rings at the side of the frame.

The right stick is called the male stick and the left the female. The tone of this drum is full and mellow and when used in the orchestra, marks the larger divisions of time similar to our bars.

TSURI KANE — Sonorous Substances. Japan. A hanging gong of metal about half a foot in diameter, and struck with a wooden beater.

TUBA — Cup Mouthpiece. Europe. This non-transposing instrument belongs to the Sax family and is the only member which has been introduced into the orchestra, the others being considered too coarse in tone for use in other than military bands. Wagner has done much for the tuba, his most striking effect being the music of the tubas alone immediately preceding the entrance of Hunding in the first act of Die Walküre. The naturally coarse and powerful tones effectively typify the rude huntsman, and forecast the sorrow to come. The instrument is of brass and is furnished with valves, numbering from three to five. The mouthpiece is similar to that of the trombone, but it is large and the player can change the position of his lips within it and thus overcome many discrepancies in tone by the degree of power with which he blows. It was the invention of Wieprecht, a Berlin bandmaster, in 1835.

The tubas are in three sizes, the smallest being better known as the euphonium, the second in E flat, as the bombardon, the largest is the contrabass tuba in B^2 flat, an octave lower than the euphonium. The entire compass of the set is about four octaves. However, the best notes can be obtained between F and the lowest D of the piano. The second size is used most frequently in the orchestra and has an especially full and rich lower register. As the deepest bass of the brass instruments it has completely supplanted the ophicleide to which it is greatly superior in its powers of blending with the other brasses. The tone is of a quality intermediate between the horn and the trombone. See euphonium and bombardon.

TUMBURU — Plucked Strings. India. The curved body is of gourd or wood and has a straight neck. This instrument is furnished with four strings.

TUMBURU-VINA — Plucked Strings. India. A circular body about a foot in diameter and furnished with a neck which extends some three feet beyond the length of the instrument. Four strings pass from the base of the body to the end of the neck.

TUNGKEO — See la-pa.

TY — Vertical Flute. China. A flute made of wood and having a beaked mouthpiece and six finger-holes.

TZETZE, ZEZE, SEZE — Plucked Strings. Africa. A bow shaft usually with one string, and a resonator of gourd or shell. The shaft is also provided with three crude frets which are carved into it. An instrument of this kind from Mombassa on the East Coast has a string of fiber passing over a bridge of bent porcupine quill. It is found in different forms among the various tribes. In some instances more than one string is used and the additional one or ones do not go over the frets, but act as drones, and the resonator is frequently in several sections.

UDAKEA — Vibrating Membranes. India. Shaped like a dumb-bell. The heads are of skin, the edges being laced together with strips of skin. It is beaten with the fingers.

UMPAN — Sonorous Substances. Japan. A bronze gong. The circular plate has irregular edges, and on each side an unusually deep incision curves in almost to the center. The gong is large, having a diameter of about two feet.

UTA-DAIKO, SHIME-DAIKO — Vibrating Membranes. Japan. A plain drum, the commonest of the Japanese drums, used in the theatres and played with two plain sticks whose sharp edges are beveled off. In processions it is carried before the player in a wooden frame and is decorated with orange-red cords. If the player is celebrated, pale blue and lilac cords are substituted in his honor. The beating is a vigorous business, both sticks being lifted over the right shoulder, brought down with rapid circular motion, and immediately raised again.

VALGA — See wambee.

VALIHA — See marouvane.

VALVED HORN — See French horn.

VALVED TROMBONE — See trombone.

VALVED TRUMPET — See trumpet.

VIELLE — An original form of the violin. Later the name was applied to the hurdy gurdy by the French.

VINA — Plucked Strings. India. A stringed instrument bearing some resemblance to the mandolin or guitar and played with the finger nails. There are seven strings, four passing over frets, and three at the side to mark the time. The neck rests on a gourd near its head. The tone is rather thin but curiously soft and plaintive.

VIOL — Bowed Strings. Europe. The treble viol was the immediate predecessor of the violin. It was one of a family of obsolete instruments with which the bow was used. They appear with distinctive qualities about the Fifteenth Century. Previous to that they were in a process of evolution from the rebab or rebec, and had no inherent qualities. They had sloping shoulders and flat backs that were strengthened with heavy cross-pieces that took away much of the power of vibration.

The necks were fretted as are those of the guitar. Sometimes the frets were detachable and the performer put them in place when he desired to use the instrument. The waist of the viols was broad and the inward curves shallow. The bridge was made high in an effort to raise the strings so that the bow would not touch more than one string at a time. When held at an angle necessary to touching some of the strings, it was in danger of rubbing against the side of the body. The sound holes were not ff shaped, but are known as flaming swords, and were merely slanting openings with an irregular outline. Consequently they could not do what the ff holes are designed to do, divide the fibers of the belly into the correct number of long and short parts, as to produce the low and high notes. The frets on the neck did not allow the fingers of the left hand to move quickly in stopping the strings.

The viols were found in different sizes, and to each size was assigned a part of the harmony, such as soprano, alto, or bass. The different sizes were known under many names. The violone was pitched an octave below the bass and reinforced it. The violin was the soprano instrument reduced in size and improved when the ff holes assumed their present shape and the bridge was lowered. A more complete idea of the viol will be gained by referring to the article on the viola.

Viola — Bowed Strings. Europe. Although referred to as the tenor violin, its pitch is more that of the alto, but the size of the old tenor viol made it less easy to handle than the alto and it fell into disuse. The size of the viola permits it to fit into the crook of the arm when that member is bent at an angle of about 120 degrees. It has been in use as long as the violin, for Gaspar da Salo, who reduced the size of the treble viol to that of the violin, made violas, as did also the Amatis.

The viola has a construction exactly like that of the violin, but is a fifth larger, and is pitched a fifth lower. The French name quinte is derived from this peculiarity. The strings of the viola are heavier than those of the violin. They are of catgut, the lower two being overspun with wire.

The viola does not have a method particularly its own, and the fingering is much like that of the violin, although the greater length of the neck increases the distance between the fingers of the left hand as they stop the strings, and much practise is necessary to assure proficiency. The music for the viola is found in the C clef with the high notes in the G clef.

The tone blends well with the others of the orchestra, and its duty of carrying the third part in the stringed quartet is often laid aside that the viola may double the first or second violins. The upper strings are capable of producing tones of penetrating quality, and the depth of the tones of the lower strings can be almost tragic in effect. Lavignac says that its range of sentiment runs from sad reverie to agonized pathos.

Its voice formerly was more powerful than it is now, and in 1597, in the first piece in which it was scored, one viola was united with six trumpets and a zinken. Wagner has given the violas a bacchanalian passage in Tannhäuser; Gluck in one instance allows them to carry a bass accompaniment to the first violins, and Berlioz, in Harold in Italie, gives the viola the plaintive melody that characterizes the thoughtful hero.

VIOLA BASTARDA, LYRA VIOL — Bowed Strings. Europe. This instrument received its first name from the fact that it was too large for a tenor and too small for a bass in the chest of viols, having in consequence no legitimate part in the music of that day. Some of the older writers refer to it as the "contralto." John Playford (1661) is said to be authority for the statement that one Daniel Farunt was the inventor of the lyra viol by which name the instrument was known in England in the early part of the Seventeenth Century. He also speaks of it as a "viol da gamba" strung with lute strings and wire strings, the one above the other, in other words with sympathetic strings. Even in his day the viola bastarda was falling into disuse, to be replaced by the baryton. See baryton.

VIOLA DA BRACCIO — Bowed Strings. Europe. An alto or small tenor viol. It was called an arm viol because of the manner of playing, although this title is sometimes restricted to the violin form of the bowed instruments. This viol is often confused with the viola da spalla. It had six strings as a usual thing, but in the Eighteenth Century the sixth string was discarded, this being a step toward the tenor violin. See viol.

VIOLA DA GAMBA — Bowed Strings. Europe. The name means leg viol and refers to the fact that owing to the size of the instrument, it was held between the knees while being played. Until the Seventeenth Century it had six strings, when a seventh was added probably by Marais, a Frenchman, who also caused the lowest three strings to be overspun with wire. These changes, however, were not adopted by all makers.

The viola da gamba was very popular in England during the Elizabethan period, but began to decline in favor with the beginning of the Eighteenth Century. To play upon it was an accomplishment of fashionable Seventeenth Century ladies. Mrs. Sara Ottey in 1723 and Miss Ford in 1760 were public performers upon it. The last celebrated player, Carl Frederick Abel, died in 1784. John Sebastian Bach introduced it in his Passion music and M. de Caix d'Herveloix (1710) wrote several viola da gamba "suites." It was the bass of the chest of viols and the predecessor of the violoncello. The instrument was used in various ways, as in solos, in orchestral music and in obbligato accompaniment in singing.

John Playford in 1654 gives the following rules for tuning the viola da gamba: "When you begin to tune, raise your treble or smallest string as high as conveniently it will bear without breaking; then stop only your second or small mean in F and tune it till it agree in unison with your treble open; then stop your third in F and make it agree with your second open; then stop your fourth in E and make it agree with your third open; then stop your fifth in F and make it agree with your fourth open; and lastly stop your sixth in F, and make it agree with your fifth open. This being done you will find your viol in tune, according to the rule of the Gamut (scale)."

Viola d'Amour — Bowed Strings. Europe. A tenor viol with sympathetic strings. Its seven catgut strings were tuned in thirds and fourths and gave the chord of D major, while the sympathetic strings of wire passed under the finger-board and through small holes drilled in the lower part of the bridge. The wire strings were tuned in unison with the others and vibrated sympathetically when the

VIOL FAMILY.

Property of The Metropolitan Museum of Art.

In the center is a violin and about it are grouped what may be considered its prototypes. Beginning at the left of the top row and continuing in a circle the instruments are, the Japanese Kokin; the Chinese Erh H'sien, resembling the Hindu Ravanostrom; the fiddle of the Apache Indians, North America; the Rebab, found in Arabia and Syria; the Kemangeh, found in Persia, Arabia, and Northern Africa; the Hindu Sarinda; the Burmese Thro; the Hindu Sarangi; the Hindu Sarungi; and a Viola d'Amore.

instrument was played. Meyerbeer wrote a solo part for the viola d'amour in Les Huguenots. The softening of the tone by the sympathetic strings and the manner of their vibrations suggested the name. It is now practically obsolete.

Leopold Mozart refers to the viola d'amour as the English violet, as does Albrechtsberger also. It was the tenor size of a series of instruments with sympathetic strings which were only useful in solos, which fact is the secret of their short life. They were the latest development of the viols and date from the Sixteenth Century. See viol.

VIOLA DA SPALLA — Bowed Strings. Europe. The large and lower tenor viol. The name spalla was due to the fact that the instrument was played upon the knee, the head being placed over the left shoulder. The strings were six in number. It was smaller than a viola da gamba and gradually changed into the viola. The viola da spalla flourished about the beginning of the Eighteenth Century. See viol.

VIOLA DI BORDONE — See baryton.

VIOLA POMPOSA — Bowed Strings. Europe. The name given by Bach to a five stringed viol of large size. It is now entirely obsolete, although compositions for it by Bach are extant. See viol.

VIOLA-ZITHER — Bowed Strings. Europe. In shape this still more resembles the violin than the philomele to which it is very similar. In tone also it is like the violin. See philomele.

VIOLIN — Bowed Strings. Europe. From the Sixteenth Century, Italy was rich in violin makers. In Brescia and Cremona were long lines of masters, pupils acquiring the knowledge of teachers. Gaspar da Salo, Mariani, and Bente made Brescia prominent for nearly a century. In consequence, violin composition comes into evidence about 1630 and violin playing attained prominence during the same century. Then the art of playing this instrument was as generally understood as pianoforte playing is today, and the composer of that time had the fiddle ever at his hand much as those of the present have the pianoforte.

To Gaspar da Salo is attributed the work of reducing the size of the viola to that of the violin. That he was a good maker is attested by the fact that although Ole Bull had an Amati and a da Salo, he preferred the latter.

Andrea Amati, born in 1520, stands as the first of the Cremona school. His sons Anthony and Jerome ("Antonius et Hieronimus," as their labels read) were great among their kind, and each generation had a beneficial secret to add to the accumulating treasure of the craft. The brothers Amati made violins distinguished for their comparative frugality of adornment. To Nicholas, son of Jerome, must be given the glory. He was the teacher of Stradivarius, and his instruments were but little inferior to those of his celebrated pupil. After Stradivarius came Jacob Stainer, Frances Ruggieri, and Joseph Guarnerius. The products of the last named find favor in high places. Paganini's favorite violin was of this make and was held so dear by the virtuoso that when he died he bequeathed it to his native city, Genoa, that it might not be desecrated in alien hands.

The fruitless efforts of violin makers of today to repeat the work of the Cremona masters suggests many questions. If the secret died with the last of the Cremonese, will not violin music three hundred years later be a lost art, since time destroys and the Cremona instruments will gradually drop from existence? Or does the secret of their excellence lie in their age, and will they eventually wear out while the products of recent years which have been received with disdain will age into prominence?

When it first sought favor the violin's small size and the high tension of the strings rendered its tone too shrill for unaccustomed ears. Mace (1676) makes reference to the "scolding violins," also he says: "You may add to your Press, a pair of violins to be in readiness for any Extraordinary Jolly or Jocund Consort-Occasion; but never use him but with this proviso, viz., be sure you make an Equal

Provision for Them by the Addition and Strength of Basses so that they do not outcry the Rest of the Musick to Which That Implement is Not naturally Proper."

Heron-Allen, an English violin maker, in the following words tersely describes the violin as the eye sees it: "A hollow box from thirteen to fourteen inches in length; at the widest part eight and a half inches, and at the narrowest four and one-half inches broad. It is about two and one-half inches deep at the deepest part, and weighs about eight and one-half ounces. Beyond this we have a neck terminating in a scroll, which, with pegs, finger-board and tailpiece of ebony bring the weight up to about twenty ounces. The wondrous capacities and wonderful equilibrium of all the parts may be summed up in one short sentence. It supports a tension on the strings of sixty-eight pounds and a vertical pressure on the bridge of twenty-six pounds."

A structure so unpretentious scarcely bespeaks intricacies and yet a well wrought violin consists of seventy parts, each cunningly and painstakingly prepared. In every detail, small though it may be, the makers of today and of all days since the Seventeenth Century, have followed where their king, Stradivarius, led. He learned the secrets of each of the parts, and carved and glued them into a congenial whole, so that they would not engage in harsh dispute when the bow touched the strings.

A violin must be hand made, for, other than the sides which are bent into conformity, each piece must be carved and fitted into shape. The violin may differ slightly in size from its illustrious model, but there must be perfect harmony in all its measurements. A model is the first requisite. The maker often takes an old violin apart and placing the back and the top, or more properly called the belly, upon a sheet of heavy paper or of wood, traces their outline, cutting around with a sharp knife, thus making the pattern.

The back and belly are usually of two pieces each, joined in the center. The back is of maple as a rule, and the belly of deal or some other soft wood. The wood must be selected with great care as to grain and seasoning. The grain must run smoothly or the entire plan is ruined. Knots or irregularities of any kind will interfere with the vibrations. Green wood is never used and entirely sapless wood is useless. It should contain enough moisture to be elastic and capable of conforming to the strain which use will bring to bear. A back and belly must be found that will vibrate in accordance with each other. If the tone of one resonance board conflicts with that of the other no real music can ever be produced. The Cremona makers seem to have had in their finger tips a genius for this delicate selection. Others following have tried to duplicate the Stradivarius violins, but after a period of use the best effects will disappear and the instrument will take its place among the failures.

Grossman, a scientist of Berlin, has recently declared that he has solved the problem of tuning the back and belly correctly. Time alone can prove the truth of his claim. A new violin, whose voice is almost perfect, is in danger of being like the too godly youth, for its days are numbered. As the wood further dries and settles into place, the tone must change. On the other hand, a voice a trifle unpleasant at the beginning in no wise denotes failure as the drying and settling may bring a happier result. No exact rule of dimensions can be followed as to the thickness of the back and the belly, that indeed lying entirely with the maker, but the back is always a trifle thicker than the belly.

The sides or ribs are of maple and great care must be exercised that they are neither too thin, nor too high. If not of correct thickness they will not properly transmit the vibrations from the belly to the neck, and if of disproportionate height will afford an improper space for the volume of air within the sound-box. They consist of six pieces of wood dipped in water before being curved with a hot bending iron, a delicate process, and one in which failures are many.

When the sides have been glued to the back, six corner blocks are fixed into their places with a drop of glue. These blocks are small pieces of pine or willow carved to fit exactly into the corners formed by the center bouts or curves, and into the top and bottom curves. They aid a little in transmitting the vibrations and add firmness to the structure. The side linings are thin strips of wood which line the ribs between the blocks, making the instrument more substantial.

The purfling consists of three parallel strips of plane tree wood glued together. Finished, it is about one sixteenth of an inch in diameter and is placed about three-sixteenths of an inch from the outer edge of the belly to prevent the wood from splitting. Stradivarius made of its neat application a work of art. It is a remnant of the former superabundance of decoration, and is applied sparingly, although in some of the best instruments it appears in designs upon their backs. Leopold Mozart well says in his "Violin School" that "to choose a fiddle for its outward symmetry and varnish is like choosing a song bird for its fine feathers."

The bridge is the tongue of the violin, and is as vital a part as the tongue of a woman is reputed to be. The modern maker finds it impossible to change the bridge in the least degree from the precedent of Stradivarius, without ruining the tone. It is of birdseye maple of horizontal grain and neither too hard nor too soft. At the top where there are four shallow notches for the strings it is just one-half as thick as at the base. Unless the feet are exactly arched to fit the arch of the belly the tone will be hollow and dull. The arched top brings each string to a different level so that the bow will not be in danger of rubbing more than one at a time. The height is regulated by that of the finger-board and is such that the strings may be on a correct slant. If the slant is too decided, the tone is dull and sluggish; if too gradual a harsh and piercing tone results. The bridge stands between the two necks of the ff holes with its right foot over the bass bar, and its left near the sound-post.

The soul of the violin is a simple thing apparently. Its practical name is sound-post and it is a carefully carved round stick one-fourth of an inch in diameter extending from the back to the belly. But if it is too short, too tall, too thick, or too slender, it will be a worrying soul. It is carved from even grain pine and its whole duty is to transmit the vibrations from the belly to the back, which will be impossible unless it is of the right height. As it is not glued into place it can only be adjusted through the right f hole, and long hours are employed in the task. It should be placed as near correctly as possible for each change means readjustment in the delicate equilibrium of the violin. Care must also be taken or the f hole is marred. Generally speaking, the position is one-fourth of an inch behind the right foot of the bridge, but an increase in the arch of the belly necessitates a position nearer the bridge.

The bass or sound bar is the violin's nervous system. It is a strip of soft, even grained pine about ten and one-half inches long, running somewhat obliquely under the left foot of the bridge. It strengthens the belly and counteracts the difference of pitch caused by the severing of the fibers of the wood by the ff holes. The angle at which it lies is small, the bar deviating no more than one-tenth of an inch in its entire length and must be carved and placed to suit the individual instrument. Unless it is perfect it breeds the "wolf," that nerve rending growl which makes many instruments worthless. The edge, which is glued to the body is carved to follow the curve of the belly, and the opposite edge is rounding and undulating. The Cremona makers cut and fitted their bars to accommodate the lower pitch prevailing in their day, but the higher pitch of the present requires new ones, so that even the best of the old fiddles have modern sound bars.

The sound holes vary a trifle with the various makers, but in outline they must be nearly the same or they will not do their assigned work. They must divide the fibers of the wood into long and short lengths so that there will be enough of the short to sound the high notes, and enough of the long to sound the low. Without them the belly would not vibrate sufficiently, and to them the violin owes much of its symmetry and grace.

The four strings are tuned in fifths, and when open, they sound G below middle C, D, A, and E. Their preparation is very complicated. The lowest is wound with wire which adds to its weight. Although denominated catgut, sheep, or goatgut, has been used for numberless years. The process of making is long and the raw material must be soaked in many solutions and scraped and cleaned diligently before it is in a condition to be divided into shreds, which are then spun into strings. The number of fibers varies from three to eighty-five according to the use to which the strings will be put. Silk strings have been introduced from the Orient, but are of little account, the great fault being that they do not remain tuned. The best for use and wear are the gut strings before they are polished. When purchasing, size, quality and substance must be well considered as must also the instrument and the style of the player.

The neck, with the scroll as its head, is carved from a block of maple about ten inches long, by two inches deep, and one and five-eighths inches wide. It must be substantial, for upon it rests the entire strain of the strings, and the wood must be carefully selected as to grain, in order to do its work in the transmission of vibrations. As its name indicates, the scroll is carved to represent a spiral and much of the symmetry of the instrument depends upon it. Just below the scroll is that part of the neck through which the pegs pass, and which is known as the peg-box. The pegs are made of box-wood, ebony, or rose-wood and fit firmly into their holes. The continued turning soon wears the holes too large, when they are plugged and bored again.

The finger-board is a strip of ebony of the same width as the neck, about three-sixteenths of an inch thick, and a little over ten inches long. It is glued to the upper surface of the neck, and extends along the belly to a point about two and one-half inches from the bridge. It cannot have too smooth a surface. On the finger-boards of the old viols were gut frets as on the guitar, but to interpret the exquisite compositions of later days the fingers must be able to glide from position to position without the least hesitancy. The thumb is held under the neck and the fingers can assume eleven positions. Only seven are used by most players.

The nut is a small piece of ebony an inch in height and is cut with small grooves for the strings. It is situated between the peg-box and the finger-board, and its office is to raise the strings a trifle above the finger-board.

At the lower end of the violin is the tail-piece to which the strings are fastened. It is a concave piece of ebony pierced along the upper edge by holes, through which the strings pass before they are carried over the bridge. The tail-piece is not screwed or glued to the violin, but is furnished with a loop of gut string which is held in place by the tail-pin, a peg of ebony firmly embedded in the bottom block. The tension of the strings supports the tail-piece in a position just clear of the edge of the body. The tail-pin requires very careful fitting as this tension is entirely brought to bear upon it.

Softened tones on the violin are produced by the use of the mute, a piece of wood or metal furnished with three prongs that clamp the bridge in such a manner as to prevent its vibration. Consequently the vibrations of the strings are not transmitted to the body and the tone is muffled. In violin music rests are found to allow the performer time to attach and remove the mute.

Notwithstanding the fact that so much skill and patience are required in the making of violins and other members of the stringed quartet, most marvelous things have been done in the way of repairing. The wood may be splintered into a hundred bits, but a skilful maker can glue them into place again. Here and there a new piece must be added but care must be taken or the association of too much new wood will ruin the old. The disembodiment which has been caused by the need of replacing the sound bars, has brought to light many impositions. Stradivarius and the others of Cremona varnished as carefully within as without and the interior finish is one of the best proofs of true worth.

"Prison Josephs" have been a popular imposition. Joseph Guarnerius del Gesu made instruments more rugged in appearance than those of others of the Cremona school. This lack of polish proved a temptation to makers of forgeries, and as an explanation of especially rough violins a romantic story has been manufactured. The tale rests upon an imprisonment which Joseph is said to have suffered, although even this fact cannot be proved satisfactorily. It it said that for the sake of amusement Joseph made love to the jailor's pretty daughter, who loved him in return, and through her efforts the prisoner was furnished with inferior materials and inferior tools which he used in constructing crude instruments. The story has effected many sales and the uninitiated often points with pride to his "Prison Joseph."

Many indignities have been practised upon the violin. A cane has served as the foundation of an instrument described as the cane violin. One designed for use by travelers has been so constructed as to fold upon itself, and is called the traveler's violin. One freak is known as trapezoidal. Even the sanctity of a Stradivarius violin was invaded by an Englishman who took away the sides and substituted a central rib with a complicated mechanism in which a steel spring figured.

Nothing is more pitiable than the attempted playing of one who does not understand and never can. "A fiddler is, when he plays well, a delight for those that have their hearing, but is, when he plays ill a delight only for those who have not their hearing," says J. Stevens in his Essays and Characters, Ironical and Instructive (1615). In former times it was considered most unseemly for a woman's hand to touch the violin. W. Parke in his Musical Memoirs speaks of Minerva dashing her flute to pieces because of the horrifying reflection in the water, of her face while playing, and goes on to say, "Although I would not recommend any one playing on a Cremona fiddle to follow the example of the goddess, yet it strikes me that, if she is desirous of enrapturing her audience, she should display her talent in a situation where there is just enough 'light to make darkness visible.'" However, today there is not an orchestral instrument, unless it be the harp, in the playing of which more grace can be exhibited.

The violin is the most wonderful instrument in the orchestra. Its versatility and its powers of expression are greatest and the performer has unlimited control over it. There are but four fixed notes on a violin, the fundamentals of the strings as they lie open, but tones and semitones can be produced infinitely. In fact, this quality makes the violin rank next to the human voice in flexibility and it outranks the voice in range. It can produce two notes at once and by a quick sweep of the bow over the strings a chord of several notes is possible, the tones sounding almost simultaneously. The violin and its music hardly bears description. It is an instrument that charms all people. Its voice sympathizes with wealth and dignity or with grief and affliction. The greatest virtuoso was Paganini, born during the last part of the Eighteenth Century. He played so wonderfully that the public could not believe that the charm lay entirely within human powers, but imaginative minds could see the devil as he guided the hand holding the bow. But is it not paying the devil too great a compliment to even hint that he could have any connection with the joy and the sadness, the quiet and the passion that the violinist can depict?

VIOLIN HORN — Bowed and Cup Mouthpiece. Europe. This is of the usual violin form, but has many folds of slightly conical brass tubing concealed within the body. The upper end of the tube passes through the neck and issues at the back of the scroll where a mouthpiece of French horn or trumpet shape is inserted. The other end of the tube widens within the body into a flattened rectangular bell, which takes the place of the usual block at the bottom of the violin. When the violin is held vertically on the knee and played in violoncello fashion, the horn can be sounded at the same time. It was patented in 1854 in Germany by Ferdinand Hill and in England by W. C. Newton.

VIOLONCELLO or BASS VIOL — Bowed Strings. Europe. This instrument is the bass of the stringed quartet. Its name, which is frequently abbreviated into "cello," is a diminutive of the Italian "violone," meaning contrabass, and is given to this instrument by virtue of being smaller than the double bass. It originated in the latter part of the Seventeenth Century, and the viola da gamba, which it superseded, gave way before it only after a struggle. The gambists in Germany went as far as to protest formally in a paper appearing in 1757 against what they considered to be an infringement upon their rights. The violoncello gained recognition in England about the time of the Restoration, and in reality supplanted the viola da gamba as an orchestral instrument in the middle of the Eighteenth Century. The violoncello has several undeniable advantages over the viola da gamba, a prominent one being the more convex form of the bridge. The flat upper edge of the bridge of the viola da gamba made the avoidance of a strong tone necessary as the other strings were liable to be sympathetically affected.

The violoncello is constructed much as are the violins and the viola, but is larger, measuring four feet from end to end. Its size is such that the performer must rest it upon the floor, holding it between his knees, while seated in a chair. The strings are naturally long and are tuned in fifths, an octave below the viola. Owing to the greater space to be covered on the neck, the fingering differs materially from that of the violin. The practicable compass of the cello is about three and a half octaves. The music is written in the F and tenor clefs, although in certain cases the G clef is sometimes used.

The tone of the violoncello is rich, full and expressive. It is particularly beautiful in melody playing. Pizzicato effects, obtained by plucking the strings, as also the harmonic tones, are readily and effectively drawn from the instrument. In general its range of expression is very wide and it is one of the most prominent instruments in the orchestra. A familiar example of the use of the cello in a melody is in the bass solo, "Be not afraid," from Mendelssohn's Elijah. Its use in pizzicato is illustrated in Hérold's Le Pré aux Clercs.

VIOLONE — Bowed Strings. Europe. See contrabass.

VIOLONE, CONTRABASS VIOL — Bowed Strings. Europe. The largest of the chest of viols and the only one to survive to the present time, when it appears as the contra or double bass. Its name came from its doubling of the part of the viola da gamba. See viol.

VIRGINAL — Plucked Strings. Europe. This instrument was so named from the fact that it was the fashion for young girls to play upon it, and not in honor of Queen Elizabeth, as was so long the popular impression. The name was given in England to an instrument identical with the spinet. Hipkins declares that the name was limited to the keyboard instrument with a jack and one string to each note. Attached to the end of the key-lever was a jack or wooden upright. This jack was a centered tongue of holly held in its place usually by a bristle spring placed behind it. The spring was occasionally of steel. A pin or small piece of crow quill projected perpendicularly from the tongue. When the key-lever was depressed the jack would rise and the pin would cause the string to vibrate. As soon as the finger was removed from the key, the jack would resume its position and a piece of cloth fastened to the jack just beyond the quill would come in contact with the string and damp it.

At first virginals were played on tables and were trapezoidal in shape, allowing only room for the length of the strings. Later, an oblong case was introduced and it is claimed and generally accepted that the name spinet was applied from the fact that John Spinitus, a Venetian (1503), was the first to make use of the new shape.

Notwithstanding, the instrument in the oblong case was found in Germany under the old name of virginal. The instruments are found in various forms, heptagonal or pentagonal, in sham cases wing-shaped or transverse, from which the true virginal was withdrawn for use, and the oblong in which the case was non-detachable.

The virginal was popular in spite of its exceedingly weak tone. Pepys, whom all the world so delights in quoting, remarks regarding the efforts of the Londoners to escape from the great fire in 1666: "I observed that hardly one lighter or boat in three that had goods of a house in, but that there was a pair of virginals in it." It may be well to mention in this connection that in those days the expression "pair" was used in many cases where only one article was referred to, as similarly, a "pair of regals."

Queen Elizabeth was proficient on the instrument as was likewise Mary, Queen of Scots. William Byrde, Dr. John Bull and Orlando Gibbons were famous composers of the Seventeenth Century, and the first virginal music published was a collection of their works in a book called Parthenia or the Maydenhead of the first musicke that ever was printed for the Virginalls. Hayward and Hitchcock were famous spinet makers and before them, from 1491 to 1544, was Michael Mercator who was maker to Cardinal Wolsey and Henry VIII. The double spinet seems to have originated in the Netherlands. These instruments were of the usual size, but at one side of the keyboard another smaller instrument was fitted into the case and could be played while in this position or could be removed and played separately.

Hipkins gives 1784 as the date at which the active career of the spinet closes. The makers delighted in covering the cases with handsome paintings and pithy inscriptions.

VISSANDSCHI — Sonorous Substances. Africa. A zanze of the Bateka tribe. See zanze.

WA-GON — See yamato-koto.

Wahle Khoht — Sonorous Substances. Burmah. A tube of bamboo several feet in length is split to form what resembles a pair of tongs. It is shaken and is used as a clapper.

Waldhorn — Cup Mouthpiece. Europe. German for hunting horn. See hunting horn.

Wambee — Plucked Strings. Africa. One of the most popular of West African instruments and found distributed over a wide area. Also called the valga. It consists of a box-like sounding-board to the back of which are bound a varying number of canes, the tops extending forward as well as upward. From these canes are stretched fiber strings to the base of the sound-box. In East Africa is found a similar instrument called angra ocwena.

Waniguchi or E'Suzu — Sonorous Substances. Japan. A hollow resonant body of metal circular in shape and rather flat. On the upper edges are two rings and just below on either side, a small tubular projection open at the end. It is in various sizes and the larger ones which are hung at the entrance to shrines are furnished with a suspended rope which is used as a beater.

Wei-Shun — Sonorous Substances. China. A very ancient bell made in the shape of a balloon and suspended singly upon a frame through a knob made to suggest a monkey. Small round bells are attached as a tongue and make the sound exceedingly shrill. The Chinese declare that their idea of suspending bells was derived from a certain monkey with a yellowish-gray head, a forked tail, and an upturned nose, which in rainy weather hangs from the branches of the trees by putting the two ends of its forked tail into its nostrils, thus forming a circle.

Wurst Fagott — Double-beating Reed. Europe. Also called rackett or cervelas. Sausage bassoon is a prosaic appellation. It consists of a diminutive tube of cylindrical bore wound about several times to make it more compact. The narrow bore conduced to the weakness of the tone. although it was possible for it to be as deep as a bassoon.

One instrument four and three-fourths inches high had a continuous passage of about three feet and six inches and its compass was of one octave and the four notes, D to A. The instrument had a false exterior and within the apparent tube were wound the true small tubes.

XYLOPHONE, STROHFIDEL, ECHELETTE — Sonorous Substances. Europe. This consists of bars of wood tuned to a scale and laid on ropes of straw. It is struck with wooden hammers. The instrument is popular among the Tyrolese singers and originally belonged to the people of eastern Europe. Considering its rude construction, the fine effects produced are most surprising. Mendelssohn heard Gusikow perform upon the strohfidel and was greatly pleased. Its dry flat tone makes it useful in descriptive music. The instrument was employed in the orchestra, by Lumbye in Traumbildern, and by Saint-Saëns in his Danse Macabre. It is not, however, a true orchestral instrument.

YA-GWIN — Sonorous Substances. Burmah. Cymbals.

YA-KOTO — Plucked Strings. Japan. A development of the yamato-koto. It has eight strings. See koto and yamato-koto.

YAKUMO-KOTO — Plucked Strings. Japan. The body is made of bamboo and has two strings being almost identical with the ni-gen-kin. See ni-gen-kin.

YAMATO-FUYE — Transverse Flute. Japan. This flute has six holes. It is lacquered red inside and closely bound between the holes with string laid on with paste and afterwards fixed with lacquer. The string is a substitute for the strips of cherry bark formerly used. The top is plugged with lead wrapped in rolls of paper, fastened with wax, and finished at the end with wood decorated with brocade or highly finished metal ornaments.

YAMATO-KOTO or WA-GON — Plucked Strings. Japan. This is essentially a national instrument and was originally made from six hunting bows tied side by side. The sounding-board is cut at one end by six long notches to perpetuate the idea of the bows. Through these notches pass six heavy cords from underneath the body. To the cords are attached the six strings, which are stretched over six movable bridges to the opposite end where they are fastened on the under side. The melody is plucked with the little finger of the right hand, a drone accompaniment being played with the finger tips and a slip of hard material. Despite the crude construction, the tone is sweet and mellow.

YANG-CH'IN — Struck Strings. China. This may be in form of a rectangular, trapezoidal, or oval box. Herein is found a range of fine metallic wires disposed in sets of two, three or four to each note, decreasing in length from the bass upward and fastened at both sides with a peg. The two bridges are each perforated with seven or eight holes, over and through which the strings are stretched. The strings which pass over the first bridge have to pass through the opposite holes of the second bridge and vice versa. It is played with two strips of bamboo and is capable of extremely pleasant sounds when well played. It is sometimes heard with the violin and guitar to accompany ballads.

YANG GUM — Struck Strings. Korea. An instrument of the dulcimer type. The trapezoidal box is mounted with wire strings which are struck with two strips of bamboo. A specimen in the Metropolitan Museum of Art bears fourteen strings and is twenty-six inches long by eight inches wide. See dulcimer.

YANG'ONG — Sonorous Substances. Siam. A bamboo instrument similar to the jew's harp. See jew's harp.

YAN-KIN or HYOKEN — Struck Strings. Japan. An instrument resembling the dulcimer with fifteen double strings fastened at one end underneath and coming up through eyelets. It is said by the makers of instruments to have come from Italy to China, and thence to Japan. See dulcimer.

YAYOI-KOTO — Plucked Strings. Japan. A long narrow body of wood, with a flat surface and having a bridge at either end. The strings are fastened at one end on the under side. Passing up over the two bridges, they are again brought to the under side through diagonally arranged holes and are fastened to pegs set in a circular depression at the opposite end.

YEKTAR — Plucked strings. India. The body of the instrument resembles a wooden dipper and it has a single string. It is formed from a piece of bamboo to the under side of which a large gourd or hollow cylinder of wood is attached, having one end closed with a piece of parchment. In the center of the parchment is a hole through which the string, stretched from a peg in the end of the neck to the inside of the cylinder, is passed and is tied in a knot to prevent its slipping back. It is played with a plectrum. The yektar is associated with mendicants.

YING-KO — Vibrating Membranes. China. This drum is called for in many ceremonies, and is suspended in a frame by four rings and beaten on the upper surface with two sticks. The shell is richly decorated with birds, dragons and flowers. One at the Metropolitan Museum of Art has a diameter of thirteen and a half inches and is twenty-four inches in height.

YO-KIN — Plucked Strings. Japan. A small Chinese koto with thirteen strings. See koto.

YOKO-FUYE — Transverse Flute. Japan. A Chinese flute in use in Japan. It has seven finger-holes. It is also called ryuteki or the dragon flute and was originally made of monkey bone, but now of bamboo. There are long and short varieties, the longer being made of thinner bamboo and producing more delicate tones.

YU — Sonorous Substances. China. This is in the form of a tiger resting on a rectangular box. On its back are twenty-seven teeth resembling a saw. At the end of each strophe, the attendant strikes the tiger three times on the head and rapidly passes his stick three times along the projections upon the back. Formerly each tooth-like projection could produce a given note.

YUEH — Vertical Flute. China. This is a short vertical flute with three finger-holes. It was formerly used by dancers in the temples, being occasionally sounded to indicate their movements. In the present ritual music the dancers hold a stick which is called by the same name.

YUEH-CH'IN — Plucked Strings. China. The name means moon guitar and the instrument is so called because the usual shape of the body resembles a full moon, one variety, however, having an octagonal body. The neck is short and is furnished with frets. There are four strings which are sometimes made of copper though usually of silk. The yueh-ch'in is favored as an accompaniment to ballads and songs.

YU-HSIAO — See yu-ti.

YUNG-CHUNG — Sonorous Substances. China. A very large bell gradually decreasing toward the apex. This was kept in towers and was made to correspond with a very large drum used in temple music. The drum gave the signal for beginning the ceremony and the bell for closing. Neither is in use now, though both are still to be found.

YUN-LO — Sonorous Substances. China. An instrument composed of ten little gongs suspended upon a frame of fine silk cord. The gongs are all of the same diameter but differ as to thickness. They are used at court, mainly on joyous occasions, and sometimes figure at weddings and funerals, but then only for form's sake as the player does not attempt to carry the tune of the other players. They can not be tuned successfully.

YU-TI, YU-HSIAO — Vertical Flute. China. Two flutes constructed quite as the ordinary flute, except that the material employed is marble instead of bamboo which better preserves the sound of the lüs, or scale, changes in the atmosphere not affecting the marble.

ZAMR-EL-KEBYR — Double-beating Reed. Syria. This consists of a conical tube of wood with a double reed mouthpiece.

ZANZE — Sonorous Substances. Africa. A rectangular box or a gourd with a sound-hole generally forms the resonance box. To the surface are attached strips of iron or of hard wood, loose at one end. These are plucked by the thumb and first fingers. The negroes are able to produce a melody from the zanze.

ZEZE — See tzetze.

ZICHIRFI — Sonorous Substances. Japan. Hollow rings strung on a wire attached to a handle and shaken in giving the alarm of fire.

ZIL — Sonorous Substances. Turkey. Turkish cymbals. See cymbals.

ZINGUE — Sonorous Substances. Persia. Castanets. See castanets.

ZINKEN or CORNET à BOUQUIN — Cup Mouthpiece. Europe. An obsolete instrument, the predecessor of the serpent and the ancestor of the cornet, which was very popular in the Fourteenth and Fifteenth Centuries. It was slightly conical in shape, and was made of wood and generally covered with leather. It usually had six finger-holes in front and one in the back for the thumb. The detachable mouthpiece was cone-shaped, the lips being pressed against it to produce the tone. The larger instruments were made of two pieces of wood glued together and leather covered. In tone it was rather harsh. The zinken was used in churches to accompany the service. The supposition is that there was a difference in pitch in the instruments used in church and in secular music.

ZITHER — Plucked Strings. Europe. A shallow soundbox placed upon a table to be played. It was at first merely a sounding-board with strings, similar to a psaltery, but later an addition was made of a fretted finger-board. Over the finger-board are stretched usually three strings, the rest acting as bass strings. The performer is provided with a ring on the right thumb. This ring is partially opened and the dexterity manifested in its use, determines the beauty of the effect. Several efforts have been made to increase the size and the number of strings of the zither, but the result has been merely to detract from the strength of the tone and to render the strings beyond the reach of the hand. The bridge is similar to the violin bridge in that it transmits the vibrations of the strings to the sounding-board. Double zithers are designed for duet playing. Two ordinary zithers are reversed and placed side by side, the sections sometimes varying in construction.

Part of the strings are of gut and part of silk overspun with silver-wire. Johann Petzmayer, an Austrian peasant, by his playing of his native music brought the instrument into public notice. The thumb and the first, second, third, and sometimes the fourth fingers of both hands are used in playing. The left hand is used on the finger-board and the right thumb with its ring plucks the strings passing over the frets, while the fingers of that hand manipulate the bass strings.

Zobo Flute — Vibrating Membranes. A cylindrical tube pierced with one hole and having at one end a vibrating membrane. The instrument is played like the onion flute. See onion flute.

Zobo Horn — Vibrating Membranes. A conical tube, having at one end a membrane. By humming into the mouthpiece the sound is increased by the vibrations of the membrane. It is of the present time.

Zoommarah — See zummarah.

Zoraija — Vibrating Membranes. Africa. A small bottle-shaped drum resembling the daraboukkeh. Morocco. See daraboukkeh.

Zourna or Sorna — Double-beating Reed. Asiatic Russia, Persia. A conical tube of varying length fitted with a double reed mouthpiece. The Turkish name is zamr.

Zourna or Zamr — Double-beating Reed. Africa, Persia, Arabia and Turkey. A conical tube of wood with finger-holes and usually with additional holes in the bell for altering the pitch.

Zummarah — Single-beating Reed. Egypt. Two tubes of bamboo are bound together with a waxed cord. Each has a smaller tube for a mouthpiece in the side of which is cut a vibrating tongue. There are six holes in each pipe. Also spelled zoommarah.

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